Chapter 6

DESIGN AND DEVELOPMENT OF DIGITAL EDUCATIONAL CONTENT
Institutional proposals and actions

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Abstract: Digital educational content is a key element in the successful application of Information and Communications Technologies into the area of education. For years, the Spanish education authorities have been very active in both in the design and development of materials and the establishment of standards and specifications. In this chapter we present all these advances: the strategic plans and the operative actions, the main lines of the programs "Internet in the School" and "Internet in the Classroom" for the development of digital educational contents, and the standards application.

Key words: Education, Information and Communication Technologies, Digital Educational Content, Digital object, Standardisation, Metadata.

1. CONTEXT

In the last decade, European institutions have released a variety of documents and communications regarding Information and Communication Technologies (ICT) in the area of education, focussing on the need to promote the creation, diffusion and evaluation of quality multimedia materials.

   Almost all declarations and strategic plans have insisted on the need to exploit the potential of ICT in the development of pedagogical methodologies. This potential should lead to a learning environment based on autonomy, flexibility and the interrelation of different areas of knowledge. ICT can and must contribute decisively to the historic

opportunity for change in European educational models. For this purpose, it is necessary to encourage and promote the creation and development of digital educational content, offering quality educational materials while contributing to the development of an emerging industry which can compete on a global level.

It is imperative to reinforce all those initiatives that favour research and development in effective education and training models. While digital educational material is still in its early stages of development (similar to the beginnings of other media such as film, television or radio), it is fundamental to explore all avenues for the creation of these products and establish a standardised evaluation model permitting the identification and sharing of "best practices" in education.

In this new learning environment, it is necessary to have a variety of content and services which respond to the educational and training needs of the general public. From this perspective, quality, reliability, utility and "recognition" are the most valued characteristics. The establishment of quality criteria, effective systems of cataloguing and indexing permitting agile "knowledge management" and academic or professional "recognition" criteria for content and levels will all be necessary in order to guide education-training processes within the new European educational environment promised by ICT.

2.   STRATEGIC PLANS AND ACTIONS

The Spanish educational authorities have been active in the development of general action plans, recognising the importance of promoting the use of new technologies in education and the acquisition of skills to take maximum advantage of the opportunities offered by ICT languages and systems. This is a response to the strategy of the eEurope initiative (eLearning Action Plan) outlined during the European Council in Lisbon of March 2000.

Both the "Internet in School" plan (2002-2005) and the current "Internet in the Classroom" program (2005-2008) are based on an ambitious series of actions aimed at creating an educational environment where these resources, services and applications are implemented in a natural, integrated and efficient manner. These plans have been conceived to promote strategies that encourage the effective incorporation of digital resources.

In this scenario, the education community requires an agile and simple access to quality digital education materials which can be used and adapted to diverse teaching needs and circumstances. To meet this need, various initiatives are underway to promote the creation, diffusion and cataloguing of quality multimedia materials providing a wide range of digital content for all non-university education levels.

In addition to these broad programs, the various Spanish education administrations are carrying out a series of initiatives to promote research and develop in this area. These actions include a number of competitions for the development of educational materials, the establishment of multimedia content development programs under the auspices of the Ministry of Science and Education (MSE) and the Autonomous Communities (AC), as well as European projects such as the Minerva Program.

3.   INTERNET IN SCHOOL: ON-LINE EDUCATIONAL RESOURCES CNICE

The Spanish education authorities offer a wide range of digital educational content, including a significant collection of materials provided to the public by the National Centre for Educational Information and Communication (CNICE in Spanish) of the Ministry of Science and Education. Since the 1990's, and particularly since the year 2000, this Centre has been active in supporting education and training processes within the classroom (CNICE, 2006). With these actions, the CNICE is addressing the growing demand for content, with the progressive incorporation of tools, services and technological infrastructures from different sectors of society and applying them to distinct educational and training contexts.

The economic resources and strategies deployed for the "Internet in School" plan (2002-2005) have provided a significant incentive for innovation in methodological materials and the production of educational content. The role of teachers as the ultimate and optimum specialists in creating strategies for developing ambitious didactic materials is combined with the experience of professionals specialised in the production, programming and development of multimedia material. This will ensure the efficient application of resources and the latest languages to meet educational goals: the concepts 'interactivity' and 'multimedia' are therefore fully realised, providing greater effectiveness and value in their application and integration into educational and learning processes.

Initially organised, presented and published in an aggregate form – generally in blocks and thematic modules – around an area and educational level, these projects provide specific access and work areas for three basic profiles of potential users: students, teachers and families or the general public. The concept of the "eBook" has been surpassed, and the methodological models and production are experiencing constant and dynamic growth. This is in parallel to the increasing availability and flexibility in the creation, organisation, presentation and publication of software and content.

At the same time, the "Internet in School" plan represents an area for collaboration between distinct Spanish authorities bringing significant benefits. These benefits include the development of digital educational content, the optimisation of actions, methodological and productive innovation, an increase and greater diffusion of the existing materials and their adaptation to the distinct social and cultural contexts where they are applied.

4.   INTERNET IN SCHOOL: DIGITAL EDUCATIONAL CONTENT MSE-AC

The first fruit of the collaboration among Spanish education administrations, under the auspices of the "Internet in School" plan, is the ceding of materials developed by the CNICE to the Autonomous Communities for distribution, modification or translation into co-official languages according to local conditions and requirements. (Technical Committee for Information and Communication Technologies MSE-AC, 2003).

This provides a snapshot of the common and public availability of digital content for the non-university education in Spain. It illustrates the emphasis placed on materials for GCSE, A-level and Professional Training courses, and focussing on objectives for the immediate production of materials in Kindergarten, Primary Education, Foreign languages and other areas of a transversal nature such as Special Needs and Social Integration and Communication.

In order to produce new materials, a collaborative system with three areas has been established: decision making, administration/management and production. This last area is where the most interesting phenomena occur, with the start-up of 14 work groups, each consisting of members with different profiles (teachers, professionals and companies). The teams are organised into three areas (Content, Graphic and Audio-visual production and Technical Development) co-ordinated by an expert in education and ICT and collaborating on-line.

The resulting content reflects the notable development of strategies, languages, resources and production tools. These materials respond to the those needs which cannot be met by other classroom resources and take advantage of the possibilities of interactivity as well as the languages and expressive resources of multimedia. These have been specifically developed with close attention to diversity and accessibility to persons suffering from disabilities. Technologically, these applications are concerned with accessibility and are open, flexible, easily modified, adaptable and translatable. Structurally, the content is modular according to content and

learning objectives. Beyond its educational utility, this content also provides valuable experience in development avenues and strategies for a future that is becoming increasingly present.

5. DEVELOPMENT ACTIONS: CONTENT IN COLLABORATION WITH THE "INTERNET IN THE CLASSROOM" PLAN

The "Internet in the Classroom" plan (2005-2008) arose as a continuation of the "Internet in School" plan, as an expansion of established objectives to promote the creation, diffusion and use of digital educational content. Under the auspices of the Ministry of Science and Education, the Ministry of Industry, Tourism and Commerce and Red.es (the Public Business Entity), it proposes a wide range of actions to be carried out in collaboration with the Autonomous Communities.

The prior experience with the "Internet in School" plan created a forum for consultation between various education authorities and demonstrated the need to produce quality content which is useful, accessible, modular, inter-operable and reusable in order to optimise production (by and for all parties involved). The aim is to complement the general educational content currently available, share experiences, knowledge and solutions, provide an impulse to innovation, ensure the presence of experts in each area and generate a production system defined by professionalism and high technical standards.

Based on these principles, a development process was set up for digital educational content characterised by institutional collaboration, giving priority to the experience of the user. The learning model is based on Core Learning Goals, as part of a structure of eLearning Objectives, designed to meeting specific education targets. The development is based on standardised processes to ensure the content conforms to the characteristics mentioned above (inter-operability, accessibility, etc). The Learning Goals are defined through "Modular Hierarchy" where each module is self-contained and independent, meeting its own specific goals. This structure is divided into Intermediate, Intermediate Integrated, Learning Goals, Teaching Sequences, Training Programs and Educational Resources.

In this line, and with the experience gained from the "Internet in School" plan, various expert working groups have been created to focus on the development of Learning Objectives and Teaching Sequences, carrying out a needs analysis within each area of activity. For this purpose, collaborative working tools have been designed to ensure effective communication between experts and those responsible for the technical aspects of the content.

Areas and stages are defined annually for which digital educational content is created. The entire process is defined according to multi-annual actions based on the following priorities:

1.- Kindergarten Education
2.- Primary Education
3.- Special Needs
4.- Transversals:
4.1.- Environmental Education
4.2.- Health Education
4.2.- Civic Values Education
5.- Languages
6.- GCSE
7.- A-level

Once the needs analysis phase is complete, each team of experts proceeds in the creation of "Teaching Files" for established Teaching Sequences and Learning Objectives. Through these, pedagogical information is structured, establishing the principles for the development and production of multimedia materials.

Taking these files as a base, the Autonomous Communities and Red.es, with the coordination of the Ministry of Science and Education, will create content through a variety of formulae and in collaboration with different agents from the private and public sectors.

The legal framework for the development of this content is defined by Creative Commons licenses, which, under the premise of "distributed digital communication", have a "some rights reserved" structure of intellectual property rights.

The quality of this content will be optimum, given that the process is subject to continuous assessment by experts in each area as well as experts in new technologies from the different educational administrations.

When production is complete, accessibility assured, in accordance with applicable legislation, and with the collaboration with institutions related to disabled learners, the final product will be translated into the various co-official languages of Spain and standard international English.

Annually, and throughout the execution of the plan, the digital content will be stored using an 18-module digital platform distributed and made available in integrated packs according to Goals and Metadata. In this way, and through a system of data search and retrieval, the Education Community can access a wide spectrum of quality digital educational content which is accessible, modular, useable, recyclable and constantly expanding.

6. DEVELOPMENT ACTIONS: STANDARDS APPLICATION

In conjunction with these projects and linked to the actions mentioned above, various initiatives are being carried out for the development and application of standards for Learning Objectives. These actions are a response to those needs which may arise as objectives are achieved. These objectives are: multimedia, interactivity, accessibility, flexibility, modularity, adaptability, reusability, interoperability and portability.

In this way, a series of sequential projects for analysis, research and development are initiated:

- Firstly, the standardisation of management processes related to administration, search engines, visualisation and recovery of learning modules (*technical and didactic interoperability*)
- Secondly, the standardisation of management processes related to the combination, packaging and transfer of these modules (*technical and didactic portability)*

6.1 Standardisation by indexing of standard metadata

The work at this level, which is the most advanced at the moment, is being carried out by the Ministry of Science and Education, the Ministry of Industry, Tourism and Commerce (thorough Red.es) and the Autonomous Communities. The project falls within the area of the SC36-Educational Information Technologies program of the Spanish Agency for Standards and Certification (AENOR in Spanish). To date, it has been agreed that both the organisation and the classification of the educational objectives should comply with a structure of *Modular Hierarchy* (based on aggregate models). This means that aggregate modules define and organise the structure and function of learning goals based on three variables: *structure, function* and *curricular coverage*.

With the finalisation of the previous phases, a standardisation initiative adapted to the needs of the project has been selected: this is the *Learning Object Metadata (LOM) of the Learning Technology Standars Committee (LTSC-IEEE)*. From here, a consensus has been reached on the design and creation of specific application profiles (LOM-ES) which address and meet the needs of institutional programs and the target education community. The following is a description of the changes with regard to the original standard.

6.2 Profile description of application LOM-ES v.1.0

▪ Category 1. General: Element 1.4. Description: information is added related to the technical and expressive characteristics of intermediate and intermediate integrated objectives. Element 1.8. aggregation level: these are given a more specific definition without altering the original standard.

▪ Category 4. Technical: Element 4.4.1.2 Name: the vocabulary of names of operating systems and navigators is expanded.

▪ Category 5. Educational Use: Element 5.2. Type of Educational Resource. A new vocabulary is developed which incorporates level 1 aggregation typologies (intermediate and integrated intermediate) and levels 2-4 typologies from active learning methods. Element 5.5. Audience. New expanded vocabulary which groups its values according to the following variables: educational agent, management agent and group. Element 5.6. Context. New expanded vocabulary which groups its values according to the following variables: location, attendance and modality. Element 5.10. Description. Information is added related to the educational design of the ODE. Element 5.12. Cognitive Process. New element imported from the profile of the French application LOM-FR but with a new and expanded vocabulary which incorporates cognitive processes from active learning methods.

▪ Category 6. Rights: in Element 6.2. Intellectual property rights. New vocabulary expanded with open licenses from the GNU and Creative Commons initiatives. In Element 6.4. Access. New element providing information about existing access restrictions.

▪ Category 9. Classification: Purpose of classification "Education Level". New taxonomy source which includes the levels of the Spanish education community. Purpose of classification "Competence". New taxonomy source with classifies basic competencies within three factors: general-personal, academic and social-working in teams (LOE, 2005; CCE, 2005; CAI, 2001 and Birembaum, 1995). Purpose of classification "Accessibility". New taxonomy source which includes the classification corresponding to the objective with regards to accessibility criteria. Purpose of classification "Discipline". New taxonomy source based on the European thesaurus *European Treasury Browser (European schoolnet-ETB)* and the *LRE thesaurus (European Resource Exchange)*.

In conclusion, and in relation to this standardised level, it can be said that generally, the metadata associated with eLearning objectives allows greater efficiency in management processes and the administration of information and knowledge (design, production, cataloguing, publication, recovery, use,

transference, etc.). Furthermore, the knowledge of this information is closely related with performance, motivation and satisfaction of those who use and work with these types of educational materials (Alonso, 1999).

All of this reflects the importance the education authorities attach to standardisation processes for the development of digital educational content.

7. CONCLUSIONS

The realisation of the Knowledge based Society and the effective integration of Information and Communications Technologies in Education is based on multiple factors. Among these are the general consensus which exists about the need to have an ample catalogue of quality digital educational content available on-line.

Given the response to this need, for years the Spanish education authorities have been making a significant effort to expand the offer of this content. The "Internet in School" and "Internet in the Classroom" plans (Plan Avanza) are clear examples of the success of these efforts. Thanks to these plans, there is now a significant amount of eLearning modules at the disposal of the Education Community for all levels and areas of pre-university education with projects underway to expand this supply.

In parallel, aware of the importance of facilitating recovery systems for users, as well as guaranteeing aspects of interoperability or portability, actions have been taken oriented towards the adoption and adaptation to the context of Spanish education the international standards and specification which have proved most effective.

In the immediate future, the development of digital educational contents coordinated for different administrations, the putting at the disposal of a federated system of nodes, and the advances as for standardization are extraordinary challenges that chase the aim to promote the effective and habitual use of Information and Communication Technology in the classroom.

8. DOCUMENTARY SOURCES

Alonso, J. y López, G. (1999) Efectos motivacionales de las actividades docentes en función de las motivaciones de los alumnos. En *El aprendizaje estratégico.* (pp. 35-57). J.I. Pozo y C. Monereo (Eds.). Madrid: Santillana (Col. Aula XXI).

Birenbaum, M. (1995). *Alternatives in assessment of achievements, learning processes, and prior knowledge*. M. Birenbaum and F. Dochy (Eds.). Boston: Kluwer Academic Publishers.

CAI. Centro de Aprendizaje e Instrucción (2001). *Proyecto Educ@Sup* [online summary]. Universidad Autónoma de Madrid. Available at: http://www.uam.es/servicios/apoyodocencia/cai/lineasinves.htm [June 21, 2006].

CNICE. Centro Nacional de Información y Comunicación Educativa (2006). *Recursos educativos en línea* [on line]. Ministerio de Educación y Ciencia. Available at: http://www.cnice.mec.es/sobre_cnice/recursos_educativos_en_linea/ [June 21, 2006].

CCE. Comisión de las Comunidades Europeas (2005, 10 de noviembre). Recomendación parlamento europeo y consejo sobre competencias generales para el aprendizaje permanente. *EUR-Lex* [online], Brussels. 10.11.2005. COM(2005)548 final. 2005/0221(COD). Available at: http://eur-ex.europa.eu/LexUriServ/LexUriServ.do?uri= CELEX:52005PC0548:ES:HTML [June 21, 2006].

Comité Técnico de Tecnologías de la Información y la Comunicación MEC-CCAA (2003). *Documento marco para el diseño y elaboración de Recursos Educativos Multimedia MEC-CCAA.*. Unpublished working document.

European Treasury Browser (European schoolnet-ETB), [online]. Brussels. European Commission. Available at: http://www.eun.org/eun.org2/eun/en/etb/sub_area.cfm?sa=440 [June 21, 2006].

LOE. Proyecto Ley Orgánica de Educación (December 26, 2005). In *Boletín Oficial de las Cortes Generales* (BOCG Nº 43-13) [online]. Available at: http://www.mec.es/mecd/ gabipren/documentos/loe_congreso.pdf [June 21, 2006].

LRE thesaurus (European Resource Exchange), [online data base]. Brussels. DG Enterprise (European Commission) and CEN/ISSS Workshop on Learning Technologies. Available at: http://cenisss.eun.org/kms/sites/cenisss/index.cfm [June 21, 2006].