ICT IN CATALAN SCHOOLS
A Look at its Foundations and Early Developments

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Abstract: The authors of this article have been – and continue to be – in charge of the Catalan project of educational integration of ICT since 1986, when the Department of Education of the Generalitat set up its Educational Computing Programme (Programa d'Informàtica Educativa - PIE) with the objective of boosting computing in Catalan schools, within a framework of political decentralization and educational reform. This article aims to look at the initial period of its endeavour –the decade that goes from 1986 to 1995, from the start of the PIE until the appearance of Internet– with the aim of revising, with the perspective of the years gone by, the intentions and results of decisions taken, and, at the same time its influence in the birth and evolution of an organisational model of educational integration of ICT in Catalonia.

Key words: Primary schools; Secondary schools; Teacher training; Curricular integration; Educational telecommunications; Information technology integration policy

1.   INTRODUCTION

Catalonia is an historic community within the Spanish state, with a population of more than 6.5 million inhabitants, 3,800 schools and 82,000 teachers serving more that one million students. Approximately 63% of these schools are state-owned, and the rest are privately-owned - although a substantial number are subsidised - where a large part of the running costs of the school are financed with public funds. The Department of Education of the Catalan Government is politically and administratively responsible for the management of education in Catalonia.

In 1986 the Government of Catalonia set up an specific unit within the Department of Education, the Educational Computing Programme

(Programa d'Informàtica Educativa - PIE), with the aim of promoting educational innovation by the use of computing in schools.

The setting up of PIE, together with other action programmes, took place at a time when the educational system found itself immersed in a process of infrastructure change and strong growth, as well as change and reform of the syllabii and associated curricular models. This process also implied the boosting of a new curricular model, which gave prevalence, among other concepts, to active and interdisciplinary action, and gave rise to considerable organisational changes in the system, such as extending the age of compulsory education from 14 to 16 years and the reformulation of secondary education and professional training.

2.   OBJECTIVES

The general objective of promoting the use of computers in education in an integrated way was stated within the framework of the following premises:

- Computing was seen as a powerful instrument to favour and encourage positive changes in students' learning and in teaching methods and contents.
- The projects were to encourage the maximum participation possible by all those involved in the educational system.
- Computing was seen as a powerful and versatile instrument that offered a variety of possible approaches, each one of them with its specific advantages and contributions. The PIE addressed this variety, establishing priorities among the different ways of possible use, according to the amount of available hardware and circumstances of each specific project and surroundings.

So as to be able to carry out its work in a suitable way, the educational Administration assumed responsibility for the different aspects related to the introduction of computing in the educational system:

- Acquisition and distribution of materials (hardware and software).
- Teacher training and support.
- Curricular development activities with the help of Information Technology.
- Development and support of communication, information and documentation resources.

Each of these aspects gave rise to a number of actions which will be described and assessed hereunder.

3. ACQUISITION AND DISTRIBUTION OF MATERIALS

During the period under study, between 1986 and 1995, computers were distributed to a total of 1,250 state schools and 200 support centres or educational services, covering all secondary and vocational schools and 50% of state primary schools. From the start there was a commitment towards extensive action, which referred to a large number of schools. So the first action, from 1986-1989, already included all secondary education schools, with a total of 3,500 computers distributed among the 500 secondary education schools, and a smaller number of primary education schools, which was progressively increased in the following years, supplying all schools in Catalonia by 1996, which already lies beyond the time span of this paper.

The hardware supplied to schools was primarily standard market products. Particularly the standard PC was adopted (with the exception of a few Unix workstations for vocational training), due to the wide range of suppliers of existing hardware and software. The educational specificities appeared in the form of peripherals (concept keyboards for very young learners, Computer Assisted Experimentation sensors for assignments in scientific subjects, etc.) and other hardware accessories. The hardware that was distributed at all times included features of state-of-the-art technology, such as hard disk drives and colour monitors. We underline the fact that from 1988 all equipped schools had a modem at their disposal to access telecommunications services, and a separate connection for the computer hooked up to the local network. This was boosted in the 1990/1991 academic year with the installation of local area networks in vocational schools; or with multi-media computers in 1991.

The basic platform was the operating system MS-DOS and later MS Windows. Once consolidated, Windows has been used most widely in the Catalan educational system, and has only been countered with the maturing of free software, again not within the time-span of this survey.

It is worth underlining that there was, and continues to be, a widespread use of "professional" programmes not specifically intended for education: wordprocessors, databases, spreadsheets, artistic and technical drawing programmes, statistical packages, etc., in keeping with the paradigm of using the computer as an instrument of intellectual work. Thus, during the first years, the intensive use of the integrated package Framework was particularly relevant, This program was later replaced by Office, the integrated package from Microsoft. Together with the "professional" programmes, "educational" programmes were used with specific approaches and objectives. Initially the degree of use was low due to the fact that these

products were less available, and the difficulty of adapting products coming from other environments, but the degree of their use increased progressively. PIE lent support in the acquisition or production of such programmes. This then gave rise to locally produced products, such as the text editor for children Quadern, the related environment Electra; the open environment supporting activities CLIC; musical editor and interpreter MUSIC; Computer Assisted Experimentation environment; geographic work environment WINGEO; etc. On the other hand, products from external companies and entities were acquired and used, among which we should like to point out the geometric laboratory CABRI, the working environment WINLOGO, the electronic laboratory Electronics Workbench, and the set of educational applications associated with the touch-sensitive keyboard DIL. During the last years of that period there was a proliferation of multi-media programmes especially relevant in enriching teaching methods in a large variety of learning areas and styles.

Some of the developments of that time have left a consolidated seed, both as new products and in effective working methodologies: CLIC, developed by Francesc Busquets, has had a highly relevant success, with over 100,000 educational activities developed by teachers worldwide, which has led to a recent reprogramming that allows those educational activities to be accessed from the Internet.

Some locally produced programmes have been substituted or added to by professional programmes that covered the same area of activity: MUSIC, also developed by Francesc Busquets, has been substituted by Music Time; the EXAO locally produced programmes have been upgraded for use in high-schools science classrooms which include specialised peripherals and software, such as microscopes or consoles that control sets of specialised sensors.

LOGO enjoyed a considerable level of interest but its use was already dropping by mid-nineties. One possible cause is that the dramatic increase of learning opportunities provided by standard and educational software meant a decreasing emphasis on programming as a learning tool.

It is worth pointing out that almost all programmes, both professional and educational, are in Catalan language or have versions in it. In many cases specific translations and adaptations were made.

4.   TEACHER TRAINING AND SUPPORT

Right from the start it was thought that the effect on a large sector of teachers was an important requirement for the success of an educational integration policy in computing. Thus, the teacher training action was

especially intense. Throughout the analysed period, over 28,000 teachers did courses in different areas of educational computing. Most of the training consisted of modules averaging 30 to 60 hours in length that were attended throughout the Catalan territory by working teachers who combined training with their normal work, using an organizational model previously developed in the "Applied Computing Cycle" at the Polytechnical University of Catalonia.

A significant exception has to be pointed out: before setting up the PIE and for the first years of its existence, some "intensive" courses lasting one year were held. Those courses were attended by teachers who were released from their usual work for a whole academic year. This strategy resulted in a good number of teacher trainers, very well qualified in educational computing. They, in turn, where the leaders of the snowball process of teacher training.

Telematic in-service training of teachers began quite early, in 1989 (Ruiz, 90). From the beginning it became clear that such courses provide high levels of time-space flexibility, very much appreciated by teachers, although telecommunication facilities were somewhat fragile and costs were high.

The training methods used throughout this period have mostly been consolidated, giving rise to a wide offer of in-service training for teachers. Currently almost 25,000 teachers take part every year in training activities for teachers on information technologies and their educational uses. From the start, in conjunction with the training, there existed infrastructures lending support to teachers in their daily work in computing, giving rise both to the provision of training, information, and work materials as well as promoting communication among teachers so as to provide an exchange of experience and information.

The most relevant instruments to achieve this were the support services provided by external firms and the Up-dating Seminars on Information Technologies, known as SATI (Catalan acronym).

Service companies have been very important in providing on-going support, maintenance and professional advice. During the first stage these actions were centered on providing technical maintenance and support to hardware, as well as logic maintenance (audits, consultancy and assessment services) in complex issues such as local area network environments or Unix workstations. In recent years, the proliferation of computer hardware, its increased complexity, the new infrastructures of connectivity and access to the Internet have increased significantly the need of hardware maintenance and of external support. This has have become a vital condition for achieving success with information technology in the school.

The SATI have been – and continue to be – a key part in boosting the successful use of computing in schools. Set up during the first years of PIE,

they consist of decentralised meetings throughout the Catalan territory, which are held simultaneously 3 to 7 times per academic year. The Department of Education calls and co-ordinates these meetings, with the list of topics to be dealt with, and prepares the general information and materials to be handed out at the meetings, and also collects highly significant information and opinions with regard to running and assessing the global work project. The seminars in themselves are an important exchange of experiences among participating teachers, contributing to spreading and consolidating successful ways of educational integration of computing.

5.   CURRICULAR DEVELOPMENT ACTIVITIES

Curricular development activities through Information Technology are the end objective towards which the actions in this area converge. The real use of hardware and computer programmes was in the daily teaching work, with the objective of integrating these into educational practice.

As has already been mentioned, from the very start, the versatility of the computing instrument favoured a variety of possible uses in education, under different forms or models of action. From the outset, one of the most widespread models in schools in Catalonia was the idea of the computer as an instrument of intellectual work to be integrated into the normal learning work of pupils, to encourage the development of their capacities. The availability of the computing instrument, together with the professional programmes that go with it, very often enables the carrying out of projects or activities that would not be possible without it. Examples of concrete lines of development in this area of action were: work with standard office computer system tools (word processors, databases and spreadsheets, desktop publishing programmes), artistic and technical design and drawing, the use of computing in musical education, robotics, Computer Assisted Experimentation, the use of statistics packages, meteorology and collaborative work using telematics.

On the whole, the use of computing was intended to carry out tasks in different areas and contexts, in a similar way to which this occurs in different facets of society. It may be stressed that the studies were – and continue to be – more interdisciplinary and global in primary education than in secondary education, where the in-depth study in different specific areas or subjects becomes more important. The work carried out in vocational training warrants special mention. In a considerable number of schools this had specialised classrooms in different areas (office computer systems, industrial, hotel management, fashion and the clothing industry) consisting of a series of computers connected via a local network. Initially these used

Novell Netware operating system and later Microsoft environments, equipped with a series of relevant software for the area in question.

Another area of action of considerable importance was the setting up of "Computing Labs", made up of a series of multimedia computers connected via a network of Windows operating system. This lent support to work carried out in different curricular areas, with special attention to language learning, where the ease of having at one's disposal multimedia materials and access to communications are worth stressing. The provision of these laboratories has been fully consolidated, and these have now become "Multimedia Labs" without being linked to any specific area of use, since computing has proven to be valuable as an aid in all curricular areas.

In addition to the model and projects already mentioned, there co-existed a variety of alternative working methods. Thus, the teaching of computing as a specific subject of study was carried out in a large number of schools, often as a conceptual and reference framework that included the presentation of the areas of end-user application that are most widely consolidated today, but also that support a specific programming or developmental technology. Another noteworthy reference was that of the work with LOGO, in projects and activities encouraging the development of students' cognitive capacities, though the intensity of its use has diminished over the past few years. The use of educational programmes in specific areas also took place, especially favoured by the arrival of powerful and easy-to-use multimedia programmes, as well as the support given to areas of specific use. These included work in the school library, where the PERGAM programme is used, developed in PIE, or the more generic use of documentary databases as an instrument of conceptual collection and organization of information in diverse curricular areas.

6.   COMMUNICATION, INFORMATION AND DOCUMENTATION RESOURCES

The training, support and backing structures mentioned in the above sections were supplemented with the development of two major projects in the area of communication, information and documentation: The Catalan educational telecommunications network XTEC and the educational resources database SINERA.

Since the PIE began its operations telematics were a very important issue to foster and implement, so in 1988 the Catalan Educational Telecommunications Network was created (XTEC; Xarxa Telemàtica Educativa de Catalunya). During the first stage, XTEC was implemented according to videotex protocol, which at that time was the incipient

communication standard in Spain, following the model adopted in other countries, especially in France. The videotex was a limited yet effective system of communication and access to information, although its was clearly limited for other activities such as tele-debates or exchange of materials linked to collaborative work processes. To overcome those limitations some services were developed under a private full-duplex communication protocol that was not subject to the technical drawbacks of the videotex.

XTEC enabled carrying out a considerable number of collaborative working activities among schools according to different formats and strategies. Among these were the secondary school tele-debates in different curricular areas, such as language and literature, and ethics and social sciences. XTEC also allowed the development of international communication activities, with noteworthy contributions in foreign language learning, and gave support to the work of specific groups of people, such as the Pedagogical Resources Centres, the teachers and students of rural schools, or the groupwork activities carried out by teachers of primary education (Ruiz, 1992; Castells, 1993).

The XTEC network was integrated into the Internet in April 1995, and the Department of Education became a supplier of Internet services for Catalan schools. The adoption of Internet has meant a considerable increase in the use of XTEC as a powerful tool specific for the education sector, having considerable impact in almost every area of educational use of ICT. Many of the educational work models that have been mentioned in this article have been boosted and amplified by Internet, and it has made new ones possible as well. The capacity of the Internet to become a global "médiathèque" and its far-reaching communication facilities improved the working standards of XTEC from the start. The information resources and the community dimension of the XTEC and the face-to-face interaction provided by the web of seminars were crucial for teachers becoming acquainted with the materials available in many curricular areas (Vergés, 1994; Castells, 1995a; Castells, 1995b). The continuing success of XTEC as a solid educational reference enabled the creation in 2001 of a specific portal for students, edu365.com, but this lies clearly outside the time-span of this article.

The work done on document databases and specifically on the SINERA (System of Educational Information and Resources for Learning) database, was shown to be a key resource and a quality factor backing the task developed by the PIE in the early years of its operation. The SINERA database (Canet, 1994) was implemented according to the models of professional document databases - distinct of the more classical bibliographical approaches - and contained many thousands of references to educational resources, which were provided by a network of suppliers, both

teachers and specialists on educational materials. These were described in accordance with a design that stressed the educational value of every resource. This was achieved by giving each field of the database register a general meaning that was then implemented according to the specificity of the resource.

SINERA was initially implemented on the Mistral document database management system, and was accessible both in the videotex and full-duplex protocols of the XTEC. Later, with the coming-of-age of multimedia standards, it was distributed in CD-ROM, a media that offered greater information storage and distribution capacities. When in later years, with the appearance of Internet, there was an explosion in the magnitude of educational resources stored in digital format, it was no longer possible to continue the development of SINERA. Its methodology has nevertheless survived as the indexing method of the "médiathèques" of the Pedagogical Resources Centres of the Department of Education.

The availability of a truly efficient cataloguing and retrieving system for the educational resources available on the XTEC, including the edu365.com portal, is a pending issue. Even though the available searchers on the Internet (Yahoo, Google, etc) help to gain access to available resources, they were not specifically intended to address the needs of students who are looking for the resources to satisfy a learning need, quite often ill-defined. To fulfill this gap it is being considered to take up the experience of SINERA, coupling it with the new description standards and the technical possibilities that are offered by systems of advanced linguistic analysis, so a balanced model of indexing and retrieving of educational resources suited to the new situation can be put in place.

7. CONCLUSIONS

This article has mentioned a series of actions organised in a simultaneous and coherent fashion by the Educational Computing Programme of the Government of Catalonia in order to introduce computers and promote its educational use in the schools.

New learning opportunities and teaching models, new forms of classroom organization and school work brought about by momentous technological changes are continuously emerging and being explored. The appearance of the local area network fostered the use of computer laboratories, multimedia computers provided access to an entirely new brands of interactive educational contents, and the appearance of the Internet consolidated the social use of telecommunications and boosted the communication and collaboration aspects of learning and school work.

The existence of a coherent organizational and support model has proven to be a key factor for helping schools and teachers on the hard task of integrating information technology into education. The authors of this paper believe that such an integrated policy is still valid at the time of writing this article and that it will become even more critical in the near future, in which the gap between new cohorts of students living immersed in technology since their childhood and a school system that operates on industrial age paradigms will most probably widen (Ruiz, 2003).

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