Broadband and satellite communications in schools:

Challenges and opportunities for the educational community in rural areas

Proceedings of the First Conference of the Network of Multigrade Education (NEMED)

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Introduction

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This book contains a selection of papers presented during the First Annual Conference of the Network of Multigrade Education (NEMED).

NEMED is a transnational network bringing together educationalists and researchers from Europe who share an interest in researching, enhancing and supporting multigrade education in their countries and at the European level[1]. The term 'multigrade' describes schools in which teachers work with more than one curriculum grade at the same time, in the same class. Multigrade schools play an important role in providing access to 'Education for All' in many parts of the world – both developing and industrialised. They are also more than a reality in primary education in many parts of Europe, arising through necessity rather than choice. Their role is crucial, as they are meant to provide isolated communities in remote and disadvantaged areas with pedagogy and community service of good standards. Nevertheless, due to geographical peculiarities and other socio-economic oddities, multigrade schools typically constitute a neglected aspect of education systems. Acknowledging the significance of multigrade schools for equality and quality in education, NEMED systematically carries out and supports networking activities at the European level, which are methodologically structured around the concept of dedicated focus groups researching diverse aspects of multigrade education in parallel.

NEMED regularly organizes open events, which intend to disseminate the knowledge and experiences accumulated within the network, as well as forming an integral part of the network's work methodology. NEMED Annual Conferences constitute one type of such events. These public scientific events aim to make work relating to multigrade education (undertaken within the Network and beyond) known to larger audiences, consisting of field practitioners, academics, and policy makers.

The First Annual Conference of NEMED took place in Argyroupoli, a suburb of Athens, Greece, on 14-16 October 2005. This important international event was co-organised with other projects and collective bodies from the field of school education and new technologies in

[1] *For the years 2004 to 2007, NEMED is supported by the European Commission under the Comenius 3 Action of the Socrates Programme.*

education in this country, thus securing high levels of teacher attendance and participation.

The Athens Conference was entitled "Broadband and satellite communications in schools: Challenges and opportunities for the educational community in rural areas". The choice of place, time, and conference focus was not without significance. In year 2005 discussions about broadband connectivity for schools have reached a point of maturity in Greece. The inclusion of remote rural schools, too, in the Information Society is one of the issues currently concerning policy-makers, and the implementation of advanced technological solutions, such as satellite internet connections for a large number of schools in geographically and digitally disadvantaged areas, is promoted as a priority. This context provided NEMED with an excellent opportunity to foreground issues relating to multigrade education in particular, which forms the prevalent model of schooling in the above mentioned areas, in Greece as well as in many other European countries.

The three conference days offered ample space for educationalists and technologists, both from the practitioner as well as the researcher communities, to share new knowledge and exchange views relating to the inclusion of remote rural schools in the Information Society, with a special interest in the exploitation of broadband satellite networks for the benefit of both remote schools and their hosting rural communities. Other pedagogical, methodological and organisational issues relating to multigrade education were also covered. What is more, conference organisers actively promoted the participation of teachers from remote multigrade schools in the conference, with a view to extending teachers' partnership with, and inclusion in, the NEMED network. Importantly, also, a Comenius seminar for teacher attendants was included in the conference programme, aiming to inform teachers about how to involve primary schools in European Programmes and Initiatives.

Note:
This is a collective volume. Authors' original presentation styles and conventions have in general been preserved; a considerable degree of variation has been allowed for by the editors so as to reflect the various settings and backgrounds from which authors and their texts originate.

Broadband and satellite communications in schools: challenges and opportunities for the educational community in rural areas

C. Tsolakidis, University of Aegean, Greece

Why Technology has delayed implementing in education

A Global Issue of mass character

Education is a global-scale issue of huge "mass" since it concerns a very large number of people. Its mass character is the result of an evolutionary process that reflects democratic ideologies and the adoption of human-centric social policies. This mass keeps increasing, furnished with new ideas and practices; lifelong learning is one of them.

Such an extensive, non-elitist mass character is certainly positive in a democratic world, since it offers to an increasing number of people (if not to everyone) the opportunity to become educated.

However it has also a corresponding huge "inertia" against changes. The fact that education is a huge and increasing sector obstructs "risky" changes especially if these changes involve expenditure -as is the case with technology and specifically Information and Communication Technologies (ICT).

An investment with no immediate return

Worldwide, a very large part of formal education (primary, secondary and higher) is state organized and operated. As far as a government is concerned, investment in education yields long run, hence when acute and immediate needs are encountered, as in cases of severe poverty, educational targets such as the introduction of ICT become of secondary priority. However it is in these cases that ICT could provide real solutions, offering at the same time the chance to improve the development rates of poor societies of an extended time scale.

A Cultural Issue

The real inertia of education is the lack of technological culture that exists in most parts of the world. There are historical, social and psychological reasons for that. Thus:

For a very long time in the past, school provided an environment, which differed substantially from the environment in which other functions of society were taking place. School uniforms, conservative ideas, political, social and religious stereotypes, formal way of addressing pupils and teachers, even a different way of speaking, formed a military-like culture to which everybody had to conform. The modern character of ICT culture seems to contradict the strict culture that dominated behaviour in most educational environments.

Nowadays, all these have changed and the atmosphere in a class is very different from that in the past. However there is still some noticeable backwardness. In a modern society, nowadays, outside school, everybody uses technology, plays with technology and works with technology. In today's class in many cases the only equipment that exists (depending of course on the specific social environment) is the same old traditional blackboard of past ages.

Broadband Connections

What is broadband connection?

Broadband services is the social, technical and financial environment that comprises of fast connections to Internet and proper network infrastructure that allows distributed development network applications.

In fact with the term Broadband we mean:

a. Permanent connection to Internet without complicated adjustments.
b. Fast speeds of between 10 and 100 times the speed of a conventional connection for new applications
c. Reliable digital connections with guaranteed stable high performance

Why do we need broadband connections in education?

The fast development of new network technologies and the forthcoming convergence of telecommunications, informatics and electronic mass media bring some important changes in the economic development models in the field of telecommunications, informatics, services and commerce. The competitiveness of a state in the contemporary environment of high technology is strongly related to the existence of advanced internet (network) infrastructures of high quality, capacity and reclamation. These networks, if technologically advanced and properly marketed and priced, offer easy, safe and uninterrupted access to the international complex of knowledge and commerce.

The situation in Greece

Greece is last in Europe in the use of Broadband connections; that means 0,5 connections every 100 people. The average of Europe of 25 is 8,8 connections and the average of Europe of 15 is 9,9 connections per 100 people. (Data: Greek Information Technology Observatory 1 July 2005). The reasons for this lag in development are attributed to:

a. The small percentage of Internet users in Greece (nearly 20%)
b. The "difficult" geographic conditions of the country (many islands and many

mountain regions)

c. The oligopolistic environment in the broadband service market. Greek Telecommunication Organisation is the sole player

d. Lack of electronic content and services

There is a set of measures and policies that could help overcome the problem and alter the current situation.
One problem of the terrestrial broadband services is that they demand infrastructure that are expensive to develop and not financially viable in less populated areas.

Satellite Technology

A new technology

The need to establish broadband connections to a large number of areas in a country can be satisfied using satellite links. This solution is viable and can be cost effective. It can be an optimum choice where the terrestrial networks are inadequate.

Centrally, the structure needed, is the satellite station and the satellite itself, altogether an expensive set. Yet, there is no need to establish all the necessary terrestrial networks and intermediate stations that are necessary to provide a broadband connection to all the parts of a country. If we consider the mountainous areas and the formations of islands scattered in the Greek seas, then satellite solution sound promising in providing broadband connection to remote and isolated areas in Greek periphery.

We have also the local infrastructure to every receiving station that is every home, school, authority or other establishment building that has a use for a satellite broadband connection.

It consists of a small antenna (a small dish as the ones used for TV reception), and a receiver. It is connected to a personal computer, a home device now.

The established link can be one way or two ways a) one downloads only from the satellite and the response goes through terrestrial lines and b) all communication is performed using the satellite link.

The subscription costs are reducing fast in world market and the main obstacle is the monopolies. In the case of education, if subscription costs can be covered by other institutions (Ministry of Education, other ministries, local authorities etc) and not the schools themselves, the situation can be far more easy and immediate in its implementation.

With the use of satellites new strategies can be applied and new methods to provide education.
One has to have a clear strategy to use effectively all the facilities and the characteristics of the satellite. One characteristic of the satellite use is broadcasting, a very useful facility in which the data transmitted by the satellite can be received by every subscriber of the service; very much like satellite television.

The Greek Ministry of Education is preparing a pilot project with the intention to connect 1000 schools to the Greek satellite HellasSat. Out of then 600 schools belong to secondary education and 400 to primary education.

Challenges and Chances

Information technology can be used in education very effectively.

Using Broadband connections we have a new perspective in the use of ICT in education together as in other applications of everyday life.

Multigrade schools that they usually operate in the periphery/ countryside have a lot to win by the use of ICT enriched by broadband connectivity.

Since the major disadvantage is remoteness and isolation in most cases, it can be cured in a very large extend by the use of broadband connectivity.

New innovative practices find their way about in multigrade schools.

Cooperative learning, cross curriculum subjects, project methods, are some of the methods that are applied in everyday school life in Multigrade schools.

The small size and strict necessities on management, pedagogy etc, are new parameters that they can be used constructively in teaching in the multigrade schools.

The Educators

Usually multigrade schoolteachers are young and the job in a multigrade school is their first assignment. It is probable that they are enthusiastic about their job and likely have knowledge if ICT. Yet they are inexperienced and have a lot of duties apart from teaching. They have administrative duties, a difficult and full of responsibility task. They are called to play a role in local society too. They have to communicate with parents, with local authorities and with other people in the local society.

They need to get trained while offering education. They need to ask consultation while they give advice. They need to practice their new ICT skills. To all these, ICT is a reliable ally and if supplemented with broadband connection, it becomes an invaluable tool.

Shortage of time that in the class is a formidable problem outside is a good ally. In both cases it can be dealt with effectively using the broadband connection

Multigrade Schools in Greece

There is a big number of multigrade schools in Greece located in their vast majority in remote and isolated areas of the country, in islands and mountains.

The function of multigrade schools in Greece is tightly related with the institutional role of the local authorities in the area. Thus, a few years ago the amalgamation of communities /

municipalities (that took place following an Act called "Kapodistrias" has shrunk the presence of state services in many small communities. In these areas Multigrade schools became the only official representative of the state. These schools play a multiple role in the life of the village and form its cultural center. In some cases the school building provides the only public premises available for social events. Schools in which multigrade teaching is taking place are listed in Table 1.

Single grade means that the teacher has to teach up to six grades (if they exist) in a room on his own.

Table 1. Multigrade Schools in Greece 2005

Single grade	832
Two grade	968
Three grade	466
Four grade	236
Five grade	62
Total	2564
Total Number of Schools	5994

From the above it is shown that multigrade schools represent 42,7 % of the total number of schools a large percentage by any standards.

It should be noted that there are also 263 schools that are not operating due to lack of students but still exist as institutions. This means that potentially they can operate if some pupils appear in the area.

Past and present Projects

The University of the Aegean that operates as a regional University at the periphery of the country, where many multigrade schools operate, has developed a sensitivity to the multigrade school issue, and also the expertise to tackle the problem in many, diverse ways. In this case technology proved to be of critical importance. The extensive use of technology, the development of technical applications and the invention of ways and means to support multigrade schools became of top priority.

Teacher training, distance learning and ICT in primary education, are ingredients that usually form the basic principles of actions and projects that the University of the Aegean undertakes. In the beginning the projects were the results of some enthusiastic initiatives. Later we advanced to larger and international projects with Greek and international partners, of which Ellinogermaniki Agogi is outstanding.

Tilos Island Project: The University of Aegean with the assistance of Tilos Island Municipality conducted the first lessons of distance training in Greece. The trainers were in

Rhodes and the trainees in Tilos, a small island of the Aegean Sea. Teaching was materialized via the Internet. The Greek Army contributed decisively, since it offered transportation of the Rhodes team by helicopter to Tilos. http://www.rhodes.aegean.gr/sxedia

SXEDIA project: Within the framework of this project 86 computers were installed (in local networks as necessary) in 46 multigrade schools of 32 small Greek islands. That was conducted in 1999 and financed by the Ministry of the Aegean. We consider of major significance the fact that it was the first time in Greece and one of the very first in Europe that an official body such as a Ministry, recognized the importance of multigrade schools and entrusts ICT with the role of multigrade teaching enhancement. Within the deliverables of this early project was the development and sustain of a platform, which provides teachers with abundant educational material. http://www.rhodes.aegean.gr/sxedia

MUSE project: This project aimed at developing an in service training programme that was designed to meet the needs of multigrade schoolteachers in order to improve their educational performance in the multigrade school environment. Training was based on using ICT applications to improve all aspects of life in the multigrade school and particularly teaching. The development of an educational platform allowed for continuous training and support of the multigrade schoolteachers.

Among the project's aims were the conduction of an intervention study on multigrade teaching in some countries of Europe and the promotion of communication between the remote multigrade school teaching environment and the rest of the educational community. www.ellinogermaniki.gr/ep/muse

DIAS Project: This project aimed to develop an in service training so as to exploit advanced communication networks in support of multigrade schools. The project was based on the intense collaboration of education experts, technology experts, schoolteachers and experts in telecommunications and was based on satellite telecommunications. DIAS aimed to:

- Provide in service training for multigrade school teachers, implementing the capabilities of satellite telecommunications.
- Improve professional qualifications of multigrade schoolteachers and develop their ability to use ICT
- Train schoolteachers so as to undertake the role of instructor, in order to improve familiarization of local societies with the use of ICT

www.ellinogermaniki.gr/ep/dias

NEMED Project: This still running project is focused in the establishment of a network of schools and educational institutions aiming to communicate and exchange experiences, knowledge and methodologies.
One of the most important aims of the project is the recording and comparison of the existing policies regarding multigrade schools through out Europe and the development of a series of suggestions for new policies, presented as part of the final report.

Within the framework of the networking activities an extended survey on multigrade needs and best multigrade practices is conducted in each of the countries of the participating institutions.

A user-friendly web educational and networking portal is developed aiming to act as the core node of the network community and facilitate continuous communication, training and exchange of ideas and materials. www.nemed-network.org

RURAL WINGS Project: The project is aiming to the development of a cognitive based open learning system and environment that can increase creativity and the ability of learning -to -learn through the development of a new learning culture. The aim of this project is not to impose solutions but rather to empower people to invent their own solutions. Also the project aims to:

- Perform an extended validation and evaluation of the technology, scenario settings and services.
- Determine how the DVB-RCS platform should evolve to fulfill increasing user expectations.
- Create of a world-wide network of Learning Hubs in rural areas.
- Provide a range of learning methods that will enable users to become independent learners.
- Provide e-Learning tools that can be used by all members of the local community who are in need of continuous training, education and support.
- Utilize ICT capabilities for promoting the local community's interests.
- Enhance communication between rural communities

The hundred-dollar laptop: access to knowledge for the world's children

M. Bletsas, MIT Media Lab, USA

Introduction

The Massachusetts Institute of Technology (MIT) and the One Laptop per Child (OLPC) non-profit association have launched a global program that seeks to equip hundreds of millions of students and their teachers with ultra-low-cost, individual, connected laptop computers to dramatically enhance the children's primary and secondary education. These will be fully-powered, general-purpose laptops, sized for children and adolescents, running open-source software, with wireless connectivity. Among other unique features, each will carry a suite of software designed by the MIT Media Lab's team of world leaders in developing innovative technology for learning.

The mesh-networked machines will feature a 500Mhz processor and seven-inch SVGA LCD screen with a dual mode option that permits either a standard "DVD" display or a sun-readable, black-and-white e-book mode with 4X resolution. Each will have at at least 500Mbytes of flash, four USB ports, and will be powered either via an on-board AC adapter or by means of a handheld crank.

OLPC's laptop will be built and sold at a target price of $100. According to the present schedule, integrated prototypes of the Gen-1 laptop will be available Q1, '06. Manufacturing begins Q2. The first 10 to 15 million Gen-1 pilot-phase machines will ship by Q1, '07, to five or six large, geographically and culturally diverse countries. Each of these nations will identify three or more regions emphasizing, when possible, rural and remote areas -- where all students in all primary and secondary grades receive a personal and connected machine: One Laptop per Child.

An essential feature of the pilot program will be training, logistics and an administrative initiative based in the host country. Here, in partnership with local educational organizations or other groups to be determined, the MIT Media Lab will help create a center to implement a carefully designed, exponential process to impart the necessary technological and pedagogical

skills to classroom teachers over a period of six months or less.

The OLPC project's technological infrastructure incorporates design and engineering advances developed at MIT's Media Lab, plus innovations in manufacturing and distribution to bring costs in line with the host countries' budget structures. The laptops will be made available only to schoolchildren and their teachers, through government programs, and not through retail or commercial channels. MIT and OLPC will license or give away the IP necessary to bring similar products to retail.

The Vision

Once upon a time, only the very adventurous traveled, and only a few people had access to knowledge. Then, technologies such as the compass, paper and printing transformed the world by expanding these limits. Today there is a new opportunity to transform the world once again, to create and disseminate a technology that will allow schoolchildren in even the most distant places access to knowledge and learning on an unprecedented scale.

Preparing students for success in a knowledge-based, science- and technology- rich society requires more than dispensing facts and practicing textbook skills. It requires developing new ways of thinking. It requires a culture of science, information and global understanding. And it requires learning foreign languages.

The question we address is how this essential work can be accomplished in distant communities, that have been poorly served by the digital revolution, where teachers know of the new technology only from poor or incomplete descriptions in books.

Our answer is to provide every student with a personal laptop, a full-powered computer with permanent wireless connection that can be used at home as well as at school, and is easily carried to places of play, culture and social action. Quantitatively this permits more high-quality learning than can be achieved in the hours spent at school. But the real gain is qualitative: the $100 laptop removes the barriers that separate learning from living, school from family and society. It embodies the new culture and fosters individual growth within that culture. Just as a language is best acquired by speaking it, a culture is best acquired by living it.

Savings help offset costs. Under OLPC, governments can distribute required texts digitally, and update them freely at a fraction of the cost of printing and shipping hard copies. Plus there will be an even greater savings for those books that every student should be given but only comparatively rich families can afford. These include encyclopaedias, full dictionaries and professional quality atlases, as well as personal subscriptions to periodicals.

The computer can serve as a library, a laboratory and an art studio, saving construction costs while making existing facilities far more useful. It can reduce the number of teachers for specialized subjects: for example, students can learn English by interacting with English-speaking students online. There are also savings that come from having greatly reduced numbers of students with "learning difficulties."

It is important to note that everything we have said here about how students will learn with their laptops applies equally to teachers. They also need to learn. The days when a future teacher could be "trained" to do everything that needs to be done in a career of teaching are over. The world changes too fast. Teachers need to be
permanently engaged in learning as they teach. Every student is exploring new knowledge and challenging the teacher as much as the teacher is able to challenge the students.

In the same spirit, when the children take the laptops home they are also bringing new ways of thinking into the family and giving their parents new opportunities to learn. Thus, the laptops will transform education not just in the narrow sense of schooling. We are talking about transforming society: which of course is what education should be about.

Experience to Date

The concepts underpinning the One Laptop per Child philosophy have already taken root around the globe. One of the earliest programs was started in 1989 when the Methodist Ladies College in Melbourne, Australia, began requiring all incoming students from the fifth to twelfth grades to arrive with their own portable Toshiba laptops.

Since then, schools in numerous countries have followed the Methodist Ladies College's lead. For example, Costa Rica's program for bringing computers into education, the first, and still most widely praised program on a national level, is based on a design by Seymour Papert, and was implemented in collaboration with a team from the Media Lab.

Other initiatives range from the modest, a small but so-far promising program involving 50 children in two remote Cambodian villages, to the ambitious, such as the U.S. State of Maine where the State legislature has mandated that all seventh- and eighth-grade students, 37,000 children, be issued laptops. An estimated 1,000 U.S. school districts have followed Maine's example. There are also two similar programs currently underway in France, including one in Marseilles, the nation's second-largest city, but a poor one, with enormous ethnic and cultural diversity.

It is too early to assess the full impact of One Laptop per Child in detail, but the most extensive study to date, a four-year investigation of 50 schools across the United States conducted by Saul Rockman, a widely-respected educational consultant, ratifies Seymour Papert's constructionist theories on which the One Laptop per Child program is based.

Among Rockman's key findings:

1. Learning environments are transformed:
   - Educators involved in laptop programs … promote collaborative learning and…provide individualized instruction.
   - …students and teachers move around more. Instead of staying put to do seatwork, students gather to work on projects
   - …(this) frees teachers to roam about the room helping those who have problems or

need remediation.

- …learning in laptop classrooms is often more self-directed

2. Assessment techniques change:
   - Teachers in laptop classrooms are more willing to assign presentations and multimedia products to students, and score them using customized, project-driven rubrics and even self-assessments.

3. Students are highly engaged:
   - Like teachers, students also show improved technology skills and sophistication.

   Productivity increases:
   - Students develop better organizational skills because they now need them to keep track of what's on their computer and to accomplish complex project work in a timely manner.

4. Attitudes toward writing improve:
   - 76% of students said they enjoy writing more on the laptops than on paper3;
   - 80% indicated laptops make it easier to rewrite and revise their writing
   - 73% said they earn better grades for laptop work.
   - The data demonstrate shifts in not only students' writing attitudes, but also in their practices. These are changes that have also been observed in language arts teachers' writing instruction strategies, and in the attitudes and practices of other content area teachers.

"It absolutely begins to transform the high school," said one school administrator in Florida. "It's the single most dramatic thing I've seen affect the classroom in a very positive way."

Laptop Economics

Global implementation of One Laptop per Child clearly is infeasible when the average cost of low-end machines is $600. When the price of a full-feature laptop is just $100, however, One Laptop per Child makes compelling economic sense, in part because it comes closer to the cost of providing the students with textbooks.

This initiative reduces costs in five major ways:

1. Reducing to nearly zero the usual profit margin, together with sales, marketing and distribution costs. Together, these typically account for over 50 percent of a laptop's price.

2. Innovation in the machine's display. The display accounts for 50 percent or more of the machine's remaining cost. We have devised several strategies for reducing those costs to about $30 per machine.

3. Putting the laptops on an operational diet, so to speak. This saves up to 75 percent of the residual expense by deploying a scaled down processor and needing less memory, using a significantly lighter weight operating system -- a "skinny Linux."

4. Designing and building our machines to be rugged and durable, thus reducing the annualized cost of using them.

5. Moving in entirety to an open-source model for software: OS and applications.

OLPC commits to holding and driving down costs in the future, as well. The enormous potential volume of these machines should enable unprecedented scale economies in manufacture. Also, OLPC is a non-profit association, meaning that its mission of providing high-quality laptops at the lowest possible price will not conflict with the more typical, profit-making responsibility of increasing shareholder value.

These machines also will be less prone to theft because they will not be available on the retail market. Initially, at least, anybody seen using one had better be a student or a teacher.

In time, implementation of "One Laptop per Child" also will considerably reduce the need to purchase expensive and bulky textbooks that in many disciplines quickly are out of date. Laptop data are infinitely updatable.

Generations of Machines

Two generations of machines are planned: Gen-1 and Gen-2. An exciting innovation and a powerful emergent technology are two of the reasons that both iterations of the $100 laptop will be special and unique in all the world.

The innovation is the toggle-controlled capacity of our Gen-1 machine screens to switch back and forth between full-color and black-and-white displays at 3X resolution. The $100 laptop will be the world's first portable computer to double as an e-book, fully readable in direct sunlight.

The new technology, called E-ink, permits thin-screen, exquisite text reproduction with very low power consumption. Developed at the Media Lab by Prof. Joseph Jacobson, this full-color, bi-stable technology will be ideal for textbook replacement and general purpose, low-cost laptop display in a new form factor, including flexible plastics. E-ink also is as much as 10 to 100 times less expensive than the lithographic based processes used to create Thin Film Transistors' (TFT) for equivalent sized areas. OLPC sees prices headed as low as $0.10 per square inch.

Currently, there are about two dozen efforts, both at start-ups and within large corporations, focused on adapting the economics of printing to the manufacture of TFT's and displays. As an indication of where this field might go, E Ink Corporation, using its ultra-low-power display laminates along with partners including Plastic Logic (Cambridge, UK) and Polymervision

(Eindhoven, Netherlands), has recently demonstrated a series of displays that incorporate printed organic transistor backplanes on flexible plastic substrates. Other companies such as Kovio are developing printed inorganic transistors more similar to the transistors found in standard TFT's. Prof. Joseph Jacobson is a founder of both E Ink and Kovio. OLPC plans to use printed electronics in Gen-2.

From MUSE to ZEUS and RURAL WINGS

S. Sotiriou & P. Koulouris, Ellinogermaniki Agogi, Greece

Introduction: Multigrade schools in Greece

Multigrade schools are considered to play a decisive role for the provision of access to education in isolated and remote regions. Unfortunately, however, in the practice multigrade schools constitute one of the most neglected structures of educational systems in Europe, due to geographical and socio-economic peculiarities characterising the areas and communities hosting such schools.

Multigrade schools constitute a widespread form of schooling in Greece, too. About 40% of primary schools are multigrade, and approximately of 15% of primary school teachers work in such schools. In the numerous isolated insular and mountainous regions of the country such schools - at least theoretically - do not simply aim to provide just any kind of access to education, but modern pedagogical services of high standards, avoiding discriminations between urban and rural areas. In fact, multigrade schools do fulfil a function of national importance, as they provide, or try to provide, the children of remote and less accessible areas with the access to education which all children of Greece are entitled to. Indeed, in many small islands or remote villages the multigrdae school is the only kind of provision and service offered to the local community by the state.

Teachers' need for continuous professional training

Teachers of multigrade schools are confronted with significant challenges. In particularly promiscuous classes, they simultaneously teach two or more age groups and possibly more than one subjects. Teachers' initial professional training does not suffice: indeed little if anything about multigrade settings is included in the formal preparation of a teacher. The need for continuous training becomes evident – especially in the light of the fact that typically inexperienced, newly-appointed teachers are posted to remote schools for a short term service.

Providing teachers from remote areas with in-service training is not easy. A teacher's round

trips between their remote school and an urban training centre tend to be costly, if not virtually impracticable, given that there may not be a colleague available to replace them during their absence.

At the same time, teachers at remote schools suffer the consequences of the digital divide between rural and urban areas. Broadband access to the technologies and services of the Information Society still remains unachievable for the inhabitants of remote and less accessible areas with deficient telecommunications infrastructures.

The above described difficulties of multigrade teachers working in remote areas are not unique to Greece. Internationally, the shortage of teachers in rural and remote areas, and the weaknesses of the education systems in the provision of training and professional support to these teachers, have been well-documented in the literature – particularly with respect to rural districts of the USA and Australia.

The use of ICT for multigrade schooling

The need to support multigrade education thus becomes obvious. As a response to the obstacles described earlier, the use of different forms of technology-supported learning and distance education models have been advocated for the enhancement of quality and accessibility of teacher training programs (Squires, 1996). Distant delivery of instruction through the use of technology has appeared to be a viable approach for addressing the problems and issues associated with providing effective and efficient teacher training in rural areas (Ludlow, 2001). The literature reflects this focus on the role of technologies enabling distance training of remote teachers, generally following the technological trends in the field of computer-supported learning. In the early 90s Kendal (1992) offers an appreciation of the benefits of a computer-based telecommunications network used for delivering telementoring and teletraining for educators in rural areas. Ludlow & Duff (2002) describe the use of webcasting technology in a personnel preparation program for rural special education practitioners. Falconer & Lignugaris-Kraft (2002) report on the use of two-way conferencing technology for the provision of teacher training in remote areas, while Forbush & Morgan (2004) focus on delivering two live internet-based real-time video and audio teleconferencing courses to special education teachers in rural areas in the USA, which they claim has successfully overcome some of the training obstacles inherent to rural school districts, including access to skilled trainers, college/university training, and quality curriculum. Generally, the content of training delivered via the different technologies to the remote rural teacher varies greatly, from conventional seminar-type lessons to more imaginative uses of technology-enabled remote access, such as classroom observations at a distance (McDevitt, 1996).

Importantly, however, beyond technological concerns and novelties, international experience has also pointed out the importance of an adequate strategic and organizational framework, such as the one reflected in the direct outreach of universities and teacher training providers to the rural areas, and the development of university-school partnerships, which are believed to help alleviate isolation and the several disadvantages (e.g. Menlove & Lignugaris-Kraft, 2001).

Our first response to the challenges: The MUSE project

The need to provide support and opportunities for development to multigrade schools and their teachers through the use of ICT was early realised by a team of researchers and educationalists in Greece, clustering mainly around the University of the Aegean and Ellinogermaniki Agogi, an innovative school and research and development centre for educational innovation. As a first joint response to the needs of multigrade school teachers, we initiated the MUSE (Multigrade School Education) project, a project co-funded by the SOCRATES Programme of the EU between 2002 and 2004.

The MUSE project aimed to develop an in-service teacher training programme that would meet the needs of multigrade school teachers and improve their professional performance in the environment of the multigrade school.

The training covered methodological approaches of multigrade teaching and the use of ICT applications in multigrade schools. The Internet and the WWW were use for the provision of a platform for training, collaboration, networking and exchange of ideas between teachers, students and trainers. This approach was expected to enhance professional skills of multigrade school teachers as well as developing their abilities to design and evaluate teaching plans in their own peculiar work environments.

Building a Knowledge Society without discriminations through satellites

Knowledge is a fundamental and strategic resource of society. In recognition of this, the European Union aims at becoming a truly knowledge-based economy, to enhance the quality of life, the working conditions and the overall competitiveness of its industries and services. To achieve these objectives, widespread availability and usage of broadband and high-speed Internet throughout the EU is necessary. It is becoming more and more evident that the vision of Lifelong Learning and 'Education for All' will be realised through 'Broadband for All' (cf. for instance Scottish Executive's recently launched –in May 2005– 'Broadband for Scotland's Rural and Remote Areas' initiative).

However, the digital divide in Europe remains large, and for more than fourteen million European households in remote areas the digital divide is actually growing. Teledensity is lower outside urban centres, and the rural and less favoured regions lack the same access and supply of internet access and broadband connection as the urban areas have. It is estimated that more than thirty million people in the Community inhabit remote rural areas, which account for some 30% of the territory. The proportions of rural populations living in geographically disadvantaged areas and suffering from the digital divide are significantly higher in the new Member States and accession countries, which results in significant socio-economic effects and challenges (Cohendet 2003).

It is a stated strategic priority for Europe to use to the full the potential offered by all available broadband technologies, including satellite communications, to bridge the digital divide (European Commission 2003). Satellite telecommunications can indeed play a crucial role in the creation of a balanced Knowledge Society without discriminations, as they can secure broadband access to the Information Society for those who geographical and other adversities have kept in digital isolation. In recent years there have been several initiatives in the field of satellite telecommunications applications addressing the needs of rural communities. As Cartheron (2003) shows, under certain conditions, satellite solutions prove competitive among other broadband access technologies, for the reduction of the digital divide in Europe.

Distance education: a case for satellite telecommunications

Distance education is one of the major fields of application in this area. Littman (2000) describes satellite telecommunications as an innovative delivery option for distance learning, and offers an account of different educational initiatives that facilitate access to new student populations in distance locations, sustain trans-border collaboration and research, and promote curricular enhancement and enrichment. Significant experience has already been gained internationally, particularly in the United States and in Australia, where e-learning via satellite networks has been tried mainly for adult learning, but even with children in primary education (e.g. Boverie et al, 2000; Boylan, Wallace, & Richmond 2000). In the last couple of years many other less developed countries with populations distributed over large geographical areas have been exploring the potential of satellite telecommunications for e-learning. Al-Sharhan (2000), for instance, discusses the developments in satellite communications and educational applications, with a focus on the possibilities of adapting satellite technology for instruction in developing countries, and recommendations for the adoption of satellite technology in Saudi Arabia. Cohen (2002) describes how the University of the South Pacific has created a satellite-based computer network aimed at greatly expanding its offerings to students on remote islands. Interestingly, also, from an international perspective Lorenzo (2002) describes the Global Development Learning Network (GDLN), a satellite-driven global communication system developed by the World Bank to help developing countries fight poverty and share in a global exchange of information, through Distance Learning Centers that are used by private and public organizations and institutions for distance education and knowledge-sharing programs.

Our first response to the satellite challenges: the ZEUS project

This growing mass of international experience clearly demonstrates that emerging technologies offer promising solutions to the challenges of providing accessible and appropriate training to rural educators. Making this its central concept, the ZEUS project, a national project co-funded by the Greek government (E-learning Concerted Programme), has come as a mature cooperation between technological and pedagogical experts, who have joined forces to offer a genuine response to the above-described challenges through the provision of distance e-training for multigrade school teachers via the use of broadband satellite networks. The recent

launch of the Greek satellite, HellasSat, has given ZEUS an excellent opportunity to highlight the existing potential for the provision of state-of-the-art e-learning in remote and less accessible territories of Greece.

The project, which is now (October 2005) about to end, has provided educationalists and technologists with an interdisciplinary collaborative framework for the development and exploitation of an advanced, content-rich e-learning environment based on satellite telecommunications. Synchronous and asynchronous e-learning technologies delivered over broadband satellite internet have been integrated into a unified e-training framework, which has been designed and developed based primarily on pedagogical rather than technological grounds. The output of this procedure, and main deliverable of the project, is a distance in-service training programme, which was piloted with multigrade school teachers in diverse remote and disadvantaged locations throughout Greece.

The ZEUS training programme

Based on analysis of teacher needs, that was conducted at the outset of the project through the administration of questionnaires completed by multigrade teachers as well as through literature research, the ZEUS training programme aims at helping multigrade school teachers to develop their professional skills along two main axes:

- Use of ICT in their work, both for teaching/learning and administrative purposes.
- Application of teaching and learning approaches which are most appropriate for the multigrade classroom, with some special interest in the advantages that cross-curricular approaches can offer.

Through satellite/ICT installations at schools delivered by the project, the training programme has become available to teachers at ten locations in the extremities of Greece: Thrace in the Northeast, Pindos mountains in the mainland, the Aegean Sea, Crete, Southwest Peloponnesus, and the Ionian Sea. The selected pilot sites reflect the diversity of conditions and circumstances in which a remote school may be found to operate in Greece. The sample includes schools from mountainous communities with little interaction with the rest of the country, to other disadvantaged rural areas in the mainland, and to schools located on islands which, although tourist destinations in summer, revert to being almost isolated territory during winter.

Although technical specifications do play a crucial role in a distance-education-via-satellite scenario, the success or not of the effort mainly depends on the underlying pedagogical design. Taking the primacy of a rigid pedagogical design as a rule, ZEUS has produced a training programme which aims to cater for flexibility and guidance, interaction with others and self-paced learning.

The technological environment for ZEUS

The applications mainly used for the delivery of training are: a) the MENTOR software, a synchronous e-learning suite which is specifically designed for use over the satellite platform, and which supports videoconferencing, application sharing, and chatting, all integrated in the same interface; and b) a specifically designed asynchronous e-learning environment, a dedicated web platform developed within the project, which provides secure and structured access to a rich pool of educational content.

The ZEUS e-learning environment is based on technologies which exploit satellite telecommunications for broadband delivery of rich educational content, including good quality video, 'heavy' web-based applications, exchange of large files, multipoint conferencing, etc. However, due to some limitations in the technological possibilities offered by the Greek satellite at the early stages of the project, the architecture of ZEUS (DVB - Digital Video Broadcasting) foresees the use of broadband satellite links for downloading data to user workstations, while uploading and feedback is sent by the user through existing terrestrial infrastructures (typically ISDN lines, available to virtually all schools). This architecture has been found to work rather problematically in some cases, particularly due to the poor telecommunications infrastructure of remote and isolated schools as well as due to the technological expertise needed at the user's end in order to solve problems arising.

Exploiting technological developments for better quality provision: the RURAL WINGS project

The ZEUS experience has clearly shown that satellite data telecommunications can effectively support the provision of training and professional development at a distance, particularly to professionals such as teachers who work in remote and isolated areas. Nevertheless, ZEUS has also clearly indicated that significant technical difficulties, which in some (limited) cases even caused obstacles to the smooth running of training, would have been avoided if a more advanced model of satellite internet provision (DVB-RCS) had been available, not demanding the use of non-broadband terrestrial infrastructures.

Recent developments in the telecoms market already allow for two-way broadband satellite connections (DVB-RCS - Digital Video Broadcast – Return Channel Satellite). In face of these technological developments, our team has set out to investigate the new opportunities potentially offered by state-of-the-art satellite telecoms for better quality distance education provided to multigrade school teachers. These new efforts form part of an ambitious four-year international project, RURAL WINGS, which is just about to start with support from EU's Aerospace Programme (FP6).

The RURAL WINGS project proposes to develop an advanced learning platform through satellite DVB-RCS access technologies, promoting a user-centred methodological approach; the latter in fact constitutes its major innovation. The main aim of this approach is to

support the creation of a new culture in rural communities promoting digital literacy and reducing resistance to the use of new technologies. In RURAL WINGS we go a step further, encouraging users to add their significant contribution to the emerging applications by involving them in meaningful activities, tailored to address the needs of different user groups. Thus, the project aims to offer stimulating and creative learning environments to support vibrant user communities and will attempt an extended implementation in dozens of pilot sites in 18 countries worldwide. It is expected that RURAL WINGS will help to catalyse the satellite broadband take up in Europe and beyond.

Training teachers as change agents promoting local development

In terms of content of teacher training, the major addition to our previous efforts will be a special focus on researching how multigrade education relates to the societal and cultural characteristics of the local communities in which multigrade schools operate, and investigating the far-reaching effects that rural teachers' training in the use of ICTs can have. In particular, the training will aim to highlight the multiple roles which multigrade school teachers can play within the small rural communities, with an emphasis on their role as change agents for the development of a new digital culture among local people and the exploitation of opportunities for local development offered within today's information society.

The central position of the teacher in an isolated community, and the significance and prestige of the school as one of the few public establishments, can be used in an attempt to instill a new culture in rural communities promoting digital literacy and reducing resistance to the use of new technologies. Trained, knowledgeable teachers can act as the change agents who will disseminate the new potential offered by ICTs and encourage its uptake by the local workforce.

A properly prepared rural school teacher will be able to cooperate with, and mobilise existing institutions and dormant agents of development in remote rural communities, making efforts to tackle rural scepticism towards technological innovation. The teacher, thus can turn the school and its technological infrastructire in a village, into a learning centre supporting the whole community and serving as the gateway of the local population to knowledge and the information society. A teacher with a vision to boost local development throlugh the utilisation of new technological possibilities can bring life to the stagnant socioeconomic processes of an isolated rural community, by offering opportunities for learning and creativity to all members of the local population. Such an innovative role for the multigrade school will offer considerable added value, by revitalizing the community as a place fostering civic development, entrepreneurship, lifelong learning, digital creation, human spirit, and collective efficiency. In this context, the teacehr will help local people to discover new opportunities for covering diverse needs and aspirations, e.g. by selling their products and services over the web, by promoting their area as a tourist destination or as a site of cultural interest, or by exploiting rich lifelong learning resources available through the internet as students, employees or entrepreneurs. Eventually, local active citizens will be knowledgeable and willing enough to develop their own further projects.

By supporting the isolated community to produce their own local information and content based services, offering them lifelong learning opportunities harmonised with local and individuai needs and promoting their local identity, the remote multigrade school teacher can change from a neglected agent in the margins of educational system into an original change agent encouraging the creation of a digital culture among citizens and thus helping bridge the widening digital divide. The teacher will offer real and practical support to the remote rural communities in its struggle for equal opportunities for lifelong learning, economic and social development, and a more democratic access to the information society.

Conclusion

Running from MUSE, through ZEUS, and to RURAL WINGS ovr the last couple of years has been a rewarding experience, which, on the one hand has confirmed the usefulness of ICT and particularly satellite telecommunication systems for the development of remote and isolated communities, starting from teachers working in such communities; and on the other hand, has suggested ways for introducing improvements into, and furthering our work in this field.

If one outcome of these efforts was to be singled out, it should be stressed that the predominance has been corroborated of the appropriate pedagogical design over mere availability of new e-training technologies, with or without satellite connections. The different media, tools, and contents need to be orchestrated, according to clear pedagogical planning principles, into frameworks enabling substantial learning experiences and maintaining learners' interest unabated, so that specific training goals and objectives are achieved.

Last but not least, the attitude of the participating teachers towards the training programmes has always been very positive, and this has provided us with strength and inspiration. In their majority, teachers have been dedicated to the course, and prepared to withstand any difficulties arising out of technical or other problems – and this underlines both their existing needs for support and communication, as well as how much worth it is for governments and researchers to spend effort and resources in this direction.

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Two-way satellite services for remote schools: the RURAL WINGS project

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Within the framework of the mid-term review of the eEurope 2005 Action Plan in early 2004, the European Commission will propose to set up a Forum on the Digital Divide. This Forum will bring together all stakeholders in the area of the Information Society and electronic communications, including the satellite constituency and ESA, and will analyse how to bridge the digital divide.
White Paper "Space: a new European frontier for an expanding Union", COM (2003) 673

Intoduction

In recent years there have been several initiatives in the field of satellite telecommunications applications, in order to address the needs of rural communities. This indicates the unique advantages of satellite technologies for providing high quality wireless broadband connection to any type of population within large geographical areas. Rural Wings is an ambitious project that proposes to develop an advanced learning platform through satellite DVB-RCS access technologies, promoting a user-centred methodological approach which constitutes its major innovation. The main aim of the proposed approach is to support the creation of a new culture in rural communities promoting digital literacy and reducing resistance to the use of new technologies. It will go a step further, encouraging users to add their significant contribution to the emerging applications by involving them in meaningful activities, tailored to address the needs of different user groups. Thus, Rural Wings aims to offer stimulating and creative learning environments to support vibrant user communities and will attempt an extended implementation in dozens of pilot sites in 18 countries worldwide. It is expected that Rural Wings project will help to catalyse the satellite broadband take up in Europe and beyond.

The Rural Wings project[2] will be based on innovation practices and techniques deployed in industrial environments, aiming to the optimization of the new products' development

[2] *The Rural Wings project is co financed by the European Commission (FP6-IP-516161), the Canadian Space Agency and the National Science Foundation (USA).*

process. The ultimate goal is the transfer of knowledge and the adjustment of these practices in different knowledge spaces (at school, at work, at home) as a mean for interaction between user needs and technological developments: The needs of users in rural areas feed the integration of the educational environment with dynamic requirements for new services or for the adaptation of existing ones. In this way the users' perception of their problems/needs leads the development of technology and of learning practices.

Project's background

Information and Communication Technologies (ICT) are inherently associated with the access and use of knowledge which is the fundamental and strategic resource of society. ICT require the active, informed, literate participation of the user. The internet is of little use to people who are not able to exploit electronic access to information to improve their lives. In 2003, about 150 million European citizens had not completed higher secondary level education and about 2/3 of EU workers had never had any computer training. The term "digital divide" in its more generic definition refers to the technological and socio-economic disparity among countries and peoples as is reflected to the ICT access, applications, literacy and usage skills. This broad definition includes inequalities between countries at different levels of development, between urban and rural regions of the same country and between people of different ethnic group, gender, age, educational level and income. The digital divide brings with it grave disparities in economic opportunities, education, health, safety, housing, employment and even transportation, and as such has an important and long-term impact on society (P. Cohendet (2003), Report for ESA: "The Digital Divide in the European Enlarged Economic Scenario: An Assessment of the Socio-economic Effects").

The European Union aims at becoming a truly knowledge-based economy, to enhance the quality of life, the working conditions and the overall competitiveness of its industries and services. Through its Europe 2005 Action Plan the Union has set itself the objectives of providing adequate infrastructure for education and medical care and a favourable environment for private investment and for the creation of new jobs, in order to boost productivity, to modernise public services and to give everyone the opportunity to participate in the global information society. To achieve these objectives, widespread availability and usage of broadband and high-speed Internet throughout the EU needs to be established. However, the digital divide in Europe remains large as the rural and less favoured regions lack the same access and supply of internet access and broadband connection as the urban areas have. Even where the rural areas do have access, connection speed is lower (employing early technology) than in the cities. A large number of European households living in remote areas – as many as 14 million – do not have a realistic perspective of achieving access to high-speed Internet before many years. This constitutes a serious obstacle for making the benefits of the information society available to all citizens in the European Union.

Unfortunately, despite the incredible technological advances of the past decade, the digital revolution has not yet touched the lives of many people. In fact, there are indications that the digital divide is actually growing as a result of the new technological developments, as is occurring with broadband access in some countries, leaving the rural communities increasingly behind in the digital revolution: On the one hand, cities and suburban areas offer service

providers a ready, high-volume market and provide an incentive to the private sector for developing, installing and maintaining state-of-the-art infrastructure, access and services. On the other hand, local infrastructure developments in rural areas are restricted due to the impossibility of reaching commercial viability. And there is little hope that providers will develop and maintain infrastructure for services in rural areas (bridging the digital divide) without incentives to built the information highways and policies aimed at bringing down existing barriers for providing the necessary infrastructure (P. Cohendet (2003), Report for ESA: "The Digital Divide in the European Enlarged Economic Scenario: An Assessment of the Socio-economic Effects").

This is a problem that the European Union and local governing authorities have recognised. The European Union's eEurope 2005 initiative states that all businesses, schools and universities of present Union members must have broadband access to the Internet by 2005. The EU has also stated its intention to use existing Structural Funds, such as regional and social funds, to facilitate broadband access in remote and rural regions throughout Europe (including the 10 new European countries). Thus, the market place is evolving towards the use of IP applications requiring broadband connectivity (streaming, FTP, News feed, Web-browsing, Video Conference). This is further driven by the fact that reliable and cost efficient broadband access technologies are more and more being deployed. **It is thus now becoming more and more evident that the vision of "Education for All" will be realised through the emergent actions for "Broadband for All".**

Figure 1: Learning and teaching in rural schools in Greece, Finland and Peru. Different countries, different cultures several thousands of kilometers away with a common need: "Education for All".

Can satellite be one of the alternative wireless technologies that can help close the widening digital divide in Europe?

Depending on the required bandwidth and the population density, several access technologies are presently in use: via copper lines, cable networks, terrestrial or satellite wireless connections, fiber optics networks (see Figure 1).

Within the satellite environment, the broadband two-way access is often released in a hybrid form, forward link via satellite and return link via terrestrial manner. Most of these methods even those allowing for high bandwidth capacity, target markets that are typically situated in dense or urban population areas and to a less degree in sub-urban areas, but are certainly not suited for rural and remote areas. This is because either the service (capacity and performance) degrades as a function of distance or number of users, or because the network roll-out requires existing installations or implies large investments thus they are only cost effective in areas where high revenue potential is available. The optimum solution to quickly start closing the digital divide is clearly a broadband fixed wireless access, as wireless solutions have the

ability to be both transitory and permanent technologies at the same time. By strategically placing wireless access points, operators or local authorities enable business and home users across wide areas to enjoy permanent access to the Internet at speeds ten to twenty times faster than a traditional modem. The DVB-RCS (Digital Video Broadcast – Return Channel via Satellite) is a solution totally based on satellite telecommunication (without any terrestrial links involved) typically targeting the broadband access networks. It requires asymmetrical connectivity (forward rates of 1 to 10 Mbps and return rates of 0.2-2 Mbps) thus is well suited for suburban and rural regions with the potential to address all users in those regions. DVB-RCS, recently published as an ETSI standard, forms the specification for the provision of the interaction channel for GEO satellite interactive networks with fixed return channel satellite terminals (RCST). The standard, developed under the auspices of the DVB Forum, was created through the cooperation of satellite operators and satellite equipment manufacturers, including system providers, hub manufacturers and terminal manufacturers. Companies from Europe, North America and the Middle East have been involved in this activity. DVB-RCS may well become a global satellite standard that allows equipment manufacturers to focus on the same technical solution, thus providing a healthy and open competitive environment, with enormous benefits to industry and users alike.

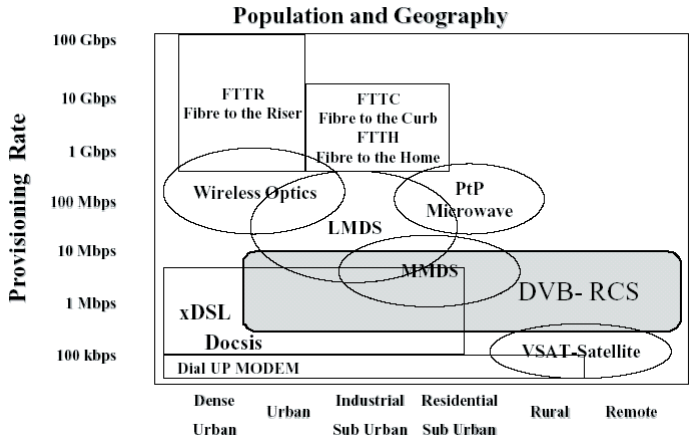

Figure 2: Access Technologies (S. Boom & G. Adams (2001): "2 Way-Sat" by Newtec).

According to the recent report "Reducing the Digital Divide in Europe – Competitiveness of satellite among broadband access technologies" (Vista Advisers, October 2003) the answer to the question, **"Can satellite be one of the alternative wireless technologies that can help close the widening digital divide in Europe?",** is **yes technically,** but no in its current form of offering, considered as **not cost-effective enough for a mass market deployment.** As bandwidth and equipment costs remain the main barrier to a mass deployment of satellite access services, it is essential to look for ways to reduce these costs. Two major possibilities are currently being considered by manufacturers and operators, a) reduce the bandwidth cost by using bigger satellite platforms and b) reduce the cost of satellite equipment per user. According to satellite operators and satellite manufacturers, spot beams and frequency re-use on new generation satellites should make it possible to lower the capacity costs by

approximately a factor of five. The lower cost of bandwidth should enable more affordable pricing for the satellite ISP's broadband access.

According to the same report an immediate way to share satellite access costs among small groups of users is to combine a two-way satellite with a Wi-Fi last mile service. The satellite/ Wi-Fi combination brings the cost of broadband for remote locations down to the same level as ASDL or cable broadband in metropolitan areas. The fact that both technologies are standard platforms contributes enormously to the low cost. **This hybrid solution could definitely stimulate the process of closing the digital divide, even though the business models are still problematical as of today.**

However, much needs to be done and understood about these technologies before they can play a more significant role in providing services in rural environments. Issues of availability, effectiveness, usability, suitability, reach, network design, cost and authorisation, all have to be tackled and understood, both by potential service providers and potential users. **It is important that the potential and implications of satellite communications are understood by the final users, in order to influence the way in which services are made available and also to benefit early on from the exciting opportunities they offer.**

The importance of the Human Factor: users needs in rural areas

In rural towns and communities the necessity of telecommunications services cannot be overstated: Where growth and economic development is desired, telecommunications infrastructure and high-speed communications to attract new business and industry are essential. Everybody in a rural community - schools, hospitals, businesses, city and county governments, community groups and individuals – benefit from access to improved communications, commerce and information. Underdeveloped communications infrastructure has a direct impact to the economic and social welfare of rural communities: schools can provide limited access to internet resources, remote tele-workers are unable to transfer large data-files between office and home, the local commercial or civic web-sites cannot be accessed rapidly, discouraging a potential customer or visitor from within or outside the community.

The rural-urban divide has a direct impact not only on the access but also on the **creation of knowledge.** Without access to broadband for example, a researcher has no access to data-intensive applications that are only available to colleagues connected by urban local area network, and a rural automotive designer needs to relocate to the company headquarters to participate in interactive, real-time, computer-aided modeling of a new vehicle. The remoteness of a rural area leads to massive set-up costs. With poor career training and low literacy rates, it is unlikely that a poor rural individual, who values access to the internet and other technologies, will be able to afford the access costs. Thus, large-scale technology initiatives have little hope of success unless at least a basic level of community capacity is in place. "The social structure of creativity relies on the existence of a milieu open to all forms of creativity – artistic and cultural, as well as technological and economic. This milieu provides the underlying ecosystem or habitat in which the multidimensional forms of creativity take root and flourish" (P. Cohendet (2003), Report for ESA: "The Digital Divide in the European Enlarged Economic

Scenario: An Assessment of the Socio-economic Effects"). Thus, **it is paramount to offer stimulating and creative environments to support vibrant communities – educational** (teachers and students in schools, universities and training centers), scientific (research and science centers), **medical** (doctors, nurses, emergency units), **artistic, local government, business –.** This in turn will help to attract those who create in business and technology and to facilitate the rapid transmission of knowledge and ideas.

The contribution of the Rural Wings project

The Rural Wings project will address how the learning needs of rural communities could be served by satellite communications. The objective will be to select the most appropriate applications and propose a roadmap up to the operational status including demonstrations and technical developments in order to promote and facilitate the use of satellite communications over Europe and beyond. This project seeks to use advanced technology as a tool to foster Human Development, in order to use the great potential capacity the new technologies have in addressing major societal challenges. This project places a great emphasis on the pedagogical, social and human development dimensions, where ICTs only play an instrumental role in order to empower people through knowledge, development of creativity and enhanced concerted action.

The project's approach is aiming at the development of **a cognitive based open learning system and environment** that can generate creativity and a capacity of learning to learn in the users, through the development of **a new learning culture.** It will offer to the users (students, teachers, doctors and health personnel, farmers, local administrators and public authorities) ubiquitous access to the learning content. The Rural Wings learning environment will be developed through the effective utilization of a wide range of ICT applications for educational purposes (e.g. WebTV channel for students, virtual visits to museums, science centres, research laboratories) based on a participatory methodology in which users will play a very active role in creating additional components, through the creative use of constructionist principles and related ICT technologies. The Rural Wings learning environment will also support the exchange of material between users and experts, it will allow for easy uploads and downloads of relevant material, it will facilitate the direct communication between the users and the networking activities of all the actors involved. Such a service offers high speed two-way connection that gives the opportunity to deliver content utilizing completely the capabilities of multimedia tools. High quality video streaming broadcasted can be delivered to users at school, at work or at home. Real-time on-line seminars can be realized in this way, while the users will have the opportunity to download simultaneously educational and training material and supporting documents or software according to their needs.

Overall, the Rural Wings project aims to improve the **functionality, usability and acceptability** of future information products and services through the development of innovative models for the provision of learning services, fully exploiting the potential of **ambient intelligence technologies,** enabling **ubiquitous, interactive, personalized** and **tailored access** to learning and **knowledge on demand.** It will develop advanced learning schemes at school, at workplace and at home and will encourage lifelong learning, thus reflecting the needs of a knowledge-based economy.

Specifically the Rural Wings project's objectives are:

- **To perform an extended validation process and a usability evaluation during the development and integration to the final system** of the technology, scenario settings and services that will be offered to the users. The goal is two-fold: a) to specify all the tasks (users' activities within the pilot scenarios) that are relevant to the Rural Wings system and to evaluate the users' task on job demands in terms of characteristics and context and b) to mobilise a large group of stake holders to take-up the results and create a sustainable plan for exploit them, and to further explore the potential domains of their application. The objective would be
- **To determine how the DVB-RCS platform will need to evolve in order to fulfil increasing user expectations and to compare this with current developments that are under way at the equipment manufacturers.** The Rural Wings project proposes to develop innovative ways of implementing the DVB-RCS platform in order to demonstrate the huge potential of communication via satellite to the users in rural areas. The objective will be to select the most appropriate applications, and propose a roadmap up to the operational status including demonstrations and technical developments in order to promote and facilitate the use of satellite communications over Europe and beyond.
- **To create of a world-wide network of Learning Hubs in rural areas.** These centres (in the initial phase schools, public offices and health centres will serve as Learning Hubs) will be equipped with the necessary infrastructure in order to support the project's implementation. These Learning Hubs pilot sites will serve as working models and demonstration sites within which the project's activities will take place. The Learning Hubs should not emulate traditional training centres. The Learning Hubs will be a place for digital creation, fostering the human spirit, civic development and collective efficiency. The tools available should be wide ranging, from computers, broadband access, digital cameras and a variety of supportive software tools (e.g. for creation of web-pages, video capturing and editing).
- **To introduce a new learning culture.** The aim of this project **is not to impose solutions but rather to empower people in all the stages of their life to invent their own solutions.** The project is going to demonstrate the use of a new generation of technologies and applications that enable people to design, create, and learn in new ways, helping them to become more active participants in their communities. The aim is to empower rural communities to both use and generate knowledge that is relevant to their basic needs by developing their local capacity to use ICTs in a creative way that allows them to create sustainable rural livelihoods and improve their quality of life. The Rural Wings consortium will test these ideas and technologies in pilot sites around the world, helping individuals and communities to develop new strategies in their daily activities ranging from commerce to agriculture to health care –and, more broadly, to transform the ways they learn and evolve. The proposed applications are supporting a "constructionist" approach to life-long learning, by helping people take charge of their own learning throughout their lives.
- **To provide a range of learning methods that will enable users to become independent learners.** The Rural Wings project targets several types of users. As each person has different ways of learning and understanding, the proposed competence-based scheme should provide a wide variety of instructional approaches. The proposed

methodology has to support learners to work independently, co-operatively and in an increasingly self-organizing way. This will be achieved through the development of different educational scenarios (educational pathways) that will cover different contexts (Learning at School, Learning at Work and Learning at Home), users (students, teachers, doctors and health personnel, farmers, local administrators and public authorities) and will touch upon several subjects from different perspectives. The scenarios will attempt knowledge construction at several levels: (a) access to information, (b) adaptation of learning material, (c) knowledge sharing and (d) technology potential (depending on the usability and the features they offer) and they will enhance a factor that guarantees success in every educational approach: the **"fun factor". The users will be involved in a series of "learning to learn" situations.** As research in pedagogy demonstrates, successful learning can be achieved in authentic situations. Furthermore, very much related to constructivist learning theories, the learner should be encouraged to actively explore "the world" by himself/herself instead of adopting teacher-oriented approaches which are often based on the idea of "knowledge transmission". In the framework of the proposed activities, the users will be able to personalize a set of resources for reference and problem solving.

- **Provision of eLearning tools that can be used by all members of the local community who are in need of continuous training, education and support.** Apart from the students and teachers, the local community members in need of such support include farmers, people in the tourist industry, small/very small businesses, etc. The key to the proposed framework lies in the decomposition of knowledge into independent, reusable "eLearning modules". This can be achieved by an efficient representation of knowledge in reusable modules by means of semantic mark-up and by devising algorithms that can efficiently match the requirements of prospective trainees to a sound combination of "eLearning modules". **Professional Development Portals** (PDP) will also be created in order to support the proposed activities and to act as stimuli for further communication between the user groups. These portals will be linked to relevant annotated documents, databases and interaction forums and will serve as a repository for locally produced materials, including archives of presented streaming sessions.
- **Utilization of the ICT capabilities for promoting the local community's interests.** Special attention will be given to the use of ICTs to serve the local community's goals. The use of ICTs is expected to contribute strongly to the connection of the young people's education with real life in their community and the transformation of the Learning Hubs to communication centres for social and economic development. This will be achieved with the active involvement of the users (teachers, students, farmers, health personnel, local administrators) in the **organization/materialization of activities (scenarios)** that will demonstrate the benefits of the use of ICTs (self-training and learning, virtual and collaborative applications) for the local community and economy (e-shops for agricultural products, e-newspapers, weather forecast etc).
- **Enhancement of the communication between rural communities.** The aim of Rural Wings is to create a **virtual learning community** where people will be encouraged to communicate and will get familiarized with the idea of cooperation and networking. The Rural Wings learning environment will be, among others, an integrated communication tool. People will be able to participate to video-conferences, to have electronic discussions with their partners on the problems, to learn about other countries and cultures.

In order for the Rural Wings project to meet its ambitious objectives **a multidisciplinary team (satellite communications' providers/operators, software experts, telecommunications companies, experts in distance and life long learning methods** as well as a large number of **users' communities** in Europe, Canada, Latin America and Africa) has been established. The consortium is bringing along significant expertise gained from the application of many related research and demonstration projects worldwide (RCST[3], TWISTER[4], ZEUS[5], MUSE2, SCHOOLSAT1, AMERHIS1, BARRD1, RIA3, NMB3, VERDI1).

7 *ESA projects*

8 *EC projects*

9 *National Initiatives*

Satellite services according to the DVB-RCS standard: Breaking teachers' and students' isolation in remote schools

D. Katsigiannis, Hellenic Aerospace Industry, Greece

Aim of the presentation

The aim of this presentation is to show the capabilities of satellite broadband communications with respect to distance learning applications and the way they can contribute toward the removal of isolation and easing the difficulties faced by students and teachers who live and work at isolated schools.

Difficulties to be addressed

We will list the difficulties that isolated schools face, which have been divided to difficulties that teachers and students face, and problems that the state has to deal with.

Teachers' and students' difficulties

1. The teachers' and students' isolation occurring by their impeded access to knowledge.
2. The small number of students at some schools that sometimes is less than the fingers of one hand.
3. The small number, as it is mentioned above, of the students that are in more than one grade and the teacher who has to cover the students' learning needs. (One-teacher multigrade school)
4. Failure to form students' working groups due to the small number of students in the same class.
5. The teachers' isolation from their colleagues and the need to work in more than one class.
6. The students' transport from where they live to the village where the school is.

Problems the state has to deal with

1. Failure to employ adequate teaching staff.
2. Failure to supply both the school with the necessary educational materials and the teachers with supporting teaching means.
3. Failure to deal with the students' difficulties in transport, from where they live to where the school is (lack of reliable roads and means of transport).

Contribution of satellite broadband communications in lifting the difficulties listed above

As we hope it will be shown in our brief presentation, all the difficulties mentioned above may be lifted or considerably reduced if the state and the teachers decide to exploit the capabilities of satellite broadband communications, which can ensure, both for the teachers and students, and the local communities a friendly and creative environment with the active participation in the national and world educational developments and in today's societies of knowledge.

Capabilities of EAB (in English: HAI = Hellenic Aerospace Industry)
Before we discuss the ways the Satellite Broadband Communications can help lifting the difficulties the remote schools face, we will present the technical and financial feasibility of supplying satellite communication networks by EAB with the know-how and the infrastructure available at the factory.

EAB has ten years of experience in designing, developing and implementing Satellite Systems and Satellite Communication Networks, thus contributing considerably to the construction of the first Greek and Cypriot Satellite Hellas Sat, and the acquisition and installation of the first Satellite Station Base at EAB in Tanagra. The know-how and the infrastructure that EAB has established and developed in the last ten years in the field of satellite communications can be put at the state's, the teachers' and the students' disposal ensuring that they have access in the satellite broadband communications. It is a technology that, can offer teachers and students the following:

- A pleasant and creative teaching and learning environment
- A smooth transition from the blackboard to a modern multimedia teaching environment
- An environment that encourages initiative and creativity by students and teachers
- Lifting of isolation for remote schools, as these schools will be able to function in an environment of virtual teaching classes, that is an environment which in fact means the elimination of the remote one-teacher multigrade schools with the small number of students and isolated teachers
- The continuous live presence of the teachers next to the students, although they may be thousands of kilometers away.
- The cooperation and daily communication of the teachers from the remote and/or isolated schools with colleagues from similar schools or schools of the urban centers.
- The students will not have to move in unreliable or non-existent roads to reach their schools and ensure communication with the teachers and access to knowledge.

Implementation of satellite broadband communication networks

From the indicative capabilities of the satellite broadband communication networks mentioned above, it is reasonable for you to ask how they can be implemented, how easy it is in terms of time and money to install such a system, etc. We will try to give some brief answers to these questions, without going into much technical and financial detail, regarding the feasibility of the new learning environment that emerges in the global village created by modern communications. We will try to answer briefly to the following two questions:

How can such a satellite broadband communication network be implemented?

The satellite technology available to EAB is DVB-RCS (Digital Video Broadcasting Return Channel through Satellite). Thanks to this technology, the users at a remote school and anywhere else are not simply passive receivers of some one-way broadcast, but everybody that has been connected with the relevant network participates bilaterally, as DVB-RCS satellite networks are interactive, that is everybody will be able to communicate with everybody else with video as well as sound, in real time, while everybody else can see them and listen to them. These schools can be thousands of kilometers away from each other, so lifting any geographic limitations put by conventional earth communication networks and the one-way satellite communication networks before the emergence and implementation of DVB-RCS technology.

How easy it is in terms of time and money to install such a system?

We can give an easy and documented answer to this question. Connecting a school to a satellite broadband communication network can be done in a day and the necessary equipment, that consists of a satellite DVB-RCS TECHNOLOGY terminal, a personal computer, a video conference camera and a projection device costs around five to six thousand Euros per school. The time and money are therefore very little compared to the possibilities it offers to the users of such an infrastructure.

What can the interactive satellite communication networks offer?

The installation of the above-mentioned infrastructure at a school can ensure:

1. Access to the internet
2. The operation in an environment of virtual classrooms, which can include children from a nearby community, island, city or places thousands of kilometers away from the urban centers of our country or, as a matter of fact, any other country. Within this environment, both the students and the teachers are not isolated, but are parts of a wider educational community that consists of students and teachers of remote schools. Such an environment allows the establishment of student working groups even in the hypothetical case where there is only one student at the third class of six different schools. In the case these are one-teacher multigrade schools, the same environment allows the teachers of cooperate, so that each teacher will teach the students of one class from all six schools. It is obvious that schools from the urban centers and the different regions can equally participate, thus enlivening the whole teaching experience. To make clear how lively and creative such an environment can be, let us suppose that

the students have a Geography class. The children that participate in the class can see and listen to a child and a teacher from a remote island in one class, and the next day they will see and listen to another child describing them the city he or she lives and goes to school. We can use a lot of similar examples, but teachers should be more suitable to do this. The rest is left to the teachers' and students' creativity when they familiarize themselves with the use of broadband communications.

3. The same infrastructure can be used for the teachers' and student's familiarization to the above networks, so that they will not have to move to urban centers. Moreover, the establishment of such an environment ensures the efficient and low-cost continuous teachers' training in other issues.
4. The nature of the above-mentioned broadband infrastructure can bring schools at the center of local communities again, as it can be used to meet any other needs these inhabitants of remote communities may have.
5. Finally, we have to stress that the main critical element for the effective use of the satellite broadband communication networks is people, in this case the teachers themselves. At this point I would like to express my optimism that so many people have come to this Conference from all over Greece who are eager to offer more to our children and our country at the era of the society of knowledge.
6. The regions covered by the Greek Satellite Hellas Sat and the Satellite Communication Networks that EAB can develop in order to connect a school at Herakleia, Oinouses, Athens, Munich etc. The inter-regional or even inter-state school that is no longer isolated, but can develop in a wider region and that allows the development of knowledge, intercultural osmosis and creative synergy.

Epilogue

In conclusion, I would like to thank the organizers of this Conference for the opportunity they gave me to present the capabilities of satellite broadband communication in distance learning before such an interested audience, and I would also like to thank you for your attention. Furthermore, I would like to emphasize that EAB, my partners and I personally are at your disposal, to answer to any queries you may have now or in the future, when you return to where you live and work. Once more, thank you.

Advanced learning management systems for distance education

T. Tiropanis, Athens Information Technology Centre, Greece

Introduction

Distance education is in a position to offer additional educational solutions and to constitute a platform for the dissemination of knowledge beyond geographical limitations. The success of distance education activities depends on the proper pedagogical and technological support. For its provision and management, thus, adapted pedagogical procedures as well as innovative technological applications are needed. A synopsis of the different types of distance education is presented below, together with support offered nowadays by learning management systems. Moreover, the provision is presented of a learning content management system within the framework of ZEUS, a Greek research project focusing on the provision of distance in-service training to teachers at remote schools.

The different types of distance education: benefits and challenges

A categorization of the different types of distance education is needed, so that the description of its benefits and of the technological challenges it poses can be done methodically. Two categories can be distinguished initially: synchronous and asynchronous distance education.

Synchronous education requires simultaneous interaction between trainees, trainers, and systems and applications of distance education. In the category of synchronous education the following cases can be distinguished:

- Virtual Classroom, where the instructor and trainees interact via applications such as videoconference as if they participated a virtual classroom.
- Collaborative Learning, where the instructor and a team of trainees, or the trainees among themselves, collaborate by means of systems and applications such as videoconference, so that they achieve certain training objectives; for example, so that a certain trainee consults with the instructor, or a group of trainees collaborate for the

needs of a joint project.

- Many other cases of synchronous education do exist, which are not worth elaborating further at this point, such as synchronous self-learning. Indicatively, also, the case of carrying out experiments using experimental laboratories from a distance can be mentioned here.

With regard to asynchronous education, this form of distance education does not require simultaneous interaction between instructors, trainees, and systems and applications of distance education. The following types of asynchronous distance education can be distinguished:

- Asynchronous Self-Learning, whereby the trainee acquires asynchronous access to educational content from a distance, via certain technological infrastructures. Of fundamental importance in this type of distance education is the precise definition of the learner's needs, the learner's background, as we as a definition of how the existing content can correspond to the needs of each trainee, given his background, via the mapping of learning paths, in which access to the content is done in a certain order, and with a pace that the trainee can follow.
- Asynchronous Collaborative Learning, where a group of trainees and/or trainers can interact, though not simultaneously, via systems and applications of distance education; for example, collaboration between trainees for a common project asynchronously, via applications that are based on the use of electronic mail.
- Other forms of asynchronous distance education are also possible, which it is not necessary to mention here.

This categorisation is just one of the possible categorisations that we could identify for distance education, so that we can approach technological challenges more methodically.

In this way, the benefits offered can also be distinguished more easily. The above categories of distance education can offer more flexible training timetables, adapted to the needs of trainees and instructors, minimising the distance between them. Asynchronous solutions can also help so that problems relating to time zones can be overcome. Flexible shaping of groups is also possible, with members that may be scattered geographically, but have better matching backgrounds and training needs. Asynchronous access to educational content can promote learning via experience (learning by doing), particularly when access is given to applications of simulation, virtual experiments, or distance access to laboratory equipment, providing thus effective learning solutions with lower costs and greater safety. Thus, learning becomes available to more individuals.

With regard to the above categorized solutions of distance education, the role is obvious that innovative technologies can play for their effectiveness. The field of systems and applications for distance education is being shaped continuously. The network infrastructures are diverse, as well as the applications for virtual experiments or videoconferences. The area, however, of learning management systems possibly appears to acquire a content particularly for distance education, that takes place as a process complementary to traditional forms of education.

Thus, systems of learning management, as well as systems of learning content management

are distinguished, which have differences with regard to their characteristics, but can also be combined effectively.

Learning Management Systems – LMS

Learning Management Systems (LMS) can be used in environments of traditional education, playing a complementary role. For example, an academic department can use learning management systems to publicise the course programme for each semester to its students, to offer course notes, as well as giving the possibility to each student separately to view his exam grades. In addition, it can give instructors the possibility to create and publish content for their courses in the form of notes, multimedia content, or even tests.

In the framework of distance learning solutions, however, learning management systems play a very important role. In the cases of a virtual classroom and of synchronous collaborative learning, for example, the role of learning management systems in supporting the educational process becomes more important. Thus, while in traditional learning environments such systems could be considered as alternative or additional, in synchronous distance education they constitute a necessity.

With regard to asynchronous distance education, learning management systems can also be applied, when asynchronous solutions accompany either traditional educational solutions, or solutions of synchronous distance education. Otherwise, in asynchronous education learning content management systems are better applicable.

Learning Content Management Systems – LCMS

The most important difference between Learning Content Management Systems (LCMS) and LMS is the use of the concept of Learning Objects (LO). Learning objects can constitute structural elements of integrated solutions when these are suitably combined and given to the trainees in the suitable order and pace. Thus, it is possible that educational solutions based on learning objects can offer learning paths to users in an individualised way, that suits their background and training needs.

Learning Content Management Systems can offer this precise possibility, as well as the possibility to create new learning objects and their characterization, so that they can be combined with other learning objects. Moreover, these systems can be interlinked with existing learning management systems.

An important role for the development of learning content management systems is played by standards (such as, for example, IEEE-LOM, or Dublin Core), as well as new technologies such as those of Semantic Web, which can support the characterization and appropriate combination of learning objects, so that they correspond to the individualised training needs and the background of each trainee. An important role is also played by Grid technologies, as well as Semantic Grid, for the distribution of learning objects, the interaction between them, and their integration with other applications.

Systems of the ZEUS research project

The ZEUS research project (www.dias.ea.gr) offers the possibility of distance education to teachers working in multigrade schools in remote locations. The distance education offered includes synchronous as well as asynchronous training, and is provided through satellite network infrastructures, combined with access via ISDN.

Synchronous education offered in the framework of the project has the form of virtual classroom, where the instructor and the teachers trained are found in different locations and communicate among them via the MENTOR.

Simultaneously, the virtual classroom was also supported by a learning management system that was developed so that it is adapted to the needs of the project. The ZEUS learning management system is offered via the web portal at palantir.ait.gr:8080/dias. In this portal, participants are given access, via access codes, to all lecture materials, or even to the corresponding video. Also, the possibility is offered to the trainees for doing exercises and making comments, as well as receiving relevant answers from the instructor.

Beside, however, its characteristics of a learning management system, this portal also has characteristics of a learning content management system, offered as support to the asynchronous distance education provided, in the form of providing users with access to additional educational content and with the possibility of asynchronous collaboration via a forum application, in form of video, text, photos, etc.

This portal also provides access -via a security code- to the administrator of system (who usually is the instructor, too) and to the users (trainees). All the content provided in the portal is structured in units, each of which serves certain training objectives. Thus, each time the administrator adds content to the system, he selects to which unit it belongs, indicates the order in which it should be presented, as well as annotating it with regard to its content, using a special form.

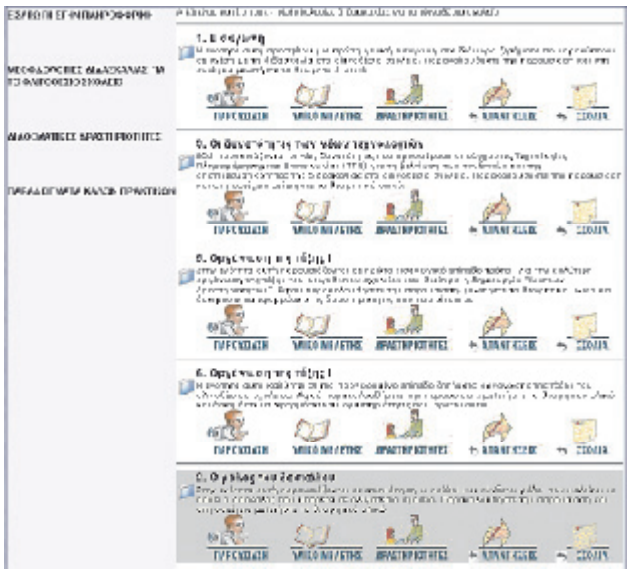

Figure 1: Distinction between learning objects which are relevant to the user (white background) and those already covered in his background (shadowed).

When the user uses the system for first time, he completes an online form, describing his background. This form can be renewed each time the trainee has upgraded his background through the acquisition of new knowledge. Each time the user has training aims that correspond to a certain training unit, the system, based on the background of this particular user, indicates those learning objects that the user should access, separating these from the objects that are already covered in the user's background (Figure 1). Thus, the possibility is offered by the ZEUS web portal for individualised solutions of asynchronous distance education.

The portal also provides the administrators of system with the possibility of reports on system use.

Conclusions

The use of learning management systems has already been well-established in distance education, and not only in it. At the same time, the role of learning content management systems is being increasingly recognised as important. However, significant issues remain open, which technologies on their own cannot face.

One of them concerns the development of specialised pedagogical methodologies. The ZEUS project has already developed such methodologies, together with other research projects at the European level – e.g. the ELeGI project (www.elegi.org), which is financed by

the 6th Framework of the European Union.

With regard to the technological issues, dealing with the question of access for all to network infrastructures and broadband is important, so that access to multimedia content is possible. Beside geographical coverage, which can be dealt with through two-way satellite access and the corresponding services that will be offered shortly, the cost of access, broadband connectivity as well as of the necessary equipment constitutes an important parameter for realising access for all.

Finally, an issue to be considered by providers of distance education solutions is the economically efficient storage of a large volume of content, its provision in different forms (formats) suiting the needs of users from different access points and different means of access. Also, the automation of the process of creating and characterizing content constitutes one additional challenge.

Satellite services for distance training: User's experience in a remote multigrade school

M. Loudaros, Primary School of Aigiali in Amorgos, Greece

I would like to thank the organizers of this Conference for the honor to invite us and give us the opportunity to present our views at this meeting.

I have been working for 30 years in multigrade schools in Amorgos, after having worked as a supply teacher for one and a half year at schools of nearby Ilioupolis, Dafni and Ag. Dimitrios.

You may wonder what could be the relevance of an old teacher with new technologies. Certainly, I did not come to "carry coals to Newcastle" even more so on a subject I am not an expert on, as there are colleagues that have been specialized on this subject. My only aim is to simply convey my own experiences.

If we consider the term "new technologies" in a longer timeframe, we will see that during all these decades our generation tried to use the "then new technologies" in order to facilitate learning at schools that functioned "by the grace of God", or rather "by the grace of teachers".

Although today it is taken for granted that schools are equipped with computers, copying machines etc, for us at those times the telephone, electricity and elementary heating were not at all matters-of-course.

Our generation learned to write using chalk on small blackboards, and we were called to start teaching at schools with nearly the same infrastructure.

The emergence, therefore, of the first computers with the orange or green screens attracted our attention.
So, I bought a computer in about 1990 and I installed it at the school so that the children get

in touch with the new technology.

Moreover, at about the same time, as the President of the Parents' and Guardians' Association for High School and Lyceum, I saw that teachers who knew about computers give optional lessons at secondary education schools.

The development of the computers in the last decade made their use by the students much more easy.
The state, however, was still absent and only the teachers' earnest efforts gave some gleams of hope at some schools. Teaching of informatics at High Schools started much later, and only in the more recent years were informatics taught at elementary level, in the context of the daylong schools.

So, when the university of the Aegean, thanks to Mr. Tsolakidis' zeal, established SXEDIA (which stands for School Educational Network Web of the Aegean) project about six years ago, we gladly accepted the invitation and the challenge to participate. At that time it was a pioneering and interesting project for all of us.

The children participated in Net Meetings, in painting competitions through computers, etc. We were also supplied with CD-ROMs with various contents. So, at school breaks, when the weather was bad, the children used computers to solve problems on Mathematics, language, Physics etc. Lots of children in the lower elementary classes managed to solve problems on fractions without having been taught the subject, by combining pictures and numbers. Moreover, the school celebration of 25th March at the School of Psara had been broadcast live to our school, for historical reasons. Finally, two students of our school were awarded with a mountain bike each, by the University of the Aegean at a "painting with the help of a computer" competition.

Even then Mr. Tsolakidis had expressed his plans to broadcast through a satellite. So, when ZEUS project was launched, he invited us to participate. On the way of the project's development we had the opportunity to appreciate the interest of the other project participants that is OTE (Greek Public Telecommunications), Ellinogermaniki Agogi, University of the Aegean, Q-Plan, INTRACOM, Hellas Sat, through their representatives who participated in the implementation process.

You may wonder why the project was called ZEUS and not HERMES, as it is related to information transmission. The explanation is that the project designers saw that the initial letters of the project name related to Greek mythology.

The co-operation of all the above participants has been excellent, and apart from technology, we established a national network of friendship, creativity and progress. The children were looking forward to the project and they kept asking "when are we going to get connected"? Moreover, some other schools expressed their wish to visit us and see how the project functions. The lack of a video-projector made viewing by many people a bit difficult.

What is ZEUS project and how does it function? At first I will name the elementary schools that participate, with the University of the Aegean: Aigiali, Amorgos, Argiri Karditsa, Avlona

Messinia, Megarhi Arta, Messovounia Kefallinia, Monodendri Ioannina, Piles Karpathos, Pirgos Orestiadas Evros, Salakos Rhodes, Hora Sfakion Crete.

ZEUS project uses MENTOR software that was designed by INTRACOM. Mentor software is an integrated tool for e-learning that can serve the needs of educational institutions but also of companies where employees' continuous training is necessary. Some of the features of Mentor are:

- Video projection for all users
- Implementation of chat and voice transmission that allows users to communicate
- Design tool – Whiteboard
- HTML Browser
- Tool for Desktop sharing – VNC
- Tool for presentations PowerPoint – Slide Show

ZEUS

During the school year, in the context of ZEUS project we also operated YouRa software. I would like to briefly describe this software.

General Introduction to YouRa

The name YouRa stands for the English name of the software: "Young Researchers in Action". The development of YouRa has been financed in part by the European Union, in the context of Socrates project.

The following institutions participated in the design, development and evaluation of YouRa software:

- Ellinogermaniki Agogi , that coordinated the project
- University of Athens, Department of Primary Education
- Univesity of Frankfurt am Main, Institute für Didaktik der Physik, Institute für Padagogische Psychologie.
- BG und BRG Schwechat
- Freiherr vom Stein Schule

The general objectives of the project are:

- Familiarization of the students in the use of New Information Technologies
- Familiarization of the students in research methodology
- Further education of teachers both on the theoretical background of Distance Education and New Technologies in general, and the implementation of Distance Education projects in Primary Education.

Implementation

- In service training for teachers
- The students participating in the project will:
  - Construct their own measuring devices

- o Collect meteorological data
- o Enter data in a specially designed electronic environment on the internet
- o Analyze the pictures or graphs that the electronic environment draws for them
- o Discuss with their peers / distance partners, through Bulletin Boards and through teleconferencing
- o Publish the results through the project magazine METEO

I hope I managed to give you in such a short time an example of our experiences in new technologies that we discuss today.

Finally, I would like to ask the state to utilize the results and the conclusions of this great and earnest effort, by incorporating them to the educational process and deciding that the extra cost is worth it.

I would like to thank and congratulate the coordinators of the successful project, for the good collaboration and the warmth they treated us, for their work. Many thanks to Mr. Costas Tsolakidis, who has been the driving force of all these projects from my students and me, as he gave us the opportunity to work with the most advanced information and communication technologies in the most remote and isolated regions of the Aegean.

Finally congratulations to the organizers of the Conference, and the Mayor of Argiroupolis, for hosting the Conference in the modern facilities of the Municipality.

The experiences of a multigrade school from its participation in the Comenius Action of the Socrates Programme

J. Vasdekis, Primary School of Monodendri in Zagori-Ioannina, Greece

The primary school of Monodendri, a multigrade school located in a small village in the heart of the mountainous region of Epirus in north west Greece, has had the outstanding experience of coordinating a Comenius 1 project which ran between 2001 and 2004.

The project, titled "Environment and its influence in providence of 4 European countries", was successfully completed with the help of the participating primary schools from across Europe:

- Primary School of Monodendri (Coordinator)
- Tuovilan Ala-Aste Finland
- Andatza Auzo Escola Spain
- Broadford Primary School Scoltland.

The issues with which we were engaged were Culture – Environment – Ecology – Cultural and Architectural Heritage.

It is worth mentioning the following activities:

- Correspondence among the pupils of the four primary schools.
- Favourite activities – hobbies list exchange among the pupils.
- Daily exchange among the four primary schools of weather data through e-mail.
- Composition of pupils' personal diaries and exchange of them (in written form and CD).
- Videotaping of each school and of the daily living conditions and exchange of this material.
- Creation of an exhibition – a corner of results in a specially formed area in each school.

- Presentation of the school territory by the pupils in the form of DVD.
- EURO DICTIONARY in four languages (already published on the Internet).
- Graphic representations of the climate conditions and their differences in each country.
- Exchange of flags and posting of them in a prominent position in each school.
- Collection of elements from each school regarding the surrounding culture and every day life (analysis, composition, presentation of data in every school).
- Architectural expansion of the place where each school is located (photographs, small projects of the children, relevant bibliography).
- Research and PROJECT from each school in a CD-ROM on the architectural, environmental, sociological, geographical and general cultural value of each school's grounds.
- Exchange of visits, during the three years that this project lasted, exchange of tutors and pupils, where there was direct contact among pupils and tutors, acquaintance with all schools, acquisition of valuable experience regarding the living conditions and the history of each country, improvement of knowledge regarding the linguistic similarities and differences among the languages and practice of the English language on behalf of all of us, and, what is more, an intense interest from the other members in learning, in being taught the Greek language and the Greek History. During the last year significant material about the Olympic Games 2004 was distributed to all members by "Athens 2004".

We believe that it has been a totally successful project, due to the fact that it helped pupils as well as instructors to increase their knowledge and their esteem on the use of computers, in all relevant school subjects (English, Aesthetics Education, Geography, History, Computer Science) and mainly in the study of the environment and the way in which this affects people's lives.

Finally, there has been a substantial growth of the European dimension of education at school, which was achieved through daily communication – co-operation impeccably accomplished among all members.

Relevant web sites:

www.geocities.com.euscholls
www.andatza.net
www.andatza.net/comenius.architecture%20wed/index.htm
www.andatza.net/comenius/Eurodictionary%20wed%20site/index.htm
www.monodendrischool.gr
www.Korsholm.fi/alaaste/tuov

Multigrade schools and the NEMED European network

C. Tsolakidis, University of Aegean, Greece

Multigrade Schools

Multigrade teaching refers to the teaching of students of different age, grade and ability in the same group. It is referred to variously in the literature as 'multilevel', 'multiple class', 'composite class', etc, and, in the case of one-teacher schools, 'unitary schools'. It should be distinguished from 'monograde' teaching in which students within the same grade are assumed to form a homogeneous group.

Multigrade schools play an important role since they provide access to primary education in rural and isolated places of many countries around the world. The existence and operation of such schools increases the chances of the international society to implement the ambitious goal "education for all". Apart from their social role, multigrade schools constitute a very interesting field of research in educational matters, promoting scientific debate on various educational issues.

However, in spite of their importance, these schools, usually operating in underdeveloped areas, form the most abandoned part of the educational system. It is noticeable that multigrade teaching is surprisingly very common. Yet only a few Ministries of Education, Curriculum Development Agencies and Teacher Education Institutions take their role into account. Their functioning within the educational system is marginal due to geographical constraints, socioeconomic features, lack of sufficient school equipment and mainly lack of staff. In general, in the field of multigrade schools practice and research very little progress has been made.

There are theoretical, as well as practical grounds, in support of the view that improving multigrade schools in some areas is equivalent to improving educational quality in these areas. At the same time there are grounds in support of the view that these schools could play an important societal role, since they could function as "social community centres".

The NEMED Network

The NEMED network brings together educational experts, academic tutors and teachers aiming to improve the quality of education offered in multigrade schools.

This network, focuses on the promotion of communication between its members, disseminating of teaching models, good experiences of multigrade teaching practice, development of teaching attitudes and provision of educational material appropriate for multigrade teaching.

The working concept of the NEMED network is based on the formation of working groups on specific issues of multigrade education, including both face-to-face cooperation and e-meetings (utilizing modern ICT). Moreover the setup of the networks' workshops, allows the participants to exchange and share first-hand experiences of the work undertaken by the groups and specify steps of further research. The academic institutions, as members of the working groups, have indicated a number of multigrade schools per country (of the institutions' origin) that will participate in the research as connected schools with the working groups.

The overall aim of the NEMED network is to develop and distribute an overall "Report on Multigrade Education" based on the working group reports. This Report is going to be presented to educational ministries and policy makers, since it is a tool that is expected helps the authorities in taking policy measures on improving multigrade education in Europe.

Apart from bringing the multigrade teaching and learning in the educational policy front, the Network has the equally important aim of providing continuous support to multigrade teachers of the participating schools, assisting in parallel the communication between inaccessible multigrade schools. The provision of educational material, multigrade teaching training and in service support based on the use of modern ICT are means by which multigrade teachers will be assisted and the participating academic and training institutions are going to support this. Emphasis is given in (a) training on the methodological approaches (group teaching, peer tutoring, self directed learning, design of cross curricula applications etc.) (b) application of these approaches to multigrade school environment and (c) familiarization with the use of ICT in the framework of the multigrade teaching. The training programme will be delivered to the teachers through ODL techniques.

A user-friendly web educational and networking portal is developed that acts as the core node of the network community and facilitates continuous communication and the exchange of ideas and materials. Teachers not only are going to be aware of new methods and techniques on multigrade teaching, but also will get the chance to propose various "political" and other issues, participating actively at the Networks' activities through the web educational and networking portal.

Partners of the NEMED Network	
University of Aegean	Greece
Ellinogermaniki Agogi	Greece
University of Lisbon	Portugal
University of Barcelona	Spain
University politechnika of Bucharest	Romania
University of Eotvos Lorand	Hungary
University of London Institute of Education	Britain
University of Lecce	Italy

University of Cyprus	Cyprus
European Distance and E-Learning Network	Britain
Oriente Network	Austria
University of Juvaskyla Chydenius Institute	Finland

Objectives

The Network objectives are as follows:
Stimulation of the effort of bringing multigrade education to the education policy front and contribution to the upgrading of multigrade teaching and learning. Despite the fact that multigrade teaching schemes represent the usual means for providing education for all in Europe and the rest of the World, multigrade education for a long time remained at the educational systems cut off. The Network is going to focus on the multigrade phenomenon.
Performance of an extended survey on multigrade teaching and learning issues as well as on the multigrade educational conditions in Europe. Working groups of the network are recording and analyzing the needs of multigrade teachers and students in Europe, best multigrade teaching practices etc. and are developing a series of reports which are going to form the basis for developing the "Report on Multigrade Education".
Proposition of specific suggestions concerning the improvement of multigrade education in European level. The "Report on Multigrade Education" is going to include parts where specific measures for upgrading multigrade education on European level, are to be proposed. The report is going to be distributed to educational policymakers and Ministries of Education in order to press for action on improving multigrade educational conditions.
Offer of specialized support and training to multigrade school teachers by supporting through the NEMED's networking platform the communication of remote multigrade schools in terms of providing professional training opportunities and access to educational resources. In addition the Network will present to teachers (a) the use of the INTERNET as a tool of constant interaction between educators and trainees and (b) the Open and Distance Learning (ODL) techniques as basic media of communication and collaboration. Moreover the teachers' training is expected to support the learning process indirectly. This will be achieved not only because the teachers will be well trained but also because the schools will have access to databases of educational material in electronic form that meet the needs of teaching and learning in multigrade schools.
Evaluation of the application of ICT-based methodologies and practices addressed to multigrade schools. The function of the network is based on the use and exploitation of the possibilities offered by Information Communication Technologies that will support qualitatively the effort. The same concept i.e. the utilization of ICT will form the basis for indicating new methodologies of good multigrade practice.
Creation of the conditions for the network's sustainability and expansion. The NEMED network aims on utilizing outcomes of other Comenius projects, develop collaboration and include other Comenius partners in the Network. In addition the partnership aims to support further the continuation of the network by own resources and by trying to ensure additional funds from other external resources.

Working Groups

GROUP 1	GROUP 2	GROUP 3
ICT for multigrade schools teaching Univ. of Aegean Univ. Eotvos Loran Univ. Barcelona Univ. Juvaskyla	**Multigrade classroom management** Univ. of Bucharest Univ. of Aegean Ellinogermaniki Agogi Univ. of Cyprus	**Links with local society /Multicultural settings** Ellinogermaniki Agogi Univ. of Lecce Univ. of Bucharest Univ. of London
GROUP 4	**GROUP 5**	**GROUP 6**
Learning modes Univ. of Lisbon Ellinogermaniki Agogi Univ. of London Univ. Juvaskyla	**Development of educational resources** Univ. Barcelona Univ. of Aegean Univ. Eotvos Loran	**Policies on European multigrade schools** Univ. of Aegean Ellinogermaniki Agogi European Distance and E-Learning Network Oriente Network University of Cyprus

GROUP 1: ICT and multigrade schools

This group, leaded by UNIVERSITY OF AEGEAN, is focused on the best practices of ICT enrollment in a multigrade teaching environment. ICT is proved to be of crucial importance as an educative ally. but in the case of multigrade schools, ICT can really transform teaching and learning conditions into a very competitive and efficient educational procedure.

GROUP 2: Management of multigrade classroom

This group, leaded by UNIVERSITY of BUCHAREST, aims to train multigrade teachers in all parameters which accommodate teaching routine. Classroom's arrangement of furniture, formations of pupils' groups and other parameters can solve many administrative and teaching difficulties, minimize lost time and maximize teaching efficiency.

GROUP 3: Links of multigrade school with local community – multicultural settings

This group, leaded by ELLINOGERMANIKI AGOGI, will examine the role of local authorities in a multigrade school's function. It is known that multigrade schools needs are delayed in their processing by ministries of educations. So, as far as financing additional needs is concerned, the role of local authorities can be of high importance. This group also investigates the role of multicultural settings in multigrade classroom.

GROUP 4: Learning modes in multigrade environment
This group, leaded by UNIVERSITY OF LISBON, emphasizes on the wide range of different learning modes within multigrade learning frame. Unique teaching and learning techniques are applied by multigrade teachers and students, such as peer teaching, self teaching etc. This group's distinct role is to train teachers how to identify these different learning modes and how to apply those for different students' needs and profiles.

GROUP 5: Educational resources for multigrade schools
This group, leaded by UNIVERSITY OF BARCELONA, aims to train teachers how to trace useful educational material, how to evaluate it and how to develop it for their own needs. The lack of specially designed books for multigrade schools can be overcome if trained teachers can develop their own educational material that meets pupils' needs.

GROUP 6: Policies on multigrade schools
This group, leaded by UNIVERSITY OF AEGEAN, is the quintessence of NEMED project since its distinct role is to record and to compare different policies towards multigrade schools, throughout Europe. On a latter phase, this group's aim is to develop a report not only including existent policies and distinguish best ones, but also suggesting new schemes that new policies can be based on.

Target groups

The Network aims to address directly the needs of Multigrade school teachers. However the development of the network is going to be indirectly beneficial for the students in multigrade schools.
In parallel the network with the development of the "Report on Multigrade Education" will focus on sensitizing the academic world (scholars, pedagogues, researchers), teachers of other non multigrade schools, teachers' trainers, curricula designers and decision makers, educational ministries and local authorities, to take action in the field of multigrade teaching and learning with the aim to upgrade quality of primary education in Europe.

Outputs of NEMED

The main outcomes of the proposed network are the following:
The Network of Multigrade Education: The creation of a Network of educational professionals, teachers, training and academic institutions that focuses on multigrade education is by itself an outcome. The network represents a very important outcome since something similar does not exist as far as multigrade education is concerned. It is strongly believed that the network on multigrade teaching will contribute a lot to the improvement of multigrade educational conditions in Europe.
The Web Educational & Networking Portal: The web educational portal is the core knob of the network's function and is designed for serving both the communicational and working needs of the working groups as well as the specialized needs of multigrade teachers. The portal is developed as an integrated communication tool providing direct access to communication, information and professional support. www.nenmed-network.org

Training for Teachers in multigrade schools: As the network develops, participants form groups that will be working on one subjects of the groups as described aerlieer. Teachers of multigrade schools will have the opportunity to be trained on the issues tackled by the groups by assessing relevant training material or participating in a specialized training programme cycle via the web portal.

Working group Reports: The working groups will cooperate implementing Distance Education techniques, ina synchronous or asynchronous mode, using the communication tools available at the web portal. The members of the working groups are having face to face and virtual meetings to record progress and conclude on their future actions. The major outcome of the working group will be the "Working Group Report" on the research theme.

The "Report on Multigrade Education": The "Report on Multigrade Education" is to include parts where specific measures for upgrading multigrade education on European level, are going to be proposed. It is considered as the main contribution of the network in the effort on pressing national educational authorities and the international academic community to pay attention to multigrade schools and take measures for providing quality education in these schools The consortium will include a prestigious editor so that the production of the "Report on Multigrade Education" will be of high quality and standards.

Evaluation report: The Evaluation Report will include a detailed description of the methodology, the tools that where used to measure the different aspects of the network's performance, the results and discussion. The evaluation report, besides showing the value of the Network, will suggest directions for further research in the field of teaching and learning in multigrade schools.

Other outcomes: In addition, a series of other products are to be developed such as:

The Network's Website that will provide: information on the project's background and idea, access to the WENP, access to training material and reports of the working groups, a description of the project's products and outcomes, links to related sites etc

Leaflets and posters will be produced, for dissemination purposes, containing complete information about the network. The proceedings of the workshops and the training material on multigrade teaching will be included in a CD-ROM.

Evaluation

Evaluation of the activities of the network will be taking into account the following aspects:

Evaluation of the network's function and working group activities: A general evaluation scheme is developing in order to record and analyse the function and the effectiveness of the network. Special focus is given on the assessment of the network's ability to expand, include new members interested in multigrade teaching as well as the ability to sustain its function after the completion of the three years of the network's run.

Evaluation of the teachers training scheme: In order to assess teachers' training, teachers' engagement in the proposed methodology and the application of ICT in teaching practice will be examined. The network aims at upgrading multigrade education and the activities of teachers' training on multigrade teaching to constitute an important part of the networking activities which need to be addressed in terms of evaluation separately.

Ethnographic evaluation: The partnership will take advantage of the different multigrade school environments across Europe and will study the attitudes of teachers with different cultures towards the application of the proposed approach as well as the attitudes between

teachers themselves. The evaluation is going to be performed by the evaluation group, which is to be formed at the early stages of the network's life.

Dissemination

As far as dissemination is concerned the NEMED network is making use of all available dissemination channels. The dissemination strategy includes specific measures for the dissemination of the products and the outcomes of the network. The following specific measures have been planned and are in the process of implementation in various levels:

Development of the project's web-page: The project's web site is functioning and will present all project outcomes. It will be linked to as many other relevant sites as possible and registered to the main search engines on the Internet. www.nemed-network.com

Provision of access to the WENP. The network's partnership intends to provide access to WENP to educational and academic institutions and individual researchers that focus on primary education.

Press Releases, Leaflets and Posters

Organization of annual workshops and closing conference. These events are open to the general educational community and the public and disseminating the Network's ideas and assisting an effort of the initiation of an extensive dialogue on multigrade educational issues.

Presentation of the project and its anticipated outcomes in conferences, seminars and workshops: The project's outcomes will be presented to international conferences, workshops and exhibitions which focus on educational issues and will be also submitted to scientific magazines.

Distribution of the Report on Multigrade Education. The Report on the Multigrade Education is the major outcome of the proposed networking effort. The aim is to develop an integrated and detailed report on multigrade educational issues that will be used to reveal the multigrade educational reality in European level. The report is going to be distributed in key educational and training institutions around Europe sustaining and expanding the NEMED network. Moreover the report is going to be disseminated widely so as to reach teachers, the general academic community, publishing houses and the general public.

Dealing with learning modes in the multigrade classroom: test and preliminary results of an inquiry to teachers

A. Duarte & S. Fernandes, University of Lisbon, Portugal
J. Paasimäki, Chydenius Institute, Finland

Introduction

This paper introduces a work which takes place in the NEMED (Network of Multigrade Education) Project. The goal is to inventor teaching practices that multigrade teachers use in order to deal with a variety of learning modes in their classrooms. This inventory will contribute to the development of materials to be used on a training module for teachers, regarding learning modes.

Besides a definition of learning modes as the variation observed in the learning process, a framework of different learning modes is proposed: surface vs. deep-organized learning; instrumentally vs. intrinsically-achieving motivated learning; externally vs. self-regulated learning; individualistic vs. collaborative.

An interview script, for assessing teaching practices regarding learning modes, was developed and tested with a group of multigrade teachers. Results show that teachers vary their practices to deal with different learning modes, identify preferred learning modes and use diversified practices for promoting specific learning modes.

What is meant by the term 'learning modes'?

Learning Modes might be defined as the variation observed in the learning process (e.g. learning can be more an individualistic process or more a collaborative one). A student can vary the Learning Mode according to the learning situation and his or her learning needs (e.g. revising by rote learning, for a multiple-choice answer test, or revising by comprehending, for writing for a project).

Therefore, there are a diversity of learning modes which can be more or less adapted to different students and different learning situations.
When a specific learning mode is consistently used by a student, this can become his or her Learning Style.

How many Learning Modes?

In order to answer this question learning modes can be conceptualised across three axes, which reflect various aspects of the learning process: 1) Cognitive; 2) Motivational; 3) Interpersonal.

Each axe involves different dimensions, reflecting diverse learning modes (e.g. Cognitive axe involves a dimension of memorising versus comprehending).

Each dimension can be conceptualised as discrete opposed poles or as opposed but in a continuum (i.e. as opposite processes or as complementing each other).

Each learning mode can appear in different ways; according to personal and environmental factors (e.g. there are many ways of conducting a self-regulated learning mode, as opposed to an external regulated learning mode)

Moreover, axes can cross, reflecting the interwoven of different learning modes (e.g. students might self-regulate their learning in a collaborative way)

For each of the three axes, we propose a focus on particular dimensions, taken as nuclear.

Considering the cognitive axe, learning can occur via a surface learning strategy (i.e. mechanically memorizing) versus via a deep-organized learning strategy (i.e. learning focused less in knowing by heart than in trying to understand the meaning of the contents, to relate them with previous knowledge, to be open to new contents and to change personal ideas, to memorise by comprehending, to critically analyse and have an opinion on contents, to be creative as well as organized and sensible to teachers' evaluation) (Biggs, 1987).

Attending to the motivational axe, learning can be based in instrumental motivation (i.e. learning to avoid failure) versus based in intrinsic-achiever motivation (i.e. learning for the pleasure and personal full-filing implicated in learning as well as for success). With such a motivation students normally go beyond what is demanded, perceive tasks as involving, get a lot of satisfaction from learning, strive for good marks and show a lot of involvement (Biggs, 1987).

Taking into account the interpersonal axe learning can be external regulated (i.e. learning is conducted by others or factors besides the learner) versus Self-Regulated (i.e. the process of managing one's own learning) (Zimmerman, 1994). By self-regulating learning learners move from being externally controlled by teachers or others to being active in the control of their own learning processes. This means the attempt to self-control cognitive, motivational, behavioural and environmental aspects involved in learning. Learning can be also more

individualistic (i.e. student learns alone, possibly along other students) or more collaborative (i.e. students work together cooperatively in small groups toward a common goal, taking care of each other's learning as well as their own) (Johnson, Johnson & Holubec, 1991). Trough collaborative learning students can discuss and help, share, encourage, explain or teach each other.

Figure 1 depicts the three axes, with their referred learning modes.

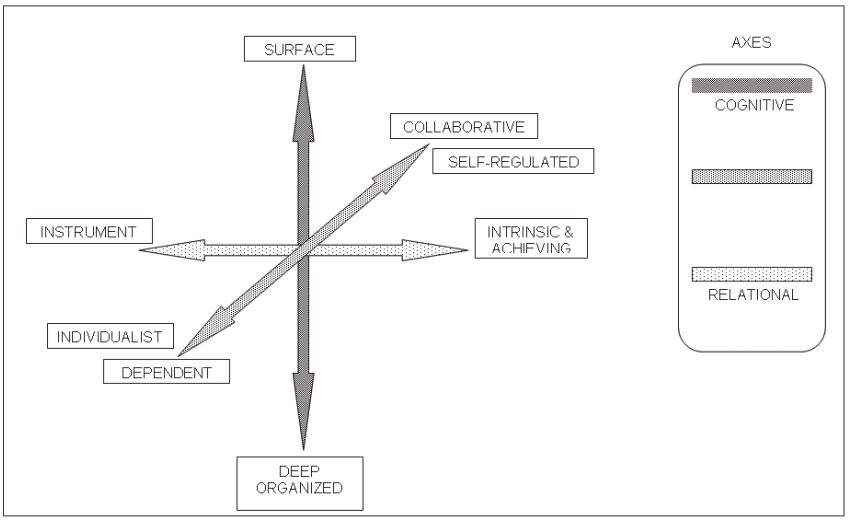

Figure 1: Learning modes in three dimensions (axes) of the learning process

Each of these learning modes is reflected in specific forms when learning in particular tasks.

Regarding the potential of ICT for education, we will consider how the learning modes of the cognitive axe are reflected in ICT-based learning.

Basically, ICT-based learning can happen as learning from ICT (i.e. students are instructed by ICT) versus learning with ICT (i.e. students construct knowledge with the help of ICT by representing their knowledge in different, meaningful ways and by engaging in critical thinking about the content) (Jonassen, 2000).

Figure 2 illustrates reflection of cognitive axe learning modes in ICT-based learning.

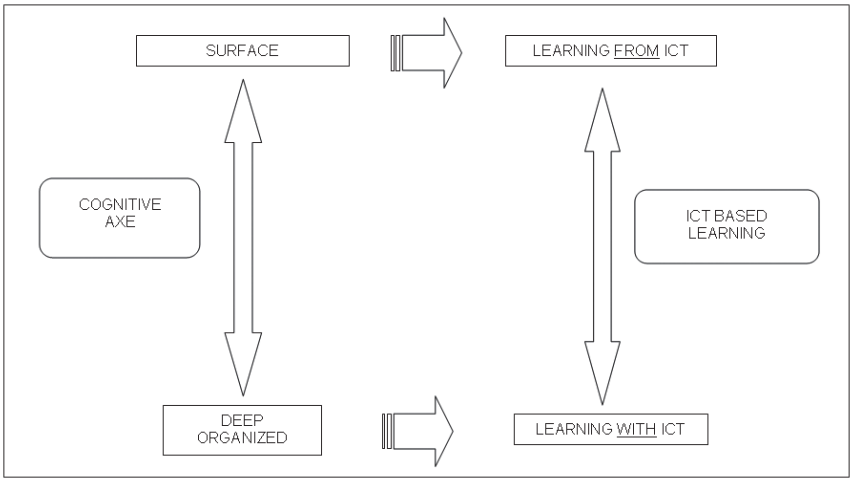

Figure 2: Cognitive axe learning modes in ICT-based learning

A teacher can develop, encourage or/and constrain the use of specific learning modes, according to educational goals and the nature of different learning situations.

What are the practical implications of the existence of different learning modes?

We think it is possible to view this issue according to, at least, two perspectives.

The first perspective is that students improve by using preferred learning modes (e.g. visual learning) or they benefit from using a variety of learning modes (e.g. visual and auditory learning). In either case, the practical implication would be that a variation of teaching practices might be a good way of reaching more students.

The second perspective is that in any class, but specially in a Multigrade class, where individual variation is higher and teachers must often attend separately to various sub-groups, students must be particularly able to: independently self-regulate their learning; to be intrinsically motivated to learn and achieve; to actively comprehend contents in an organised way; to learn in a collaborative way. Furthermore, a mode of active learning with ICT can be especially helpful in this context. There are a variety of "ways" (practices) a teacher can use to promote such learning modes. These "ways" might depend on previous training, personal experience, knowledge, competency, culture references, etc.

Figure 3 presents the two stated perspectives regarding practical implications of the existence of different learning modes.

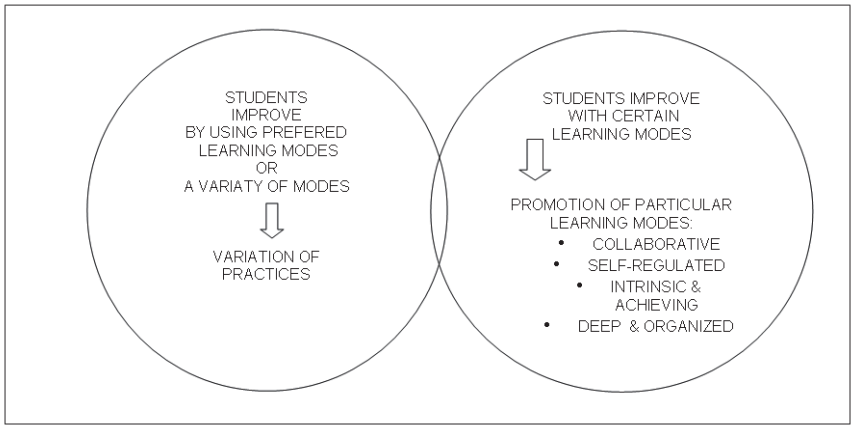

Figure 3: Two perspectives on practical implications of different learning modes.

Reflection on one's own practice and other people's practices can act as a factor of development. The NEMED project (i.e. Network of Multigrade Education) aims the development of a Network for multigrade teachers[6]. The core node of the network's function is a web portal in permanent construction. This portal supports teachers by facilitating communication and exchange, sharing of information and conducting of research, as well as provision of professional support and training.

The portal has a Learning Modes Working Area, which provides training materials and educational resources for dealing with learning modes in the multigrade classroom.

The goal of the work here reported is develop training material that will be used in a training module of the learning modes working area. Namely, the goal is to inventor how multigrade teachers vary their teaching practices according to the observed variety of their pupils learning modes; what learning modes they elect, if any, as more suitable to their classrooms; and what teaching practices they use for promoting particular learning modes (i.e. deep-organized; intrinsically-achieving motivated; self-regulated; collaborative; active ICT-based).

Methodology

In order to inquire teachers on their practices for dealing with learning modes in the multigrade classroom a semi-structured interview script was written. Interview questions address variation of teaching practices according to diversity of pupils learning modes, elected learning modes and personal teaching practices (especially ones felted as more successful) for

6 *NEMED project is supported by the European Commission under the Programme Socrates (Action Comenius 3). For more information on the project see www.nemed-project.org.*

promoting particular learning modes (i.e. deep-organized; intrinsically-achieving motivated; self-regulated; collaborative; active ICT-based).

The interview was introduced to teachers as a mean of gathering potentially useful ideas, considering that there are not "wrong" or "right" practices, that can be shared later with other multigrade teachers.

The interview script was tested with a group of six elementary multigrade teachers from Portugal and Finland and an informal first analysis of answers was conducted (i.e. list of mentioned teaching practices and elected learning modes).

Results

Concerning the way they vary their teaching according to their pupils' variety of learning modes, teachers reported the use of personalized-teaching and of attending alternatively to small groups, while other groups work autonomously.

Interviewed teachers elected cooperative learning, autonomous learning and personalized-teaching based learning as most suitable learning modes for the multigrade classroom.

Teachers refered as best practices for developing a collaborative learning mode the setting of: collective reading and writing situations; group problems; group projects; and collective games.

Regarding teaching practices for encouraging self-regulated learning mode the following ones were referred: having several open thematic spaces/areas in the classroom; setting of problems; distribution of tasks and delegation of responsibilities; support of autonomous learning or of task definition; defining tasks; prompting of planning and of joint work evaluation.

Teachers also mentioned several practices for promoting an intrinsic and achieving motivated learning mode: allowing free-choice of activities; setting of open problems; using familiar examples and tasks; using easy tasks for pupils with difficulties and using challenging tasks for more competent pupils; encouraging knowledge appliance; demonstrating enthusiasm and optimism; reading dramatically; setting situations of reciprocal teaching; inviting parents and guests to the classroom; encouraging task involvement and self-evaluation; using positive reinforcement; setting home works that demand assistance.

Taking in account teaching practices for stimulating a deep and organized learning mode, interviewed teachers referred to the use: of opportunities for tactile-kinestesic learning; of situations of learning by discovery; of open tasks; of tasks of reciprocal teaching and of writing.

Finally, considering teaching practices for developing an active ICT-based learning mode, teachers mentioned prompting their pupils for computer-based search, organization, transformation and presentation of information as well as setting of small-group work and communication situations via the computer.

Conclusion

Testing of the developed interview allowed a first impression on ways multigrade teachers deal with learning modes. Namely, teachers seem to vary their practices to deal with different learning modes. Teachers can also identify preferred learning modes for multigrade classrooms. Furthermore, teachers mention the use of diversified practices for promoting a collaborative, self-regulated, intrinsically and achieving motivated, deep and organized, active ICT-based learning mode in multigrade classrooms.

Based on this test, the interview script was revised and is now ready for future appliance to a sample of European multigrade teachers. Results of this appliance will be edited, as training materials and educational resources on how to deal with learning modes in the multigrade classroom, in a training module of NEMED (Network of Multigrade Education). By sharing these practices among multigrade teachers we hope to contribute to the improvement of teaching and learning in this context.

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ICT-based learning resources in multigrade education: experiences from the Spanish rural school system

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Introduction

It is obvious to state that the new technologies have entered into the school and are modifying the traditional education-learning processes, the curricular designs and the basic competences. But how does the adoption of ICTs affect a model with such specific characteristics as the multigrade school? Which uses of the technological innovations does the multigrade educator choose in order to overcome specific difficulties, which come on the one hand from being placed in rural, often isolated environments, and on the other hand from having students of different levels, ages and learning paces co-exist in the same classroom?

This presentation gathers and analyses several examples of how different Spanish multigrade schools use ICT-based projects in all their diversity to carry out common learning tasks, taking into consideration all the above mentioned specificities, either related to the rural environment or to the internal operations of the multigrade school. But the most interesting aspect to see is how some of these uses go beyond, linking ICT-based innovations with pedagogic renewal. It can be observed that these innovations are used to support didactic innovations, then to propose the multigrade school as a model for other types of schools. Through the use of ICT, the rural school strengthens de facto the child's role as the center of the learning process, and resituates the teacher in the role of a learning facilitator and time/space organizer.

At the present time digital technologies are rapidly penetrating all aspects of life across much of the Western world. Whether in the workplace, the home, the street, the museum or the school, computers, handheld PDAs, mobile phones, the Internet and a raft of other digital toys and tools are becoming increasingly familiar, almost ubiquitous, features of our daily lives. Some commentators have argued that the very speed of communication afforded by digital technologies means that we now live in 'speed space', an environment in which the speed of new information technologies distorts the ways in which we view and interact with the world, affecting social relations and psychological processing (Poster and Kruger, 1990).

Moreover, others argue that it is not only with respect to accessing and processing information that new technologies have impacted on our relations with the world. The very nature of our interactions with the cultural landscape is said to be changing as interactive media locate the user as central to and in control of the cultural experience – shifting us away from the supposedly 'passive' role of viewers, to the 'active' role of players and makers (Barajas et alt, 2004). These new resources, then, are seen by many as responsible for transforming not only our working and educational practices, but our experiences of time, of space, of knowledge, of narrative and of social relations.

There is no doubt about the impact of learning technologies in the school system in Europe. Still, the paragraphs above refer most of the time to the reality of the information society in cities and other urban areas. But what if we think about rural villages lacking infrastructure and services with tiny isolated schools?

Though we may think that the official discourse does not apply to this sector in our society, we argue that, in fact, the information society is also breaking into the rural world and the rural schools steadily but at different pace. In fact, the promises of ICT are quite fulfilled in places where people are willing to fight isolation and promote innovation.

There is no doubt that the digital gap affects generally the rural areas and the rural education system. This situation has been tackled in many European countries through governmental programs helping private companies to implement the services and infrastructure necessary. However, the pace of the change is slower than in heavily populated areas.

In this paper we are going to present different experiences that have been identified in the Spanish rural school system, but could also be found in other countries around Europe. Nevertheless, before presenting these experiences it is necessary to understand how children learn in the rural classroom to put the second part of this article in context; for that reason it is essential to detail the characteristics of the basic learning structure in the multigrade classroom and the essential role of the multigrade teacher. This is the main aim of the first part of this article, which will situate the reality of the teaching-learning process in the multigrade classroom, recalling its special features and its differences from the regular metropolitan school.

Basic Structural Features of Children´s Learning in the Multigrade Classroom

The multigrade classroom, and even more the one-room schoolhouse, is composed of students of very different ages, interests, capacities and expectations. It is a diverse heterogeneous group, which is sustained by collaborative[7] learning parameters, positive interdependence among all of the students, and the establishment of some shared social values necessary for the well-structured and organized operation of the multigrade classroom. It is actually a

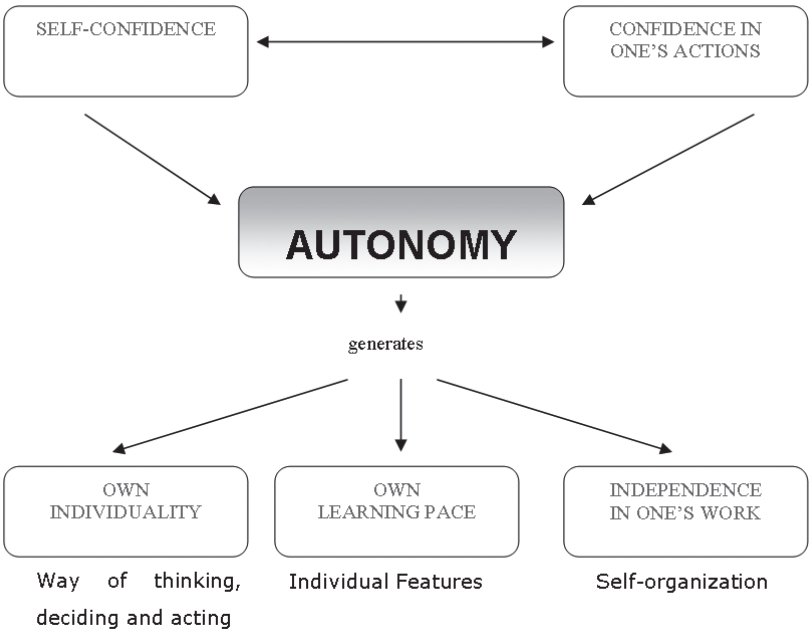
[7] *For collaborative learning we understand a learning philosophy, not just a technique, ability and/or strategy and, opposite to cooperative learning, we define it as the learning situation in which the participants goals are closely related, in such way that each one can only achieve his/her goals if the rest achieve theirs (Jonhson, D, Jonhson R p. 14., 1999)*

microcosm of society.

Diversity is the norm in the multigrade classroom. The students' grouping has to respond, then, to the guiding principle of respect towards this natural heterogeneity, and it has to be organized so that it favors the classroom and centers individuals' social and personal equity. Diversity is the situation in which a wide range of interpersonal relationships occurs, and at the same time, it is the starting point for the multiplicity of opportunities to learn.

But diversity also entails a characteristic learning structure, different to the found in the homogeneous classroom, the most usual grouping in the ordinary urban school, where children are grouped by age and, consequently, by school year.

Multigrade students have to be autonomous to be able to make learning progress, and the degree of autonomy has to be higher according to educational level and, obviously, according to the diversity of the classroom itself.

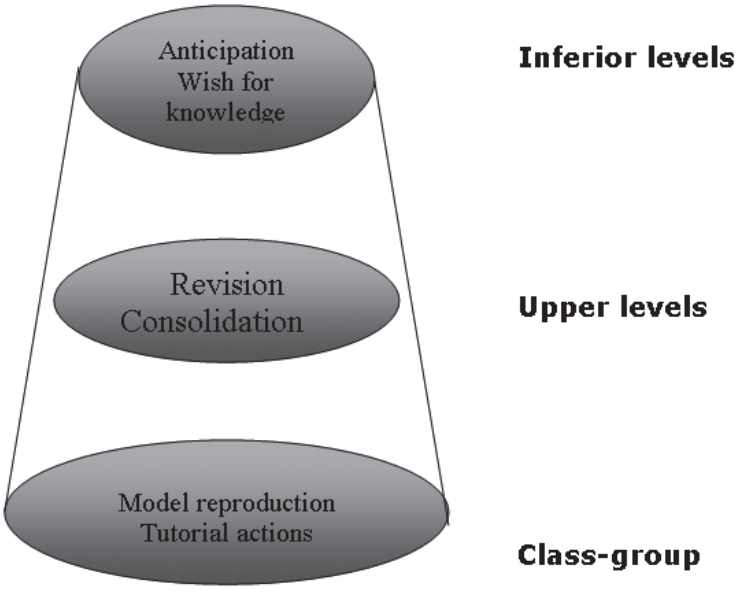


Autonomy generates to the multigrade students an individuality that allows them to think, decide and act by themselves, without the help of the teacher; as a matter of fact, they can not always count on her/him, since the classroom diversity itself pushes the teacher to dedicate more time to the children of the lower levels (i.e. nursery school and the first years of primary school); therefore, the students of the upper levels develop their own strategies, skills and talents to be able to carry out their school tasks.

This situation is important since it respects the children's learning pace to the utmost; they are the owners of their time and they have to learn to correctly organize and use it in order to be able to achieve the proposed goals. Thus, self-organization of work and time as well as optimization of the class resources and materials increase the autonomy of the multigrade student with respect to the teacher. However, autonomy is not enough to understand the basic learning structure of the multigrade students. We must also consider the cooperation among the students who have some common aims on a medium- and long-term basis; that is, the direct and active children's participation and the mutual support among them.

Concentric circles are a cognitive structure that the multigrade students use to help themselves learn and help their peers. They consist of children of the upper levels helping those of the lower levels in the acquisition of curricular content (concepts, procedures, attitudes, values and social rules). During this process, the older students revise, consolidate and/or discover new knowledge, while the younger ones are taught new; the children of lower levels want to know as much as those of the upper levels, while the older peers want to tutor the younger ones. This situation facilitates learning, both if the instruction is given by the teacher or by the peer-tutor.

- Concentric training circles -



It is important, then, to highlight this role of tutorial action that the peer-tutors play. It is a role of mediator between the teacher and their peers, generally of lower levels, who need of their help. They never substitute the teacher's role in the classroom but complement it.

The peer-tutors develop and apply procedures of task and conflict resolution that they have

been acquiring during their own experience in the multigrade classroom. That is, they develop self-teaching skills; they can identify their peers' problems and act accordingly; they use social and communal-life skills basic for the resolution of the demands; and, at the same time, the process enriches them. This has effects on their self-esteem and self-confidence as individuals and as students, and it constructs the basic foundations of the value of solidarity that is so deep-rooted in the rural classroom.

In spite of the possibility of a large age difference among the children in the same class, it is clear that the same content taught by a class peer is easier to integrate than if taught by the teacher. However, in order that peer teaching be effective, it is necessary to implement metacognitive and/or cognitive strategies to achieve the goals: deducing rules, raising hypotheses, taking decisions, searching for interpersonal and/or group techniques, remembering the content sequences, repeating by heart, searching for precise descriptions, etc.

Peer-tutors develop various learning methods, making them more and more autonomous; **they learn how to learn;** all the children in the class can become tutors.

The multigrade classroom is a fishbowl where everything can be heard and seen. The teacher has to be conscious of this privilege and act accordingly; the challenge is in the implementation of interdisciplinary and/or globalized methodologies that are founded specifically on diversity, in an open and flexible space/time. Its application is based on a contemporary view of pedagogy in which innovative strategies are used and dialog, collaboration, and critical thought, as well as proposition and solution of problems related to the several knowledge branches are promoted.

In this way, the collaborative work, the research in the environment, the project methods, the case studies, the globalized programming units, and the interest centres are didactic strategies typical of the interdisciplinary methodologies and respectful of the multigrade classroom reality. What matters is to agglutinate disciplines and set aside disciplinary organizations that facilitate neither the child's collaborative learning and autonomy nor the peer-tutor emergence.

The teacher in the multigrade school

Rural teachers generally come from urban contexts, and because of this may have viewpoints on development and progress that are different from those from rural settings. The social group that they belong to has characteristic values, attitudes and behaviours. Therefore, the urban teachers, who may not have been adequately prepared in their teacher training, need to learn about and adapt to the rural setting.

Multigrade teachers are responsible for their classes, but they can also be organizers and managers of their own school or group of schools. In the paradigmatic example of the rural school, which is a one-teacher school, all the tasks relating to the direction of the school fall on the same teacher, though they can be lightened by the presence and intervention of the itinerant specialist teachers. As we will see further on, the functions of these teachers go beyond the specialization itself.

But we must also rethink the teacher's role as an educational agent and as a mediator between the rural community and the school and, of course, to specify where they can find their performance and intervention limits. Rural teachers have to assume a particular role between the school culture and the local culture, together with the teaching and management of the school centre and/or group of schools; for that they must be able to interact with many educational components inside as well as outside the school.

Using ICT in the Rural Schools: Some Examples of Developing Learning Resources

ICT-based educational resources in multigrade schools should help students to work with other students with different ability levels, and learn from older students. The development of resources and the organization of learning activities involving ICT, pursue this general aim.

On the other hand, the specific needs and, some times, ICT limitations, of both the rural schools and teachers' competencies, demand new approaches for classroom organization and new teacher's roles.

Both specificities should be seen also as new opportunities for the multigrade classrooms, as we will see below. The following sections show specific examples on how Spanish rural schools are dealing with the needs of supporting teachers in organizing ICT-based projects. Specifically, we review practical examples of developing ICT-based projects, classified in five different models. But, first, we must briefly see the profile of the two key participants in the educational use of ICTs in multigrade schools: the ICT teachers and the students.

Helping the local teacher: The ICT "traveling" teacher

Besides the multigrade teacher, there is another teacher whose role is essential for a good functioning of the rural schools: the ICT teacher. The work of these teachers is crucial in order to break the inherited isolation of the rural schools, to break the technological gap between urban and rural schools, and to implement new technologies in rural areas. They coordinate all teachers in a group of rural schools; their tasks are diverse and of key importance.

First of all, the ICT "traveling" teacher (named also as the nomadic teacher) organizes the ICT work of all the multigrade teachers and/or teams of teachers in the groups of multigrade schools. In most rural regions, the schools of the same area form a group called CRA or ZER, in order to share the pedagogic project, material and human resources. As a result, the ICT itinerant teacher will be in charge of coordinating the several grouped schools in their ICT-based work.

Secondly, the ICT teacher promotes the participation of students and teachers: both should share responsibility for the projects undertaken in either the school or the group. As we will see below, one of the methodologies used is the project work, in which the students are upstaged in deciding what is learned and how. The ICT teacher's role in this area is one of a

facilitator and trainer, both for the students and for the rest of the teachers if necessary.

Thirdly, he/she must be open to innovation, experimenting with new ICT tools, promoting new methodologies to learning. This open attitude is fundamental in the field of the new technologies, and it will be the basis of the change which is taking place in the multigrade school, not only passing from isolation to being connected with the rest of the world, but also becoming a leader in using innovative pedagogic methodologies.

Eventually, the ICT teacher must be a comprehensive user, not just an "expert" in computing, since his/her role will be much wider than that of teaching how to use a computer.

Responding to the multigrade needs: students' design of learning materials by the school groups

One of the key methods that the teacher should master is **project work.** This method is approached by the school group (CRA/ZER) as follows: all the classroom chooses in a participatory way. The children decide a theme to work on according to a calendar of activities. The children discuss in the classroom what they know about it, and what they want to know afterwards. The next question is about how they will do it, and here is where ICT plays a key role. Searching for information on the Internet is the first step. Communication through the Internet with the other schools is the next step, in order to exchange information, discuss results and give responses to the questions posed by each school. Both individual and school dossiers are the outcomes of this strategy. The result of this process is a radical change; not only in the production of learning resources, but in general, the substitution of text books by the shared dossiers. The content of these resources are varied, from traditional to digital media; they usually contain multimedia materials, such as pictures and video clips.

Some models of using ICT learning resources in the rural school

Schools designing, distributing and using resources for preserving local traditions and local events

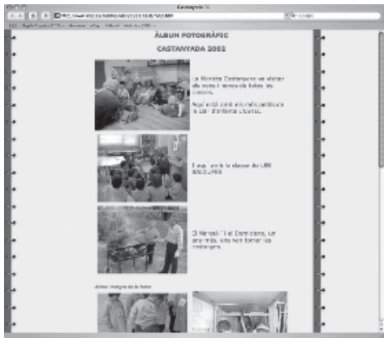


Fig. 1: ZER El Moianès, Catalunya
http://www.xtec.es/centres/a8056729/

Beforehand, we must underline the effort carried out up to now in the rural school to stay updated in the use of new technologies. Nearly all the rural schools or the grouping of schools (CRA/ZER) have their website. Through the website and other ICT-based means, schools promote the recovering of their cultural roots, claiming the value of the differences with respect to the regular metropolitan schools. Thus, we can find Christmas cards, announcements of feasts, contests, diplomas of local prizes, pictures of the main celebrations, etc. The students' works can vary from simply scanning and uploading the drawings of the parties and traditions celebrated to the task of manipulating their own carnival

pictures, writing texts for explaining the acts, or uploading traditional music from their village or region onto the web page. Doubtless, this contributes very much to improving the digital literacy of children.

Depending on the attained technical means and on teachers' and itinerant teachers' ability, we can find a variety of web pages. In most of them we find pictures of the traditional parties that have been celebrated in the school and of the works that the students made about them.

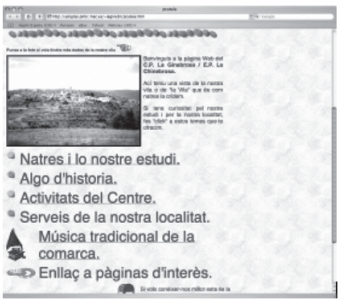


Fig 2: CRA de Castellote, Terol, http://adigital.pntic.mec.es/~castello/

However, the tasks shown in some web pages are, not only pictures or scanning of craftworks, but also multimedia productions prepared by the students with ICT resources in order to deepen the traditions in question as well as their computer skills. Thus, we find school work made with several applications such as Paint, Word, PowerPoint, Paint Shop Pro, Flash, audio, and even video (Mavica, Studio 8).

Finally, some web pages display activities of tradition research in which an intergenerational exchange is given; an older person of the village goes to the school and offers a remembrance of childhood or a popular legend to the children or teaches them to prepare a typical meal for them, and at the same time the class offers him or her something, such as a workshop on computers. In the Asturian school group, Castrillón-Illas, we have found an example of this type in the project titled "Teaching to learn – the adults go back to school."

Fig. 3: ZER Vinyes Verdes, Catalunya, http://www.xtec.es/centres/a8056808/)

Schools using telecommunication tools for fighting the problems of rural isolation

The Internet has made a revolution in the way teachers and children of different schools work and learn. The Internet is the tool that has actually broken the rural classroom geographical barrier and has granted its opening to the world, democratizing the access to information, but also allowing, for instance, for classrooms scattered in different schools to follow a common curricular learning programme. Therefore we find a second model of ICT use, specifically focused to overcome the problems derived from the isolation inherent to the rural world.

Fig 4: CRA de Castrillón-Illas, Astúries, http://web.educastur.princast.es/cp/castrill/

An interesting case of how to struggle against the multigrade school isolation through the new technologies has been found in the utilization that some teachers, especially but not only the itinerant ones, make of several ICT resources. Teachers produce educational ICT-based material and use the Internet to put these exercises or other information, models, links, etc. at the disposal

of the students from every school coordinated by this teacher (see an example at http://www.xtec.es/centres/b7007622/itinerants.htm). Furthermore, some other web pages, such as http://www.educa.aragob.es/craarino/weduca/ by the Aragonese CRA of Ariño-Alloza, are specifically designed for self-sustained multigrade classrooms, and it should be mentioned that many of the exercises that they contain have been created by the students themselves and are also used as educational material. In addition, compilations of telematic materials exclusively produced for multigrade schools use and relating to all the Primary School curricular subjects can be found on the Internet. They have been designed by experienced teachers and are available to all teachers so that each subject can be studied at the different paces that the multigrade classroom imposes, though without losing the capacity to study in depth that the student needs at each level. In this area, it is interesting to point out the work gathered on the website http://pie.xtec.es/~jsors/ierural.htm, which includes curricular activities, electronic mail activities, information research activities, activities for an electronic journal and activities for parents and teachers, among other things.

Fig. 5: http://pie.xtec.es/~jsors/ierural.htm

Fig. 6: ZER Alt Pallars Sobirà, Catalunya: http://www.xtec.es/centres/c5007803/htm/activitatsanteriors.htm

Another way that multigrade schools face their isolation problems can be found in the shared creation of learning resources among different multigrade schools, which urban schools can use. For instance, there is the project Interconte, which consists in creating a tale among a group of multigrade schools, or the project Conte Telemàtic in which multigrade classrooms and urban classrooms can take part.

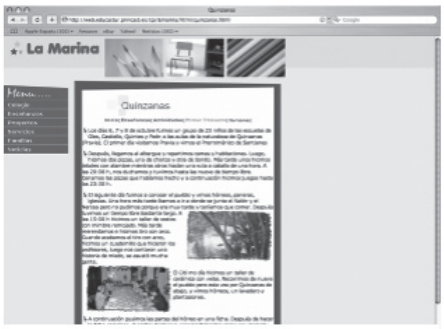


Fig. 7: CRA La Marina, Astúries: http://web.educastur.princast.es/cp/lamarina/html/_primer_trimestre.html

As a final point, we can include in this model the creation of Electronic Journals. In them, schools show the daily activities, parties, trips and the students' schoolwork in several curricular areas. As the Electronic Journals are created by a school group (CRA/ZER), they contain works of different origin and, consequently, they can become a vehicle for the students from different schools of the same rural group

Fig. 8: Telematic Project "l'Hugot"
http://www.xtec.es/crp-bergueda/hugot/index.htm

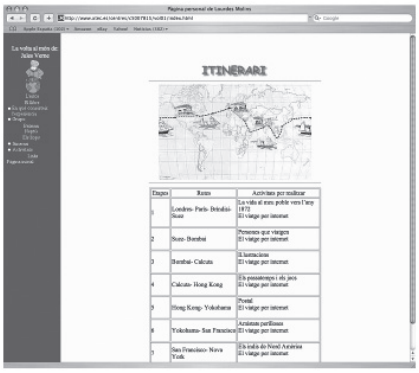


Fig. 9: Proj. La volta al món de Jules Verne
http://www.xtec.es/centres/c5007815/vol01/index.html

to know each other while they study curricular contents and improve ICT competences. Here we also find very different levels in the use and performance of the ICT resources, going from those which copy a traditional magazine format that is periodically published up to those which are completely electronic and multimedia, even incorporating a room for a students weekly Chat. Here are three examples:
http://www.educa.aragob.es/revlapic/lapiz7/revista7.html
http://www.xtec.es/centres/c5008081/20022003/htm/revista.html http://www.xtec.es/centres/c5008066/revista3/revistazer.htm

Schools using media and ICT tools for knowing, learning and sharing the local environment with different classrooms

Most schools study the rural environment and display on their websites the results of the children's study. These exhibitions can be very simple, just reporting the contents of their trips and learnings about nature; they can also include pictures and handiwork by the students. Or they can be more elaborate, being part of a more extensive project. The first type is strictly a sample of the work about the natural and social environment that is carried out in the school, in which the ICT-resources are used as a means to set forth, beyond the school, the activities and research that have been achieved. On the right we can see illustrations of how most schools study the natural environment (see fig. 6). Though many times this use of ICTs is very simple, this schoolwork is essential in the multigrade school field since it reinforces the aspect of the rural identity from its more positive features.

The second type of webpage aimed at learning and sharing the environment is the global project which the school joins and which, through the Internet and several ICT-based resources, drives the students towards the discovery of the environment, either local or global, and towards an exchange with other groups or people who will be found during their virtual journey. Our first case is the Telematic Project "L'Hugot", in which the multigrade teachers prepare electronic cards with information about the rural environment; throughout the school year, a virtual character visits the different schools and makes proposals for gathering information on new topics.

A second example is the project to discover the world through the Internet and Jules Verne. Here, the experience does not consist in investigating the local environment but in traveling around the world following the stages on the journey made by Phileas Fogg in Jules Verne's novel. In order to cover each of the stages on the journey, the students have to pass through a series of tests as the protagonist of the novel did, and the participants act as virtual tourists

through the Internet. The children have to reply to a series of questions related to the reading and have to do research using the Internet.

Fig. 10: ZER Baridà-Batllia, Catalunya, Proj. Comenius
http://www.xtec.es/crp-cerdanya/comenius/index.htm

Schools using ICT tools for helping to build learning communities that involve not only teachers and students but also the whole village or area

The arrival of the Internet and the new information technologies to the multigrade classroom has many times implied the opening of the whole rural world, beyond the school, towards these technologies. In the last years' institutional initiatives, such as the Aldea Digital Project or, afterwards, the Telecentros, the new technologies have become integrated, first in the multigrade school and later in the entire rural society. Some of the schools report the experience of how, through the Internet and thanks to the electronic mail obtained due to these programs, the students share vital experiences, musical preferences, queries, etc. with students from other groups of multigrade schools and even from other regions. In any case, the impact of these projects, added to the global educational work of the multigrade school, has been wider since, besides inverting the traditional situation and placing the multigrade school at the head of the teaching innovation process, it has meant an increasing interest in the knowledge and use of the new technologies among the different members of the rural society (many students' parents have requested training in these tools, the number of computer equipment in the area has increased, etc.). The school has been transformed into a resource centre for the village, in many cases the only access point to the Internet that exists.

Hence, we find the will of some schools or groups of rural schools to become **learning communities** that involve, obviously, students and teachers, but also the parents and other community members. The main goal is that the families share the centre's life and decisions while they enjoy its training facilities, as well as that the grouped schools work de facto in a coordinated way and enrich each other. At the same time, the creation of virtual teaching staff meetings has been carried out, spaces where the teachers of a group of multigrade schools can communicate through e-mail, a forum and a chat room in order to share experience, to plan, to evaluate and to accomplish all the usual tasks of the school staff meeting. The paradigmatic example of this creation of global learning communities mediated by ICTs is the ARIÑO-ALLOZA

Fig. 11: Proj. A window on Europe
http://web.educastur.princast.es/cp/lamarina/html/a_window_on_europe.html

school group, from Aragón: http://adigital.pntic.mec.es/~arino/. In our opinion, this is an unquestionably innovative and very promising experience since it not only continues to make use of the new technologies to provide the tasks of traditional education but it innovates and promotes new spaces, methodologies and experiences that broaden the possibilities of education and increase its quality.

Schools using ICT tools for sharing knowledge about their environment and traditions with schools from other countries, aiming at improving their own knowledge about other European cultures

A fifth model of ICT use in multigrade schools, deeply related to the third one but with broader geographical and cultural perspectives, is that of schools using ICT tools for sharing knowledge about their environment and traditions with schools from other countries. This type of project has a double aim: on the one hand, learners study their natural and social environment; on the other hand, they can learn about their foreign partners' natural and social environment, traditions and language. Therefore, a cultural exchange and an improvement of their own knowledge about other European cultures occur. These projects involve schools from different countries which generally share the condition of being multigrade schools in rural areas, so that the student's background is similar (apart from the curriculum organisation differences) and the contribution put up by each school is similar too.

These projects allow the teaching staff and the students from at less three different countries the opportunity of working together in certain subjects linked to the common curriculum. Through the experiences exchanges, the students increase their general knowledge, discover the differentiating elements of the cultural, social and economic diversity of Europe, and learn to better comprehend and to appraise the other's opinions.

In the first project analyzed (see Fig. 10), schools from four different countries (Catalonia, Andorra, France and Wales) use a website to upload and share the information and resources that the students have prepared during the school year. The website is accessible in four different languages, thus the students can read and learn everything from their partners. This project studies the wildlife in the different protected areas where the centers are located. During the development of the project, the students produce several written compositions, drawings, paintings and other artistic works, pictures, etc., and through the new information and communication technologies, they introduce their protected area to the students from the other countries. Each centre's teaching staff and students select the information to update this web page in the five languages of the participants: Welsh, English, French, Catalan and Spanish. But along with this, field work is also done: concrete actions are also carried out in the protected areas, such as the marking of some stretch of path or the cleaning of an area, in collaboration with the institutions responsible for each protected area. As a conclusion of the work and a reference for the web page, a CD-ROM will be edited as the project broadcast. The main aim is to share the information to enrich the participants' knowledge about other European cultures through the promotion and utilization of the information and communication technologies.

A second example of ICT use to learn from and work together with classes from other countries is the one called "A Window on Europe" (see Fig. 11), whose goal is favoring the knowledge among the students from different countries about their living and culture

through the exchange of materials produced by the students of the participant schools. Multigrade schools from Astúrias, Finland, Wales and Italy take part in it. Around the subject of spare time, the students produce ICT-based materials as a calendar of school's events and electronically exchange ICT-based material related to their games, likes and preferences. In fact, very interesting multimedia tasks by the students are shown on this website: video, modeling works, PowerPoint presentations, etc.

Our last example is a project carried out by three schools from Catalonia, Italy and Belgium called "Arte, Amicizia, Ambiente" (http://www.xtec.es/centres/c5008054/html/projecte.html), a project of acquaintance and exchange through letters, schoolwork and other conventional means of communication together with videoconferences. The exchange given among the schools is improved by the use of the video-conference for the children to get to know each other and to deepen the communication. Thus, children learn how ICTs can provide instant communication in an educational environment which allows them, not only to learn about different cultures and curricular topics, but to experience relationships with the other children. To conclude, these are only a few examples of this kind of intercultural exchanges, most of which are culminated with an eventual actual visit to one of the participant schools. Nevertheless, even though this kind of cultural exchange could be and has been carried out without the support of the ICTs, it is undoubtedly certain that the arrival of these technologies, and especially the Internet, has broadened and will continue to broaden the multigrade schools' barriers in a way that was unthinkable just a few years ago, disregarding the geographical isolation or the economic level of the rural areas.

Conclusions

While the extent to which this so-called 'digital revolution' in fact constitutes a distinct break with the past or the emergence of a new era remains contested (Webster, 2002), and the implications of these new resources for social well-being remain unclear (Feenberg, 1998), what is evident is that the presence of ICT tools provides both a new arena of opportunity and a new set of challenges for educational systems, for curricula and for teachers across Europe, including the rural school.

Beyond these statements, we claim that multigrade schools participate also of these opportunities, are able to evolve and adapt to the new era, and, moreover, other non-rural schools can learn from them. In fact, the multigrade school is a model which could be followed by regular urban schools; the educational approach of the multigrade school definitely implies a constant adaptation to the environment, but also, to the children's learning and maturation needs. The multigrade teachers' collaborative work, the organization and management of the grouping of schools are ways to optimize the schools' human, material and economic resources, which can be adapted by regular schools.

In the learning processes, ICT resources are of key importance in the progression of pedagogic renewal attained by the school system, so as by the multigrade schools in recent years. ICT resources allow the multigrade teacher to heighten respect for diversity, so important in the multigrade classroom. Moreover, as we have exposed, the ICT resources allow for breaking the barriers and the endemic isolation of the multigrade school while they contribute to

strengthening local traditions and specificities; that is to say, ICTs allow rural students to access the globalized world without losing their roots.

In this scenario, the creation of learning resources is a process involving teachers, traveling ICT coordinators, and students. The creation of educational ICT-based materials cannot be left (only) in the hands of multimedia designers and programmers that do not necessarily have a suitable concept of the children's learning processes. The rural school shows us that this task can also be accomplished by the school itself, which is indeed completely conscious of the education-learning processes; it can be achieved not only by the teachers, pedagogues and ICT teachers, but also by the students themselves as a part of their school task or in their role of peer-tutor.

The local rural community inspires and many times uses the resources created by the multigrade schools, which, in turn, are integrated into the curriculum. The multigrade school contextualization frames us in the historical, social, cultural and linguistic reality of the environment and allows us to incorporate it into the school curriculum. It is a matter of having at our disposal enough competences to be able to apprehend the local knowledge, to value and respect the school's physical and social environment, and to encourage the participation of local people in the curricular project accomplishment and/or revision, without neglecting the educational system's goals and policies. It is a matter of encouraging a "natural meeting between the school and the rural children's life".

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The use of ICT in Finnish multigrade schools

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Abstract

Finland is an advanced society using ICT and telecommunication. The ICT infrastructure is good as almost all schools in Finland has broadband connections. There has been a lot of national projects and strategies supporting the use of ICT. Almost every school has their own ICT-plan as part of the local curriculum. There is a lot of possibilities of in-service training for teachers. However there are still problems in the these areas and a need to develop everything further. It is important to get teachers more active in the use of ICT in their teaching. The use of net-based learning is growing in Finland all the time. At the moment the use of net-based learning is more popular in upper secondary and vocational level than in primary level. Small schools (multigrade schools) are quite isolated in Finland. Most of them are located in the rural areas. One need to find a way to further the use of ICT (net-based learning and distance learning) in small schools. The key person in this developing work is the teacher.

Introduction

This paper is an overview of the use of ICT in Finnish school education (including multigrade education). There are a lot of challenges in the use of ICT. My main point is that the teacher is the key person developing the culture of using the ICT. Teachers need of course support from the authorities. But the culture grows from the grass root level upwards, from the schools and teachers work. First some basic information of the situation in Finland. There is a quite new national strategy of the use of ICT in Finnish school education. It is built of four blocks: computers for schools, school network development, teacher in-service training, teaching methods development, which is also part in the in-service education. All schools are assumed to have their own ICT plan and -strategy as a part of their local curriculum. Most of the Finnish schools have this plan, but there are still some without it. A plan for each school is important. Because with a plan each school can develop and organize the work at its own level. It is also important that in every school there is a person or persons who take responsibility for the implementation of the plan and adapt it into the schools every day life. In quite many schools we have teacher whose special task it is to support the use of ICT.

It is the headmasters/principals main responsibility to lead the use of ICT in every school. Allover Finland has in general an advanced ICT infrastructure. The information society will be successful only if the necessary infrastructure in educational institutions is further improved. Most schools in Finland have access to the Internet and about 69 % of the primary schools and 99% of the secondary schools have a high-speed connection (The National Board of Education, 2005) At the moment a National Virtual School is under development. The national board of education is coordinating this work. ICT is a efficient tool for creating equality, especially in the rural areas of Finland, where the majority of the multigrade schools are located.

Multigrade schools in Finland

About 30% of our schools are small schools and most of them are the multigrade schools (Statistics,Finland). Small school have to have over 20 pupils otherwise there is a danger of integration to a bigger central school. At the moment the leading authorities in Finland believes that we have a too decentralised net of schools (too many schools) which means small schools will be shut down and made to bigger units in oder to save money. One could believe that this would also decrease multigrade teaching in Finland. But the situation in the future could become opposite to what we think now. Even if there will be less schools there will be also less pupils because of the decrease in birthrate. There is a chance that multigrade teaching will increase even in bigger schools.

The Use of ICT is a continuing process

In a basic education, which contains also the multigrade education, the use of ICT is a continuing process. Sometimes one can feel it as a too slow of a process, technical Chydenius-institute Kokkola University Consortium– Finland (juha.paasimaki@chydenius.fi) possibilities are developing so fast but the work at the school level is coming way after. In Finland there has been put in a lot of resources already for the use of ICT in education.

This support comes mainly from the ministry of education and national board of education. There has been a number of national programmes and virtual school projects in the recent years. But there are still some problems: at the municipality level, in-service training (which should always answer the teachers needs) and also the infrastructure in Finland not as complete as it ought to, particularly in the rural areas.

The networking culture need also to develop, in which the schools can do co-operation with other schools and organisations which can be partners in the ICT developing process.

In the multigrade schools ICT is an important tool in many ways. We have new national core curriculum (2004) which is the national framework on the basis of which the local curriculum is formulated. The education provider takes responsibility for preparation and development of the local curriculum.

ICT in multigrade schools

In the area of ICT there are quite many features to observe. The infrastructure of ICT is not as good in the multigrade schools as it is at the central schools. Net-based learning (E-learning) is a tempting opportunity for multigrade schools. We have several platforms in use in Finland (for instance: peda.net, Opit, Optima, Fronter and Moodle) from which the municipalities and schools can choose.

There are a lot of areas and subjects where it is possibility to take ICT along as a natural part of learning process. As educational software continues to develop, it brings also new aspects in to learning. In Finland there are learning environment products in the market which are suitable for primary schools. These net-based environments works in a www-platform and can be used independently. These environments includes almost every school subject and pupils can do projects and of course save all the material they are producing in to the system. It is also possible to do homework with these programmes. For multigrade schools these environments can be very useful. Then there are a lot of other educational software and CD-roms available for almost every subject. There are products which can be used with pupils who have special needs. Teachers are also using programmes which are suitable for specific needs, for instance mother tongue and mathematics. There have been also innovative projects in Finland where the targets are to create model and link (with the help of the ICT) from the central school to multigrade school.

Chydenius-institute is starting to work in Must Learn IT-project which belongs to Minerva-programme and is coordinating by the university of Patras CTI. One of the aims in this is project is to help the teaching in special subjects(for instance English) Lessons will be send from the central school to multigrade school. Creating a networking school can bring new solutions, providing the education for isolated multigrade schools.

In-service training in ICT

The support to teachers is important. Perhaps the most effective way to support teachers in using ICT, is the In-service training. Most of the teachers are getting along well with computers, but there is a constant need for updating their skills. In Finland the national board of education launched a programme called OPE.FI in the end of 1990. In which there were three levels for the teachers.

- first level, helping the basic technical skills to use ICT
- the second level, helping teachers pedagogical skills
- the third level, creating special skills

(The Ministry of Education (1999).National strategy for years 2000-2004)

This programme proved that it was possible to raise teachers' skills remarkably in ICT in a short period of time. Today the emphasis is on the pedagogical skills. For the coming year 2006 there is a great deal financial resources reserved for net-based learning and media education.

Chydenius-institute Kokkola University Consortium is organizing teachers in-service training in the field of ICT. Here are some examples of our courses we have had at the Chydenius-institute.

- Net-based learning for basic education
- Producing the digital/multimedia learning material
- Training for ICT-supporting persons
- Learning objects and net-based learning for upper secondary school teacher
- Security in ICT

Every training course Chydenius-institute provides is attended by approx. 25 teachers. There is some financial support from the Finnish national board of education for each course. Each training course has at least 5 days of compulsory study. Teachers are away from their daily work as they are studying at the Chydenius-institute. Every course includes also net-based studies. The most important content right now is to help the teachers to develop the pedagogical skills in the use of ICT.

The OPE.FI programme in Finland has ended and new targets are developed for the use of ICT in education: All students should get the basic ICT-skills/working skills, -skills to use knowledge and, - skills for collaborative dialogue. The safe use of internet is also an important target (there is an ethical point of view to be regarded as well) .

The main target for teachers in service training is to give 75% of the teachers' pedagogical skills to use ICT in teaching. Hopefully this target will bee reached the year 2007.

The net –based learning is growing all the time in Finland but it is still more popular in upper secondary and vocational education than in primary and multigrade education (The National Board of Education, 2005)

An important aspect to keep in mind is the conception of learning and the conception of knowledge, meaning the good learning process where the ICT is just the tool. It is also important to keep in mind the methods. At the Chydenius-institute one has experienced that the methods that suit very well to net-based learning are collaborative learning and inquiry learning.

Problems in use of ICT

The problems in the use of ICT in Finland are the same as almost everywhere in EU countries. First of all, passive teachers- who do not like to use ICT in their teaching process. Some still have this fear of using ICT. From the teachers viewpoint perhaps the biggest fear is the fear of failure that could be stressful for teachers. Teachers need to gatherer good experience to become active users of net-based learning.

The integration of different subjects is not easy. The easiest way is to integrate is to use programmes/software which gives the possibility to drill some skills for instance mathematics.

It is important to use different learning methods and learning modes. But all teachers are not familiar to use new methods of learning.

In-service training integration to real school life should also be better. We need a stronger commitment of the headmasters and school management in municipalities and also we need to develop the use of networks and equality of different parts of Finland. Some of the municipalities do not have enough financial abilities to support use of ICT in their schools so there is constant need of resources. There is not enough computers in the schools (The ratio is now about one computer to eight pupils) and putting them all to ICT-labs is not the best possible solution. To develop the basic skills it is suitable solution but for pedagogical use it is not. There is also all the time a need for technical and pedagogical support for the teachers at the school level.

Vision for the future

Then about the vision we have in Finland. It is important that the ICT skills of the teachers and pupils correlates with the needs of individuals and society. It is also essential that the providers of education increases the activity of using ICT. In the future ICT also hopefully supports the equality- and quality of education better. The most important pedagogical aspect is that ICT becomes real a part of the learning environment that can support the quality of teaching and learning (the National Board of education, report 2005). ICT is a tool in education with which one can reach something more meaningful. ICT has an important role in the civilized society and it´s knowledge management. ICT provides the means and further possibilities to develop society and culture. In the educational sector the teacher is the key person, creating the culture of using ICT in schools. It is essential to support teachers work in school-, municipality- and national levels.

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Evaluation and standardization of procedures in distance training for teachers in multigrade schools

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Introduction

The usefulness and appropriateness of standardization in educational methods has raised much discussion recently. The diversity of views expressed when the discussion is focused on distance education and training in particular, the long-term aim of which is to provide effective educational procedures and professional development to teachers. The popular idea of educational reform is constantly enriched with terminology from the field of standards, as social policy focuses more and more on the results of schools, such as student achievement, graduation rates and drop-off rates. However, what about school outcome and the educational procedure; What about the appropriateness of educational materials, as well as of the procedures and of the technological means used for its production? Do they contribute, or rather not, to the formation of the above outcome?

This paper attempts to present the true dimensions of the use of standards in education, as well as proposing methods for the development and provision of distance education. It presents the activities which took place during the realization of an educational procedure pertaining to the provision of distance education. The main reasons which have so far hindered the application of standards in education procedures, and particularly in distance education, are, on one hand, unease of the stakeholders (authorities, institutions, teachers, students) about the use and application of standards, and, on the other hand, absence of a guide on the organization of all basic and complementary procedures relating to the realisation of a distance lesson. As a result, for the use of Information and Communication Technologies (ICTs) in the educational procedure, the availability of and Implementation Guide is needed.

The use of standards

In earlier times, the process of identification of critical points for decision making in education related mainly to the interests of psychometrists and more generally of measurement specialists.

Nowadays, those who manage education and form policies at national and international level, involve teachers and non-teachers in tests aiming to identify acceptable and/or desired levels of student achievement in the school system [1]. Thus, the establishment of educational standards can be examined from different perspectives, such as [2]:

- Common place of discussion, where the level of identity is established between what teachers have intended to do and what they have really done.
- Intersection of ideals and reality.
- Exercise which gives voice to the underlining εκδηλωτική learning, of professionals and others, about the dynamics of the youth.
- A process of evaluation aiming to establish a framework of interpretation about assessment data in statistical form as well as in textual form.
- A mechanism for a programmed process of criticism of the outcomes of a school system.
- A psychometric technique for the rating of questions in tests.
- A medium for the attribution of social meaning to educational measurements.
- A tool for the clarification of the expectations of professionals and the public in relation to the effectiveness of school programme and educational personnel.
- A decision making process which consequently establishes further decision making points in education.

A standard is often a subject of confrontation, due to the fact that it represents and reflects different views about what is considered to be important in the educational process [3]. Almost all researchers agree that the establishment of standards is a critical exercise. As a result, a standard can only be as good as the criticisms and evaluation procedures used for its establishment. Popham claims that the introduction of standards that is based on adequate secondary data, wide range input from the interested parties and a systematic attempt to understand the relevant evaluation and performance issues, is not arbitrary, depending on the conditions prevailing each time [4]. What is more, it represents people's effort to use their analytical skills with the aim to support important decisions.

Critics tend to use two basic arguments in order to question the reliability of standards. The first is based on the conviction that controls and standards represent a type of formulism which negates individuality of human beings and undermines the unique, transactional nature of teaching [5]. Large-scale evaluations provide teachers with external reference that guides them to successful professional practice, in the same way that a radar guides a pilot to the air corridor. No-one can claim that measurements of this instrument and flight standards can reduce the pilot's ability to cause damage to the passengers, although they form the flight plan in positive ways.

The second argument is that, as standards are a human invention, they are arbitrary [6]. The truth is that all methods are arbitrary in the sense that there is no scientific procedure involved which simply introduces numbers into a formula. Different methods will yield different standards. Nevertheless, we should not characterize standards as unacceptable simply because

they are arbitrary. Besides, the word 'arbitrary' may denote either that 'they are determined by an arbiter (i.e. judge)', or that 'they are chosen randomly and for no particular reason'. Thus, when critics characterize standards as 'arbitrary', they clearly use the latter, negative meaning, although the former better reflects the effort for the establishment of standards. Even if the establishment of standards is subjective, Livingston and Zieky (1982) point out that from the moment that standards are established, decisions which are made based on these standards can be objective. Instead of a different set of criteria for each subject examined, we will have the same set of criteria for all subjects. Standards cannot be identified objectively, they can however be applied objectively [7]. In the whole, a standard favors equal treatment in as much as it allows for a critique of the quality of education.

Lastly, it must be taken into account by all those who wish to establish standards for educational procedures, that they should consider at least two categories of standards [8]:

- Technical standards
- Educational – learning standards (methods, practices, etc.)

There are already established standards in the sectors mentioned and they can be used. Some of them are already applied in some European and national research projects2.

The need for an Implementation Guide

If standards are to be used in educational procedures, and particularly in schools and courses where ICTs are used, dome action has to be taken, such as:

- Every initiative which is based on ideas and suggestions relating to the educational procedure must be realized with the support of specific processes and procedures, which need to be identified and followed.
- Every project relating to educational applications has to be accompanied by an 'Implementation Guide'.
- Standardization of the methods, practices and, even more, of the evaluation plan, has to be proposed. The availability of as standardisation plan is particularly important, as is the development of those conditions which promote change in the ways education and training systems are organized.

The Implementation Guide in educational procedures seems to be the most important factor of success. Its aim is to provide the necessary guidance, so that it can be secured that the effort invested in the educational procedure will be continued, the problems arising will be dealt with effectively, and distance training will continue to be used and developed. In the ZEUS project – which aimed at providing distance training via satellite to teachers in remote multigrade schools – the implementation guide included basic tools and methodologies which can be applied in the training process, and described how a satellite can be used as a tool for distance education following these methodologies and utilizing these tools.

The Implementation guide ought to emphasize the new ways of teaching and learning about new technologies and technical subjects. It should encompass issues relating to the ways of training for the target groups, the ways of evaluating their achievement and the relation between the educational establishment and the society. It must constitute the first step and

the roadmap for any course of educational reform in the long term. The accomplishment of high quality in education demands the combination and continuous support of all the stakeholders, the researchers, those shaping the corresponding policies, those developing the educational programme, the teachers, the students and the parents. The Guide has to describe analytically the pedagogical approach followed, as well as including the practices and methods for the application of virtual classroom activities, as an example of good practice. Among other things, the Guide can refer to the following points:

- Subjects areas suitable for importing the new tools into the initial level of education.
- Factors that influence (in both a motivating and preventive fashion) the application of ICT in training and professional development.
- Organisational issues (prerequisites, infrastructure, necessary person-power)
- Specifications for the technological infrastructure
- Description of models of critical processes and procedures that should be applied.
- A constant framework for management, with the critical processes of management that are required for guaranteeing the quality level of the proposed training programme.

The Implementation Guide should include all required specifications, practices and methods for the application of e-learning in the proposed way, and should be divided in three sectors:

- Specifications for training and education (methods and practices)
- Technological specifications (methods and practices)
- Specifications for the provision of the integrated service (methods and practices)

Attention should be given to the presentation of the plan and results of evaluation, which are expected to support the proposed education plan and the application of ICT with the target groups. The proposal of an evaluation procedure is essential so that the continuous improvement of the training program ensured according to high quality standards.

The plan of evaluation, its methods and practices should follow a systematic and continuous mode of application. A complete evaluation and improvement plan should be developed, based on the critical parameters of success for the undertaking, aiming at the determination of its advantages and disadvantages, as well as of the proposed action for improvement. This is achieved through the Implementation Guide, which will propose the standardization of methodologies and practices and, what is more, of the evaluation plan. The availability of a standardization plan is particularly important, as well as the establishment of those conditions which promote change and ways of organising educational and training systems. Moreover, the Guide should also take into consideration the technological parameter. The steps that should be followed in order to confirm that the standardised methodologies and practices are suitable, are presented in Figure 1. After the evaluation and analysis of data there is enough information available for the writing of the Implementation Guide to begin.

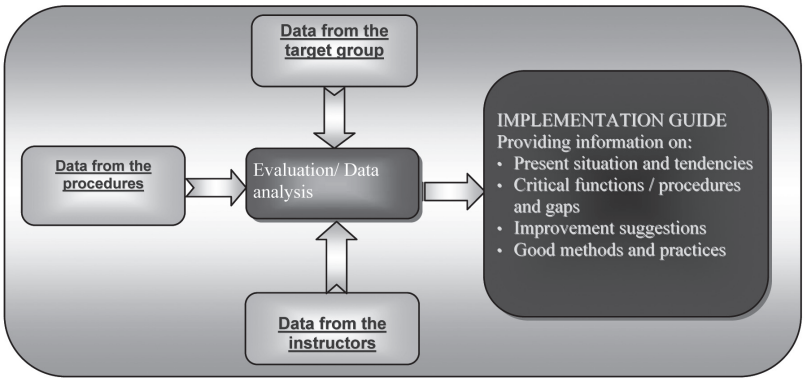

Figure 1: The proposed approach for the development of the Implementation Guide

The evaluation plan should be organised in such way, so that it is ensured that all units important for the application of educational activity, are evaluated. Consequently, evaluation should be carried out for each one of the parameters shown in Figure 2, so that all fields of evaluation are covered.

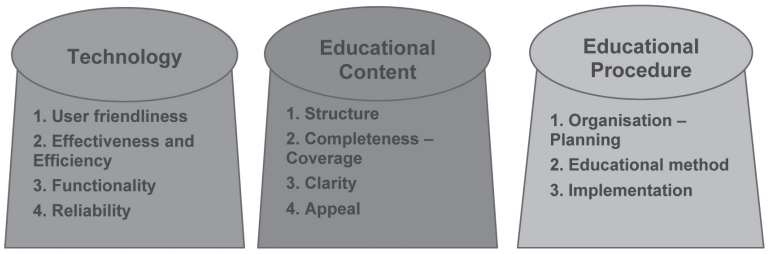

Figure 2: Evaluation fields for distance education

For the collection of the above information the use of certain tools is essential [1]. This tools should be selected and used in such a way, that results are gathered which are as objective as possible, and thus, an objective evaluation of educational procedure that was followed. The most reliable procedure is the combination of following tools:

- Questionnaires completed by the instructors and trainees during the educational procedure.
- Video recording of teaching and of the teacher in and outside the classroom.
- Interviews with the teachers on subjects relating to their training from a distance.

The most important process after the collection of data, is its analysis and the determination of the criteria and factors that will be used for the evaluation. The method for the statistical analysis should be ready before the conduct of the training courses, and it should be included in the Implementation Guide. Also, with regard to the evaluation plan, the questionnaires should be sent out before the beginning of each project phase, while the interviews with the trained teachers should fall temporally towards the end of each phase, so as to achieve the most objective and complete perspective project progress, based on data before and after the training.

In order for the plan of evaluation to be as effective as possible, it should be focused on providing a way for continuous improvement of Distance Education and/or the training process, such as the one proposed in Figure 3. The Educational Procedure, through which the Educational Material will be provided to the schoolteachers, should be divided in educational cycles. These cycles should be structured in such a way that the results, the conclusions and the dysfunctions of the first educational cycle can act as examples for reproduction or avoidance, and so that they can constitute a starting point for improving the process of providing distance education. For this reason, each cycle should constitute an independent scenario of educational activity, capable of independent evaluation, constituting, however, at the same time, part of a whole educational procedure, which aims at providing teachers with certain skills and contributing towards their professional development. After the completion of all educational cycles, and after all data has been collected and actions of improvement have been proposed and undertaken, the final evaluation and comparison of the training cycles should take place, so that it can be confirmed:

- If and to what extent the corrective actions were materialised.
- If and to what rate the total project was improved, compared to its initial form.
- What are the alternative scenarios for improvement in future applications of distance education.

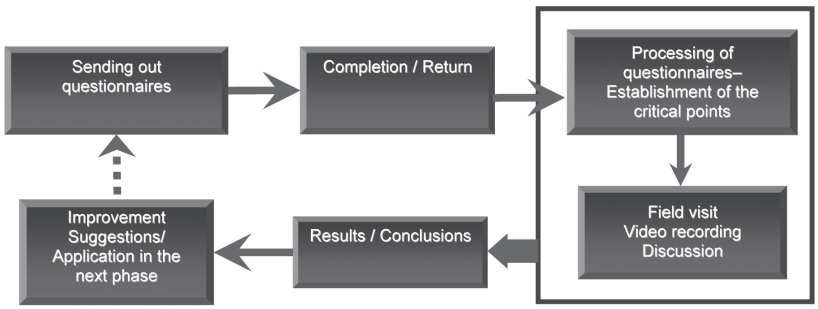

Figure 3: Procedure for evaluating distance education

Summarising, it has already been proved that standardising the procedure of distance education provision, and including it in a framework that can be continuously observed, its

total effectiveness is improved, new methods of teaching are imported and the old ones are improved, while malfunctions are minimised, with the help of evaluation, too. Thus the class and learning are upgraded to a higher teaching, technological, cultural and thematic level. And here are the advantages for the teachers to be found. As each teacher constitutes a member of the continuously evolving whole (improved methods of teaching, means, classes, more focused students, more justified and realistic criteria and methods of evaluation, etc.), he/she is more and more motivated, undertaking action in order to improve his/her his skills so as to copes with the continuously increasing requirements.

Conclusions

The Implementation Guide should be considered as a basic need, so that standards are established successfully in the educational process, and more specifically in relation to the use of ICT. The objectives of the Implementation Guide are:

- To create a framework of training that would correspond to the needs of those involved (teachers, students and the wider society).
- To recognize and present the best practices and methodologies of training.
- To standardise the educational procedure.
- To present a model for the continuous provision of training and support to those involved.
- To establish a procedure according to which the training framework will be evaluated, so that new procedures or methods of creating user-friendly environments are changed and adapted continuously.
- To recognize and follow the basic principles and models of an educational programme.

The Implementation Guide includes all specifications, practices and methods that are required for the application of electronic learning in a proposed way (e.g. Open Distance Learning via broadband networks), and is divided in three sectors:

- Specifications of training and education (methods and practices)
- Technological specifications (methods and practices)
- Specifications for the provision of the integrated service (methods and practices)

With the presence of the Implementation Guide, the instructor as well as the trainees can be sure that most factors that influence the effectiveness of the distance education procedure, follow concrete checked models, which are determined according to good practices and are continuously improved through an internal mechanism of evaluation, which is focused on locating gaps, malfunctions and differences in the procedure. Thus, the development of an Implementation Guide and the standardisation of all undertaken activities ensures the quality required in distance education and, naturally, provides the teachers with all skills required.

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Joint workshop of the NEMED focus groups: discussing issues of importance to multigrade education

Workshop abstract

Multigrade schools (i.e. schools in which teachers work with more than one curriculum grade in the same class) play an important role in providing access to 'Education for All' in remote and disadvantaged rural areas. They are more than a reality in primary education in many parts of Europe and the world, often providing isolated communities with pedagogy and community service of good standards. Nevertheless, they typically constitute a neglected aspect of education systems, due to geographical peculiarities and socio-economic oddities.

The proposed workshop provided an opportunity to examine teachers' role in multigrade school education from different perspectives, and consider the potential for them to benefit from lifelong e-learning initiatives, based on experiences from research and development projects at national, European, and international level. Educationalists currently working for the enhancement of multigrade school education shared their findings and experiences, with a special focus on the support and in-service-training opportunities promised to the multigrade school teacher by developments in educational technologies. The work presented and discussed mainly originated in the activities that had by then taken place within NEMED. NEMED activities are methodologically structured around the concept of dedicated focus groups researching diverse aspects of multigrade education in parallel.

Background information was presented on the importance and complexity of multigrade instruction for educators, and current policies and tendencies for their professional development were discussed. Different methodological aspects of teaching in the multigrade classroom were also be examined from an educational ICT perspective, including resources development, classroom management, and facilitation of different learning modes. In addition, current and emerging tendencies of broadband access provision for multigrade schools were examined, through examples of state-of-the art satellite network services offered to remote rural schools, and their potential for catalysing change and development in the school and in the local community more widely.

'Development of ICT-based educational resources as a tool for the multigrade school teacher'

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After an overview of curriculum and evaluation planning concepts, the development of educational resources based on the utilization of ICT by the multigrade school teacher is looked at as an aspect of the work he/she has to do at the level instructional organization, curriculum development and evaluation. In this context, research-based guidelines for planning, developing, and implementing instructional strategies are presented, with significant emphasis put on the development of cooperative work norms in the multigrade classroom and on ways of matching instruction to the needs of students.

The implications for evaluation and assessment are particularly important. In the multigrade class, different abilities from different ages are expected. It is very important to know the curriculum expectation for each age group and how to determine if a student is working at "grade level." Evaluation in the multigrade classroom reports how individuals are progressing over years and indicates where they fit on the learning continuum. Teachers must know the curriculum guides well for assessment. Curriculum outcomes should be of prime importance when deciding what to teach and, therefore, what and how we intend to assess. It is argued that the multigrade school teacher should have the initiative to generate his/her own resources, both conventional and ICT-based, that would best serve his/her class in this direction, too. Further, multigrade groupings are discussed as an approach that provides opportunities to assess a child over years instead of months in their life, and development of teacher-generated ICT resources that would serve this purpose is considered.

What is more, in multigrade classrooms educational ICT resources should facilitate students to work with another ability group for lessons and to learn from older students. Older students can model and teach younger ones. As part of the evaluation process, the teacher gets to overhear and observe the student's knowledge in action, the teacher knows that students have truly learned it because they see them use their knowledge and pass it on. Younger students or novices become "experts" and have a true sense of what will be expected of them in the future.

Overall, this presentation emphasizes that instructional quality and student grouping are key

components for success in the multigrade classroom, and that these should be addressed and supported through the appropriate educational ICT materials and resources. These resources need to be adjusted to the specific needs of the class, given the diversity encountered in multigrade classrooms, and therefore teacher-generated or teacher-adjusted. Such resources should promote instructional methods such as recitation, discussion, and cooperative learning, based on known planning guides and existing examples of good practice. Strategies for organizing group learning activities across and within grade levels, especially those that develop interdependence and cooperation among students, are also discussed as foundations for effective resource development in the multigrade classroom. Finally, multigrade classroom ICT-based resources development by teachers is examined within a framework of rethinking knowledge conceptions and knowledge production in the multidimensional spaces that define the European culture of the XXI century.

'Training the multigrade school teacher as an effective classroom manager: issues to consider in professional development e-learning'

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The multigrade classroom is labour intensive and requires more planning, collaboration, and professional development than the conventional graded classroom. In this context, both research and multigrade classroom practice recognize a particular importance to multigrade teacher's functioning as an effective classroom manager.

Establishing clear expectations for student behaviour and predictable classroom routines has been shown to improve student performance. Managing the classroom is a critical element in successful instruction and requires good organizational ability and consistency. Students come into the classroom expecting the teacher to give them guidance and direction about rules and procedures and how the classroom is organized for instructional use. Having a uniform and predictable set of rules and procedures simplifies the task of being successful. Having clear and efficient routines makes classroom life run smoothly. Because there are so many different levels in a multigrade classroom, the need for clear, consistent rules and procedures is even more critical than in traditional, single-grade classrooms.

In this presentation, research relating to classroom management and discipline are presented, along with a checklist for planning management routines and discipline procedures specifically suitable for the multigrade classroom. In particular, effective teachers have been consistently observed by researchers to engage in three distinct phases of classroom management and discipline: (1) planning before school begins, (2) implementing plans, and (3) maintenance. Each phase is presented, along with examples of what effective teachers do during each phase. In addition, other aspects of effective multigrade classroom management and organisation is examined including organization of materials in the classroom, storing of personal belongings, the organization of teacher activities, attendance, daily announcements, student strategies for obtaining help, organization of student activities, and establishing procedures and rules in the classroom.

A particular emphasis is put on how professional development e-learning could help teachers develop effective classroom management strategies, such as strategies for arranging and

organizing instructional resources and the physical environment of the classroom in a multigrade school setting. In the typical multigrade classroom, where multiple activities are likely to occur at the same time, classroom organization is a critical factor in developing smooth, predictable routines. It is also known from research on effective classroom practice that when students have a clear understanding of classroom structure, procedures, and rules, they are more likely to follow them, especially if they have had some involvement in decision-making. Although there is no single "best" way to arrange your classroom, there are some general guidelines that apply to most multigrade settings. Sample classroom layouts and a "design kit" for organizing a multigrade classroom are presented. The activity centres approach is particularly focused upon as an example of good practice for achieving an effective learning environment in the multigrade classroom. An activity centre can be defined as any discernible pattern of student or teacher behaviour that can be clearly described and labeled. One common example is seatwork, where students work independently at a desk. Another example is pairwork, where two students work together. Three or more students working together is generally characterized as groupwork. A classroom may also have areas designated for art, audio-visual equipment, computers, and other instructional resources. Each example reflects a type of activity where expectations for behaviour may be clearly defined. An activity center is best described as an area of the classroom that the teacher has designated for a specific purpose.

'Self-regulated collaborative learning in the multigrade classroom: implications from a lifelong perspective'

Antonio Duarte, Faculty of Psychology and Educational Sciences, University of Lisbon, Portugal

The challenge for the multigrade teacher is to meet the individual needs of students in a classroom setting characterized by multiple levels of ability, achievement, and social and physical development. In this context, apart from being well-organized and resourceful, the multigrade classroom teacher also needs to maintain a clear view and stance towards learning, and the different routes his/her different students may take to achieve learning. In particular, it is argued in this presentation, the multigrade classroom teacher ought to actively and practically promote self-regulated learning and collaborative learning.

Among the different approaches to learning of particular importance for the multigrade classroom are "self-regulated learning" and "collaborative learning". In this context, a critical aspect for effective learning to occur is that students be in charge of their own learning, essentially directing their own learning processes. Characteristics of students who are responsible for their own learning is discussed, including student's ability to shape and manage change, and proactivity.

Educators can nurture student self-regulation and personal efficacy by providing students with opportunities before, during, and after instruction to exercise some control over their own learning. This means that students are taught and engaged in specific strategies that offer them opportunities to make decisions and solve problems on their own without being told what to do at all times; they are provided with strategies designed to help them process information effectively and be self-confident; and they are helped to become more reflective about their thinking and learning processes.

Developing skills and strategies in students that allow for a high level of independence and efficiency in learning, either individually or in collaboration with other students, is essential in the multigrade classroom. Ideas for developing self-regulation is presented, such as encouraging students to set their own goals for personal development and instructional improvement, and planning ways to achieve these goals.

The presentation further continues to focus on the other end of the learning processes spectrum, namely on learning through interaction and collaboration with peers. The issue for the teacher here is how to develop skills and routines whereby students collaborate in the self-regulation of group work.

Examples of good practice are presented in terms of providing guidelines to teachers on how to develop self-regulated collaborative learning in their classroom. Aspects reviewed include setting goals and choosing learning objectives, deciding who will be involved and where self-regulated collaborative learning will take place, scheduling the sessions, deciding on subjects, materials, procedures, and strategies, as well as evaluation in this context.

Self-regulated collaborative learning is eventually viewed from a perspective emphasising the development of lifelong learning qualities and skills in the individual, considering both teachers and their students as lifelong learners.

'Interpreting lifelong e-learning experiences offered to remote multigrade school teachers in Greece over satellite'

Pavlos Koulouris, Research and Development Department, Ellinogermaniki Agogi, Greece

Multigrade schools are more than a reality in primary education offered to the children of rural communities in many insular and mountainous regions in Greece. It is estimated that more than forty per cent of the primary schools in Greece are multigrade, and about fifteen percent of all teachers are working in such schools. These teachers tend to be young and inexperienced, as many typically start their teaching career in remote rural areas. Paradoxically, these teachers are expected to cope with particularly demanding working conditions without proper preparation in their initial training. Apparently, provision of in-service training to teachers working in these schools constitutes a need, as well as posing a challenge due to geographical and a number of organisational and socio-economical reasons.

New technological solutions, such as satellite communications, which provide an advanced and reliable channel for broadband access to the Information Society in geographically disadvantaged and isolated areas, have been found to constitute a promising way out of the problem of multigrade school teachers' isolation. At the same time, the launch of the Greek satellite HellasSat has brought a new era in telecommunications in Greece. Beside technological integrity, a major challenge for the subsequent introduction of new satellite-based services is market acceptance and penetration. At the same time, investment, in recent years, in telecom infrastructure and services in most parts of the country has not returned what it could, since penetration and acceptance remains low partly because of high cost, which leads to a lack of the critical mass of users in disadvantaged regions. Satellite systems cover wide areas of earth surface, therefore providing the technological means through which new broadband services can be brought to remote rural populations, at a cost which proves low compared with the cost of the corresponding earth links, while the quality of the service suffers no loss.

In this context, this presentation offers some interpretations of the experiences and outcomes of the ZEUS (Satellite Network of Rural Schools) project, which has envisioned and realized the implementation of advanced communication channels for the provision of in-service training and support to teachers working in isolated schools in the mountains of mainland Greece and in Aegean islands. The project is based on a close cooperation between pedagogical

experts, trainers, teachers, software developers and communication experts, aiming to produce an advanced e-learning environment for the use of multigrade school teachers, delivered via satellite communications.

The training programme aims at the enhancement of teachers' professional skills in terms of utilization of ICT, pedagogical approaches appropriate for the multigrade classroom, and cross-curricular teaching in their classrooms. E-learning takes place either through typical trainer-lead sessions, or in collaborative learning peer sessions, or even through individual tutoring. Training and support activities are realized both synchronously, through a dedicated videoconferencing and application-sharing platform, as well as asynchronously, facilitated by a web portal developed for this purpose. The emphasis is on exploiting the broadband possibilities offered by satellite telecommunications in order to afford richer, multimodal online learning experiences that would not be feasible through the standard terrestrial connectivity nowadays usually available in remote parts of the country – albeit the driving force of all design is pedagogical and communicative rather than technological.

Strong and weak points are discussed from a technological and an educational viewpoint, and some light is shed on the potential - and 'responsibility' – of such initiatives to reach beyond the individual teachers receiving the training, by fostering digital culture among all rural citizens and thus bridging the digital divide. Rural schools could function as places of lifelong learning for the whole community, providing the local labour force and citizens of all ages with fast Internet access to opportunities for knowledge and creativity. The rural teacher would then take on an extra role, as an agent of change and catalyst for the penetration of the Information Society in the remote rural communities.

'e-training the multigrade school teacher'

Anita Pincas, Institute of Education, University of London, UK

The teacher of any class that has any variations in the level of abilities, ages, interests, backgrounds among the learners, always needs to make a number of strategy decisions that will influence the methodology of the classroom teaching. Multigrade classrooms are not, in principle, different from normal classrooms that always have pupils with differences. Thus, the approach taken in this talk is to highlight solutions to normal classroom problems, and then to relate these to methods of training teachers to think about solving their own problems.

The issues can be discussed online in very simple ways in an e-learning course, using basic internet communications technology. A training course can be built up over time, gradually adding further technology as the trainees develop improved access to the Internet. The most common issues for the trainees on such a training course to consider are the following: 1. Will the class be organised as a whole class, in groups, pairs, or individuals? 2. If not as a whole class, then will groups be constituted by age, ability, gender, other? 3. Or will groups be mixed in the above categories? 4. If there will be group teaching, then will they be permanent for a whole term, week, day....? Or will groups change from one lesson to another? 5. If pupils are in groups, will they actually work collaboratively, co-operatively, or as individuals while sitting together? 6. The same above questions relate to teaching pairs of learners instead of groups. 7. If the teacher wants to maintain a whole class approach, how can such teaching be made suitable for all learners of different levels? 8. If they are working as a whole class, then can they work for some of the time as individuals? If so, how can the teacher manage the time? How much autonomy should the teacher give individuals? Is talking permitted? Are they all working on the same subject at the same time? And so on.

Within an overall strategy, the teacher may have different beliefs, or may wish to try out different hypotheses, for example: Group work is easier/harder than whole class teaching or pair work; children can teach each other; younger children can even teach older children something; personalities have to be taken account of; some children will need raising of self-esteem more than others; over dominant children may have to be punished/distracted/given special tasks/ talked to quietly; etc. These are also fully discussed. The talk briefly demonstrates how such issues can be presented to the trainees, and discussed by them in groups, using, at a basic level, simple email, which can be supplemented with video cassettes of talks by tutors. Where suitable, it can also include videos of model lessons taken from existing multigrade

classrooms. The same materials can also be up-graded to make a simple advance from email to non-website platforms like FirstClass. If appropriate, however, higher technology such as full use of the WWW, including video conferencing, instant messaging, audio files, video-streaming is also taken account of. The training course itself would be presented at whichever technological level was most suitable for the cohort being trained.

The speaker demonstrates her use over many years of the simple internet platform FirstClass for her long-standing international training course, Online Education & Training, where groups of trainees from all over the world mingle online and share ideas. This tried and tested format is recommended for e-training of multi-grade teachers, and the pattern of course provision is outlined.

'Realizing the global village: broadband lifelong e-learning applications for geographically disadvantaged rural school teachers'

Sofoklis Sotiriou, Research and Development Department, Ellinogermaniki Agogi, Greece

In recent years there have been several initiatives in the field of satellite telecommunications applications addressing the needs of rural communities. This indicates the unique advantages of satellite technologies for providing high quality wireless broadband connection to any type of population within large geographical areas. The Rural Wings project is presented, an ambitious on-going project that is developing an advanced learning platform through satellite DVB-RCS access technologies. Teachers of remote rural schools, typically working in multigrade classrooms, constitute one of the major target groups of the project. Targeted users also include students, doctors and health personnel, farmers, local administrators and public authorities.

In rural towns and communities the necessity of telecommunications services cannot be overstated: Where growth and economic development is desired, telecommunications infrastructure and high-speed communications to attract new business and industry are essential. Everybody in a rural community - schools, hospitals, businesses, city and county governments, community groups and individuals – benefit from access to improved communications, commerce and information, while underdeveloped communications infrastructure has a direct impact to the economic and social welfare of rural communities.

The rural-urban divide has a direct impact not only on the access but also on the creation of knowledge. Without access to broadband for example, a researcher has no access to data-intensive applications that are only available to colleagues connected by urban local area network, and a rural automotive designer needs to relocate to the company headquarters to participate in interactive, real-time, computer-aided modelling of a new vehicle. The remoteness of a rural area leads to massive set-up costs. With poor career training and low literacy rates, it is unlikely that a poor rural individual, who values access to the internet and other technologies, will be able to afford the access costs. Thus, large-scale technology initiatives have little hope of success unless at least a basic level of community capacity is in place.

The project presented addresses how the learning needs of rural communities could be served

by satellite communications. The objective is to select the most appropriate applications and propose a roadmap up to the operational status including demonstrations and technical developments in order to promote and facilitate the use of satellite communications over Europe and beyond. This project seeks to use advanced technology as a tool to foster Human Development, in order to use the great potential capacity the new technologies have in addressing major societal challenges. This project places a great emphasis on the pedagogical, social and human development dimensions, where ICTs only play an instrumental role in order to empower people through knowledge, development of creativity and enhanced concerted action.

Apparently, Rural Wings promotes a user-centred methodological approach, which constitutes its major innovation. The main aim of the project is to support the creation of a new culture in rural communities promoting digital literacy and reducing resistance to the use of new technologies. Going even a step further, Rural Wings encourages users to add their significant contribution to the emerging applications by involving them in meaningful activities, tailored to address the needs of different user groups. Thus, Rural Wings is offering stimulating and creative learning environments to support vibrant user communities, attempting an extended implementation in dozens of pilot sites in 18 countries worldwide.

The Rural Wings learning environment is developed through the effective utilization of a wide range of ICT applications for educational purposes based on a participatory methodology in which users will play a very active role in creating additional components, through the creative use of constructionist principles and related ICT technologies. The Rural Wings learning environment also supports the exchange of material between users and experts, allows for easy uploads and downloads of relevant material, facilitates direct communication between users and networking activities of all the actors involved. Such a service offers high speed two-way connection that gives the opportunity to deliver content utilizing completely the capabilities of multimedia tools. High quality video streaming broadcasted can be delivered to users at school, at work or at home. Real-time on-line seminars can be realized in this way, while the users will have the opportunity to download simultaneously educational and training material and supporting documents or software according to their needs.

'Multigrade school education in Europe: policies, tendencies, and the challenges for educational ICT'

Costas Tsolakidis, School of Humanities, University Of Aegean, Greece

Multigrade schools have been a necessity mainly due to specific geographical and socio-economical reasons. Nowadays, in many countries there is a tendency to reduce the number of multigrade schools. The most common practice is to merge neighbouring schools, providing transportation to pupils on a daily basis to a main village in a "hub" or "centre" school. But mergence (a) is not a choice of the inhabitants of the small villages and (b) does not exist as an option in the case of small islands where there is only one school. Moreover, mergence may be strongly opposed by the residents, who consider the school, together with the local church, to be the traditional cornerstones of the village's cultural and social life. They believe that if the school stops operating then the status of the village will be reduced and this will negatively affect its future. Their point is that a school is always a vivid cell and a vehicle of civilization that helps keeping the local population in place, preventing depopulation.

Sustaining a large number of multigrade schools is a difficult task. The problems that arise can be epitomized in two categories, the financial and the educational. On the one hand, the state has to provide the necessary economic means in order to keep schools fully equipped and in an acceptable operational condition. On the other hand, there must be adaptations in the curriculum; in order to fit in the way teaching is conducted in multi-grade schools. These adaptations often lead to the belief that the quality of the provided education is inferior, compared to the quality of education in the rest of the schools. We believe there are a number of interventions that can be made to raise the quality, involving the extensive use of information technology.

At the same time, drastic constraints concerning teaching time per student, intense fragmentation of the teaching procedure, lack of coherence, the need for time-sharing so as to meet the needs of a non-homogeneous class, make the multi-grade school a very demanding professional area. The teacher of such a learning environment is called to unify diversified groups, set objectives for more than one grade, transform heterogeneous groups into collaborative teams and integrate pupils into a functional entity.

The role of ICT in education is significant in general but can be decisive in the case of multigrade schools. There are three areas where this role is distinguished, namely (a) teaching

(b) training and supporting teachers and (c) administration. In the multigrade school ICT is an indispensable tool that can provide solutions that improve the educational services offered.

In many instances ICT is used less by the people that need it most. The main purpose of a number of projects presented is to indicate in practice that ICT is needed in multigrade schools and should become a basic ingredient that has to be included in the design of a new curriculum for these schools. Multigrade schools, irrespectively of their reducing numbers, will be present in the educational scene for a long time yet, either as a necessary handicap for some or as an interesting pedagogical experiment for others.
However, multigrade schools have little chance to be the priority in educational planning within the institutional framework. To change the situation a change in attitude could be involved. Changing the attitude with respect to multigrade schools is a big challenge and ICT could work positively in this context.