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Implementing Information Technology in the Educational System. A Catalonia perspective.

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Abstract

This paper deals with the development of Information and Communciation Technology in primary and secondary education in Catalonia. Since 1986 the autonomous government has implemented an integrated policy of work.

The aspects of the work presented and analysed are:

- Teacher education: pre-service and in-service actions;
- Policies and organisation;
- Information dissemination: the SINERA project and the Web.

Introduction

It is a great honour to have been given the opportunity to speak at this conference on behalf of my institution the Programa d'informàtica Educativa to present the Catalonia perspective on the process of implementing new technologies in teacher education and in the whole educational system in this European Year for Lifelong Learning.

This paper deals with the development in Information and Communication Technology (ICT) in primary and secondary education in Catalonia region and the organisational provision taken by the regional government (Generalitat de Catalunya), which is responsible for the administration of the educational system. Special attention will be devoted to teacher education according to the aims of this conference.

The Spanish educational system: a decentralised model in a transition period

The Spanish educational system is a decentralised model established by the 1978 Constitution Act and the corresponding statutes of each autonomous region. The Statute of Autonomy of Catalonia states that the Department of Education of the Generalitat has whole responsibility over the administration of the educational system.

In 1996 Catalonia has 3.975 primary, secondary and special needs schools, with a population of 62.000 teachers and 1.150.000 students. About 60% of the schools are public, that is state-owned and administered. The importance both in quantity and in quality of the number of teachers should be emphasised: all primary teachers have a three year university degree and all secondary teachers and an important part of primary education teachers have a five year university degree. Teachers constitute in Catalonia, as probably is the case in many other countries, the most important

homogeneous intellectual professional collective. In this respect, any innovative action targeting the educational system has to rely upon their protagonism and participation.

In 1990 a new education general law (LOGSE) was passed and both the Spanish and the Catalan educational system are undergoing a large education reform. Education reform started in 1991 in primary education, and in September 1996 the first cohort of 12-year-old pupils will begin the new secondary compulsory education. The main components of this process of change are a new curricular model and organisational changes. The new curricular model emphasises curriculum flexibility, in order to cope with the variety of students' interests, as well as with the different educational priorities of Spanish regions and each school educational project. Main organisational changes are related to the extension of compulsory education from 14 to 16 years, which implies a new structure for secondary education, now divided in two stages: compulsory secondary education (12 to 16) and upper secondary (16 to 18). Vocational education has also been deeply reformulated in order to guarantee a successful transition to work.

The Catalan development regulations of the LOGSE introduces in the curriculum of the different educational stages aims, statements and targets for information technology (1). Information technology is defined as a transversal axis of the curriculum to be integrated in the different subjects. This important commitment implies subsequent educational policy actions, specifically for teacher education.

Teacher education and new technologies: a regional perspective

The systematic integration of information technology (IT) in teaching and learning, is a major innovation process which affects all the agents involved: teachers, planners, administrators and students. As Ferran Ruiz points out (2), integration of ICT in education asks for changes in teacher skills, knowledge and attitudes. These will only be lasting changes if supported by permanent teacher development and by an appropriate organisational context. The specific issues we will consider are:

- Initial teacher education
- In-service teacher training
- Professional teacher development

Initial Teacher Education

To conform the LOGSE requirements, Initial Teacher Education Schools have had to adapt their curriculum. The new education law defines the primary teacher as a generalist , nevertheless some specialities are established: infant education, primary education, foreign language, music education, special needs and physical education.

Educational technology has been an optional subject in teacher education for many years. In the nineties, after the education reform law, new technologies subjects have become compulsory in Catalan's Teacher Education Schools and Faculties of Education. In some institutions the subject covers the wide field of educational technology, while in others specific half-term subjects on educational computing or media in education are carried out.

Several universities such as University of Barcelona (UB), Barcelona Autonomous University (UAB) and the University of Girona (UdG), have experienced teams with reputed background in educational multimedia production and academic research in this field.

In-service teacher training

In Catalonia in-service teacher training involves different institutions:

- **Department of Education** (DE): Different units of the DE organise courses within a framework plan (Pla de Formació Permanent). Course topics cover many fields:, new technologies represents 15% of the framework Plan courses (this topic will be analysed in more detail later on in this paper).

  The courses, free of charge for the teachers of state-maintained schools, are conducted outside the school timetable. The average course length is 30 hours.

  The organisation and dissemination task is performed by a network of 80 local Teachers Resource Centres (CRP) that play an important role in adapting in-service teacher training to the local demand and needs.

- **Universities** through the Institutes of Education Sciences (ICE), offer complementary resources for in-service training and professional development: Seminars, workshops, courses and research grants. Many of the activities are related to or imply the use of IT.

- **Teacher associations**: Independent teacher associations such the "Col·legi de Doctors i Llicenciats" or the "Associació de Mestres Rosa Sensat" play an important role in teacher training and teacher development, through team work, Summer Schools, regular courses and participation in European Projects. I would like to mention here a LINGUA project co-ordinated by the "Col·legi de Doctors i Llicenciats" that has produced a multimedia CD-ROM on the European Dimension in Secondary Education, that will be available soon.

Professional development

Professional development is encouraged by the Department of Education with several initiatives:

- Studies licences: one-year studies licences for primary and secondary teachers are called yearly. The allowance depends on the project contents and the CV of the applicant. New technology projects have one of the highest priorities.

- Innovation grants: Yearly concourse for school projects oriented to the development and experimentation of new curriculum materials. The specific domains considered are: IT, Media in education, Health education, Sciences and Tutorial and guidance projects.

- Salary incentives: Each six years, the teachers' salary may be revised, according to an agreement with Teacher's Unions. Teachers must enrol in-service teacher training courses and perform professional development activities in order to attain the salary upgrade.

Second cycle university studies and postgraduate courses are also an important way leading to professional development. These courses represent a large investment in time (and money) and offer the opportunity of enhancing the teachers academic profile. Most primary teachers have a three-year university degree; if they want to become secondary teachers they must hold a five-year university degree; that's what we call second cycle university studies.

To cope the demand of lifelong learning and professional development in many sectors a new open and distance university has been created in 1995: the "Universitat Oberta de Catalunya" (UOC), strongly based in new technologies. UOC has introduced the pedagogical model of Virtual Campus where students and teachers interact without the constraints of time and space. In order to develop the information skills needed in

Virtual Campus all the UOC students must take a compulsory subject “Multimedia i Comunicació”.

UOC has a great concern with teacher professional development that their only offer for second cycle studies is Psicopedagogy, a topic basically oriented to teachers with a three-year degree. The new post for Psicopedagogues in secondary schools defined by LOGSE provide a major opportunity for primary teachers to work in secondary education.

The Programa d’Informàtica Educativa (PIE): strategies of work

PIE was established in 1986 with the objectives of promoting, and co-ordinating educational integration of ICT in primary, secondary and vocational schools in Catalonia. At the moment of its creation, PIE assumed previous ICT educational experiences which had been initiated during the early 80's.

PIE conceives the introduction and integration of ICT in school life as a team task, in which PIE works in co-operation with other services of the Department of Education, and in close collaboration with many teachers in the educational system (3).

It is this relation with teachers what PIE sees as the main factor to the success of its work: teachers themselves are the real protagonists of educational change and, when dealing with deep innovations the educational administration should find its role as educational and technical support, as co-organiser and adviser, and as a catalyser of the work carried out by the teachers. In this sense, the relation between PIE and the teachers in the educational system can be seen as a bi-directional relation with two kinds of interaction: "top down interaction" representing "what PIE provides to teachers", and "bottom up interaction" representing "what innovative teachers give to PIE in order to be processed and reverted to educational system".

To name just a few, the most important components of the "top down interaction" are in-service teacher training, ICT seminars, and information and documentation dissemination. Computing and telecommunications equipment provision and maintenance, and other technical aspects form part of the basic infrastructure that, being obviously essential, is not a sufficient condition for the success of the integration of ICT in education, so we will concentrate in the above-mentioned elements of "top-down interaction".

In-service teacher training on IT

For PIE the basic aim of in-service teacher training in ICT is to develop information technology awareness and skills in order to induce curriculum development for primary and secondary pupils. This idea materialises in the following general criteria of in-service teacher training:

- Highest priority is given to the discussion of the relationships between the use of IT, curriculum goals, learning processes and student activity.
- Teachers are provided with good practice examples in the use of ICT across the curriculum, as far as they are or can be useful to the different topics.
- Most of the courses are curriculum oriented instead of technology led.

Inside PIE, a specific teacher training department is in charge of the organisation, co-ordination and evaluation of ICT in-service teacher training.

The ICT in-service teacher training courses are free of charge, have a modular structure, make extensive use of the specific learning materials developed for each

course, and are based on the computing facilities available in the schools. This is at present the catalogue for the different 34 types of courses:

- Introduction to the use of ICT in primary education
- Introduction to the use of ICT in secondary education
- Word-processing in Windows
- ICT resources for infant education
- Educational software for the primary school
- ICT and language learning in primary school
- ICT applications for language learning in secondary school
- Graphic design with computers
- Development of Concept Keyboard applications
- Musical education and IT
- Applications of ICT to foreign language learning
- Mathematics and ICT in primary school
- Geometry with “Cabri-Geometre”
- Educational applications of spreadsheets
- ICT tools for statistics
- ICT applications for earth sciences
- Remote sensing
- Development of educational software with Visual Basic
- Production of educational resources
- Documentation and management of educational resources
- ICT for technology studies
- Multimedia resources for teaching and learning
- Educational activities using telematics
- ICT for vocational teachers
- Applications development with Access
- Offimatic applications
- Computer Assisted Design
- Company management
- Methodology of computer programming with C++
- Network administration and computer maintenance for ICT co-ordinators
- Local area network with Windows 95 and Windows NT
- Local area network operating systems
- Advanced UNIX operating system

Some of them are general, such as " Introduction to the use of ICT in education" while some others are specific (Musical education and IT, ICT and language learning, Offimatic applications and local area networks). The course extension is 60 or 36 hours, for courses respectively general or specific.

During the school year 1995/96, more than 400 courses have been held, reaching thus almost every corner of Catalonia. Since 1986 more than 2900 courses have been offered and 40.500 teachers have attended ICT courses, with an average of 1.5 courses per teacher.

There are also open learning courses supported by telematic means. This experience started in 1990 with two experimental courses (4) and using the facilities of XTEC ("Xarxa Telemàtica Educativa de Catalunya") -or Catalonia's Telematics Educational Network- a telecommunications infrastructure based on Videotex standard have been built by PIE since 1988 (5). The on-line in-service training experience was continued, offering four different courses, until 1995. At that moment due to technological problems (migration to the Internet standard) and budgetary cuts (lack of funding for maintaining dual services) on-line teacher training project was temporarily interrupted.

In the school year 1995-96, with the adoption of Internet technology, a new phase in school telecommunications has been initiated. In less than six months more than 4000 primary and secondary teachers have requested E-mail address. Based on XTEC previous experience with Videotex, the number of educational activities using telematics is expanding: Telematic Literary Analysis, co-operative work, literary concourse for Sant Jordi's day, participation in scientific events (Comet Hyakutake, Galileo orbital probe), international projects (musical exchange with Japan), school webs, teacher homepages,...

In this context the demand for on-line teacher training is growing and for the next school year 1996-97 the service will restart with two reformulated courses: "IT Statistics Tools" and "Educational applications of spreadsheets". A set of new on-line course materials are under development, and thanks to the integrated facilities of the Web, E-mail and News, tutor-students interaction will improve.

Teacher support

The second main element of the top-down strategy is organising periodical meetings of the ICT co-ordinators of all the schools equipped with computers. More than 65 different ICT seminars are organised simultaneously, each one having a co-ordinator and meeting at least five times a year. PIE keeps close contact with the seminars' co-ordinators, providing them guidance, working proposals and specific information, along with textual materials and software to present, discuss and disseminate. These seminars are a paramount opportunity for disseminating information, for exchanging experience between teachers and for stimulating contacts between schools, and also for creating opinion and group work dynamics. In addition to these wide scope seminars, other seminars concerning specific curriculum or organisational topics, such as "IT and music" or "Support to ICT teacher trainers", are separately held.

Information dissemination: SINERA CD-ROM and Web

Information and documentation, together with its dissemination in the most suitable way, are also a key element to support the educational integration of ICT which has to be organised by the educational administration. In all the above-mentioned in-service courses, all in-service trainees have their own course materials which are closely related to curriculum issues and methodological procedures. These materials can be taken home or to school for further reading and practice, and sometimes they can be used directly within the classgroups. Similarly, all ICT seminars have specific support documents. In turn, the seminars are also useful to introduce and distribute materials, complementing this way other technical distribution means such as the SINERA CD-ROM and the XTEC Web (www.xtec.es).

The SINERA CD-ROM

Curriculum development requires up-to-date resource materials of many types and subjects. SINERA, a "system of educational information and learning resources", is a full text database created in 1987 to provide an organised and easy access to these materials with special emphasis, whenever relevant, to education. Since then SINERA has been actively updated while expanding its areas of coverage. SINERA database, which was formerly available for telematic consultation by means of the PIE educational telematic network XTEC, is now available on a multimedia CD-ROM. At present SINERA consist of 50.000 records, and is oriented to provide the user with the references that are relevant to specific subject matters and educational activities, which can be retrieved by means of a Boolean search. This implementation, known as "SINERA en Disc", is at the same time a database of reference information and a way of distributing some of PIE's materials.

The CD-ROM contains also more than 100 educational software items, a large selection of curriculum materials that introduce ICT as an integrated resource. Other important elements of the CD-ROM are the complete guide of Catalan University courses, and a guide of vocational studies

XTEC Web

A large Web server has been created, with more than 1000 pages related to ICT in education. The Web contents could be divided in three main areas:

- Information dissemination: Agenda of ICT activities (courses, seminars), Information on other educational Webs.
- Resources distribution: educational software and curriculum materials are directly downloadable, resources for web construction, SINERA database (under implementation), technical FAQ's for ICT co-ordinators.
- Educational activities animation: school electronic magazines, co-operative work, cross-curricular topics, international projects.

Future Web developments will cover on-line teacher training, curriculum activities for gifted students and Videoconferencing facilities.

Bottom Up interactions

All the elements that integrate the "top down interaction" between PIE and the educational system have their corresponding counterparts in the "bottom up interaction". Taking into account that innovation is not a single act but a continued process, dialogue, feedback and mutual self-adjustment between teachers and educational administrators is utterly necessary for a successful innovation and also for job satisfaction. It is by means of this dialogue that training activities are decided in close contact with participant teachers: there is a formal survey of training needs as expressed by teachers, and the teachers themselves are the people who, under requirement of PIE, design in-service courses, develop the associated materials and implement the courses.

IT seminars are another example of this cyclic dialogue process. Although the seminars are announced by PIE, the seminars themselves are run by teachers, and, to be successful, they try to foster a co-operative environment where participating schools share information and take an active role. E-mail is also becoming an important way to make "bottom-up interaction" possible. Suggestions, requests, questions are more and more often submitted, and answered, in electronic form.

As for information and documentation, and more specifically SINERA and XTEC environments, it's only through active implication of teachers that these projects make sense and could achieve their objective of contributing to curriculum development. The task of PIE is to design the technical frameworks and standards of reference (structure

of the document database, structure of the telecommunications environment and so on) but it's the task of the components of the educational system to fill these environments with the information and materials that they feel are relevant.

Conclusions

The evidence gathered by PIE allows to state that significant contributions of ICT to students' learning are happening in many Catalan schools. This is consistent with research results in other places but as Watson (6) points out, research results show also that people at all levels need continuous help in formulating clear policies and strategies that should go beyond focusing on particular aspects of issues and problems and provide a comprehensive and long term view to take full advantage of the potential impact of ICT on pupils' learning.

The educational authorities of Catalonia are committed to this goal, that implies taking into account that integration of information technology depends first and foremost on the initiatives of individual professionals that should be fully supported, and secondly on the organisational measures taken at school and educational authority levels.

In practical terms this means that the two-fold bottom-up and top-down approach referred to earlier seems to be both unavoidable and highly desirable, taking advantage of the "critical mass effect" that is now working: the higher the number of schools using ICT and requiring more support and orientation, the higher the degree of experience of educational use and the number of partners in the innovation dialogue. This probably means that ICT is beginning to be consolidated as an integrated element in the curriculum, both as a subject to be presented as well as an suitable aid to help in the achievement of educational targets in many areas.

The management of technological change and its school organisational and professional implications is probably the most difficult problem to tackle at school level and also at the educational administration level. The quick evolution of technology materialised in more performant tools, like multimedia or ISDN, act at the same time as a strong incentive for new applications into education and as a source of specific school problems, because of its continuous pedagogical, technical and organisational challenges at all levels. The networking possibilities brought about by telecommunications technologies are, in particular, a factor of almost unpredictable consequences for school education, which has never before been exposed to easy communications in a world-wide scale.

The integration of ICT in education is a complex and thrilling field of practice and research, reflection and experimentation, in which many Catalan schools and teachers are deeply involved, and that is already benefiting many students. Through PIE, the Catalan educational administration will work hard to empower teachers and learners facilitating the development of flexible and rational patterns of personal and professional behaviour in our society's information technology environment.

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