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By Jordi FONT-AGUSTI

Abstract.

In 1984 Spain started the experimentation that culminated in 1990 in the law of new educational system. One of the main characteristics of the new system, together with the creation of compulsory secondary education (12-16), is the introduction of Technology as a compulsory subject in secondary schools. The autonomous region of Catalonia issued and implemented its own curriculum. This paper describes the experience of designing the curriculum, developing suitable workshops, providing equipment and, globally, changing mentality of the teachers, parents and society in general on this new subject. Achievements, lacks and future challenges are discussed.

Key words.

Technology, Catalonia, compulsory, implementation, experience, mentality

The experience of implementing Technology as a compulsory subject: the case of Catalonia (Spain).

Background.

Catalonia is an autonomous region, situated in the north-east of Spain, with 6 million people, an economy based on industry, trade and tourism, and a high level of political autonomy. Catalonia is a bilingual society, talking Catalan and Spanish. Concerning to the educational system, Catalanian has full educational competencies from 1979.

In 1990 a act of the Spanish Parliament started a reform of the educational system, and by the year 2000, this reform is almost completed. One of the most important characteristics of the new system, together with the creation of a compulsory secondary education for pupils 12-16 years old, is the implementation of Technology as a compulsory subject for all these pupils. Before this regulation, compulsory education stopped at children’s ages of 14; after that there was further education for high achievers and a compulsory vocation education for pupils without the school certificate or not incorporated to further education.

Now, education is compulsory in Spain from age 6 to age 16, and pupils from age 12 to age 16 attend compulsory secondary education. After that they can choose between vocation education (EU level II) and further education (Batxillerat). The Batxillerat is divided in four modalities (science, humanities, technology and artistic). After Batxillerat, pupils can choose between further vocational education (EU level III) and university.

1 In this paper Technology with capital letter will indicate the subject.
Technology is not taught in primary school, it is a compulsory subject in secondary schools and one of the main subjects in the technological modality of Batxillerat.

Because the political autonomy, the curriculum for all subjects has been designed by the Catalonia administration in the frame of a general education law that establishes the common curriculum (55%) for a whole Spain.

**Precedents relating technology with general education.**

In the 70’s, teachers from different levels and subjects realised that pupils need technology, not only to make appropriated choices for their future, to understand their culture and their environment, but also to make a positive contribution as adults in a technological society.

In primary schools from most social and economical depressed neighbourhoods, workshops were implemented to provide compensatory education. Some teachers realised that technology was useful for all pupils not just for boys and girls with behaviour problems. The workshops were extended and by the year 1990 near by 20% of Catalan primary schools had workshops or technology subjects.\(^2\)

At the same time, secondary schools that delivered the old Batxillerat, taught a subject called Technical and Professional Activities (EATP in Spanish). This subject had two aims; to provide the pupils with practical activities that give them applications of the theoretical subjects (physic, chemistry, etc), and help them to find their way to vocational studies or professional life. Despite this regulation, only a 30% of the EATP were really related with science-technology, mainly information technology, electronics, technical drawing and laboratory skills\(^3\).

Meanwhile, in vocation education schools, before the new system, pupils had to choice between different jobs at 14. Some teachers realised that it was too early to make a suitable choose and some schools (aprox. 15%, mainly in the metropolitan area of Barcelona) started to delivered the so-called “rotational workshops”, some times without the agreement of the education authorities. The “rotational workshops” had two main aims: first, to advise the pupils on their choice delivering one term of mechanics, one term of electricity and one term of business studies; second, to provide a technology experience as a culture.

These developments provided in some schools a good basis for implementation of Technology as a compulsory subject.

**Designing the curriculum.**

The need to include technology as a compulsory subject in secondary school as a way to give to the future citizens the knowledge they will need for understand their society and

\(^2\) Source: *Memòria del Departament d’Ensenyament 1990*

\(^3\) Inspectorate report 1990
interact with it, become evident from the very first talks held by the Spanish Education Ministry with different social agents in order to start a process of reform of educational system.

A team was formed with the purpose of writing the curriculum for general technology, in application of a 1984 law. This ordered to experiment the new system in a few schools in order to provide the basis for the final 1990 general act of reform of education. With the intention of exploiting the described experiences, the team was formed with teachers and inspectors from primary, secondary and vocation education schools. The team worked in a pedagogical framework provided by the university of Barcelona.

The writing team studied with special attention the French curriculum and the English-Welsh national curriculum. These countries were selected because they had recognised experience delivering Technology as a cultural subject (mainly England-Wales) and cultural proximity. The first conclusion from these studies was the conviction that Technology not only must be a core subject, but also it is destined to become one of the main core strands of future European curriculums.

The main discussions during the process of designing the curriculum had the following topics:

- How many and what technologies must be present? The team gradually changed from a conception of new subject as an addition of classical technologies to a general concept of technology as a mean to satisfy human needs. Consequently, the technologies that are relevant in Catalan economy (mechanics, electricity, textile, food and materials) were chosen.

- What is the suitable methodology for Technology? This question divided the team: the supporters of the English-Wales point of view that the technological process is the natural methodology for teaching Technology, and the supporters of the idea that this new subject was able to admit different methodologies (analysis of technical objects, problem solving, technological process…). Finally, the non-compulsory part of the text of the curriculum said that the subject admits an ample range of methodologies but must also include the technological process.

- What is the best way to deliver the contents of the curriculum? The same team wrote two examples of how teachers’ teams could deliver the contents. The result was eight didactical modules. Some centred in technological context (home, industrial organisation), some centred in classical technologies (mechanic, electricity), and some centred in procedures (technical languages, technological process).

The provisional curriculum was piloted in 85 secondary schools from 1985 to 1993. During the piloting, the schools were visited by teams of inspectors in order to evaluate the curriculum, the equipment and the instructions provided for the “reform programme”. The final report of the inspectorate, together with the report of the Reform Evaluation Council, was taken in consideration for the writers of the final Technology
The final product of the Catalan Technology curriculum\textsuperscript{4} for compulsory secondary education has the following characteristics:

- Technology is taken in the general sense of the word, including not only their technical or material aspects, but also environmental, economic, social and ethical ones.

- The implementation of the curriculum requires a new classroom with specific equipment.

- Pupils must work in real context and must be involved in making final products that solve real problems and needs.

- The subject has an important contribution to basic professional education\textsuperscript{5}.

- The new subject needs new teachers’ profile

**Creating suitable classrooms and workshops.**

This aspect of the implementation of Technology was more than just a provision of equipment and materials. In order to inculcate the idea that Technology was a new subject different from science or vocation education, schools were provided with a new classroom and new equipment. The subliminal message was that a subject different from science and vocation education needs a different room and equipment because its aims were also different.

The Spanish education administration and the main enterprises of didactical material made proposals on the basis that the new classroom needed equipment characterised for:

- to be polyvalent
- to enable to work with a ample range of materials,
- be able to be used in different technological contexts,
- give to the pupils the possibility of make their own realisations,
- to be safe

i.e. “meccano”, electrical components

i.e. general tools, general measure instruments

i.e. transportable electronic data capture of noise, pH, speed, pressure…

i.e. plastics vacuum machine,

When it was necessary, vocation education schools were advised on how to transform professional and specialised workshops into classrooms for general technology. In the opposite way, the further education schools with an academic background were advised

\textsuperscript{4} Act of Autonomic Government issued in 1992

\textsuperscript{5} The 1991 law on common Spanish curriculum enacts that all subjects have to contribute to educate the basic and common skill for the future professional activities,
on how to design a classroom suitable not only for “laboratory related technologies” (i.e. food technology), but mechanics and electricity too.

However, because of political changes, the supply of new equipment to government schools suffered some cuts in funding and the opening of the Technology resources centre was significantly delayed.

**Retraining teachers**

This was one of the most difficult aspects of the implementation, mainly because a large range of teacher with different specialist backgrounds joined the new subject and each one of them had their own background, and their own point of view on the new subject. It was necessary to explain to vocation education teachers that their new mission was not to obtain good mechanics or electricians, but to provide all pupils with the knowledge on mechanic and electricity they need to understand the world and their role in contributing to it. It was necessary to explain to former science teacher that technology is not an application of science and, in consequence, that the new subject had its own aims other than to become science experiments or applications.

This change of teachers’ mentality was the aim of the in-service training. During the period 1993-1995, a 65% of teachers, mainly from vocation education and science, that were reconverted to Technology received training on the new curriculum, on the way to work with new equipment of workshop, contents of different technologies and history of technology. The lack of a really full academic course to use in this retraining of the teachers (as France did in similar circumstances), the policy on teacher reconvertion and the lack of external examinations for compulsory schools are the prime reasons why in some schools Technology is not yet achieving its aims.

The incorporation of new teachers in the system recruited just for Technology and new initials and in-service training courses is consolidating good practice and helping the improvement of average quality in teaching of Technology. Moreover, the engagement of Catalan teacher in European projects concerning Technology (mainly Comenius program) is giving a international dimension to this subject and enforces the idea that Technology will become a common European background for our pupils. Finally, the recent constitution of a Technology teachers association indicates that a really new professional profile is growing in our system.

Inspectors needed to change too. A voluntary team of inspectors, mainly from vocation education inspectorate, created a working group in order to decree the aims and the way of inspecting technology as a compulsory subject. Some of them were trained in Great Britain and in France.

**Changing the mind-set of parents and society.**

This is a crucial target in order to consolidate Technology as a core subject.

Good practice in schools has the immediate acknowledgement of parents because:

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6 Source: Departament d’Ensenyament, Subdirecció General de Formació Permanent
7 Source: inspectorate report on first year of application of new curriculum, 1999.
- their sons and daughters might become engaged with other subjects through Technology
- the subject helps them to define their interests and future choices.
- the level of satisfaction amongst pupils taking technology is high.

Too much bad practice might relegate Technology to subjects considered second order ones or of minority importance.

Publishers have made an important investment to gain advantage in this emergent new commercial area. A wide range of classroom textbooks and complementary support material is now offered to teachers. Once more, British books have become the models. Quality is irregular and in the near future we will see how this market will select the best type.

One of the targets of Technology is to become useful for great enterprises, universities, non-governmental organisations and institutions in terms of technological culture, job orientation and enhance good citizenship. Currently, some railways and electricity companies have started publishing booklets and opening exhibitions in order to help Technology teachers. The Polytechnic University of Catalonia has a programme, which aim is to eradicate gender differences in technology and an award competition for good technological projects completed by pupils.

Conclusions.

The essential need to implementing technology as a cultural and compulsory subject in the new Spanish compulsory secondary education was absolutely clear from the first moment of designing of reform.

The Spanish and Catalan curriculum used the word technology in their general sense, including their relationship with science and society.

The new subject appears with its own right, its own equipment and its own core methodology.

To change the mentality of teachers, parents and society will be a long journey. In- service Training and the collaboration of enterprises, university and institutions is needed to achieve the social targets of this subject.

Technology requires appropriate funding and education authorities have to face the adequate budget in order to ensure that Technology achieve its aims.

Technology might provide a common background to the citizens of the near future European Union.

\[8\] Source: \textit{id}.
Biographical note of the author.

Jordi Font-Agustí is an inspector of education, mainly for Technology in secondary school, working for Catalonian autonomic education administration. He co-ordinates the team of Technology inspectors.

He collaborated with the working group that designed the Catalan Technology curriculum.

He collaborates with the Polytechnic University of Catalonia training Technology teachers.

He has published books in Catalan and Spanish on teaching Technology in secondary school and some articles on the same subject.

As a writer of fiction, he has published five novels in Catalan and Spanish, some of them with a technological subject.