DECODE

QUALITY FRAMEWORK FOR INTEGRATING ICT IN THE TEACHING-LEARNING PROCESS

Innovative training models, methods and tools for teachers in the digital age

National report - Spain

Authors:
UOC

Erasmus+

DECODE: 2016-1-IT02-KA201-024234
Co-funded by the Erasmus+ Programme of the European Union

DECODE

Co-funded by the Erasmus+ Programme of the European Union

TABLE OF CONTENTS

1. Introduction

In order to provide recommendations for the integration of ICT in schools, this national report aims to identify the most relevant factors and elements of national and local contexts that condition the integration of ICT in the school practices.

This National Report will include an explorations of national education policy in terms of digital challenges, analyzing through a qualitative approach based on document analysis through a qualitative approach based on document analysis and in depth interview to key actors.

In this national report will be presented the relevant key elements identified through the document analysis and the in-depth interviews, including specific examples and recommendations identified in the interviews.

This national report will take into account the Spanish context, although due to its proximity much of the interest of this report will be focused in the autonomous community of Catalonia.

This national report will be structured in ten sections:

- Opportunities and constraints at national level regarding the ICT-based education
- Further opportunities for integrating ICT in the Curriculum
- ICT in the Curriculum
- How ICT is integrated in the educational practices
- Exemplification of uses of relevant resources
- Recommendations for effective integration of ICT in the teaching and learning
- Teacher training for ICT
- Official quality assurance and evaluation tools and procedures at national level
- Conclusions
- Annexes

The different national reports of the partners of DECODE will led to a practical guide for schools: Quality Framework for Integrating ICT in the Teaching-Learning Process a Guideline to provide Educational Institutions a framework for quality assurance based on existing recommendations in the partner countries.

2. Opportunities and constraints at national level regarding the ICT-based education

In European policy and strategy papers, media literacy, and particularly digital literacy, is considered fundamental for the economic growth and democratic development of the region. In 2007, the European Commission issued an official communication to the entitled *e-skills for the 21st Century: Fostering Competitiveness, Growth and jobs* (European Commission, 2007) where it expressed an urgent need of competent and qualified professionals for answering the needs of European industry and competitiveness. That movement towards an European frame for the promotion of digital competence continuously intensified. The Commission's Joint Research Centre (JCR) started to research on Learning and Skills for the Digital Era in 2005. The Centre's scientific work culminated in the European Digital Competence Framework for Citizens (DigComp), first published in 2013 and updated this year. The Framework offered tools for improving citizen's digital competence, having become a reference for the development and strategic planning of digital competence initiatives both at European and Member State level (European Commission, 2017).

Nevertheless, these technologies may also be associated with behavior patterns that are detrimental to users. According to a report of the EU NET ADB Consortium that surveyed teenagers in seven countries, Spain has the highest level of DIB (Dysfunctional Internet Behaviour) among this population (Tsitsika, Tzavela & Mavromati, 2013). The prevalence of DIB in Spain, Romania and Greece may be the result of culture and tolerance of certain behaviors, but

> It may, however, also mean that the prevention policy in these countries is either insufficient or ineffective and should therefore be more carefully planned and applied
>
> Flora, 2015, p. 131

In this section, we will identify the official provisions, governance practices and policy innovation at the Spanish national level and the Catalan regional level, with an emphasis on the latter.

At a general level in the Spanish context, the inclusion of educational policies for the integration of ICT into the education system has been progressive. Until the LOGSE law of 1990 there was no reference to ICTs in the articles of the different educational laws. The LOGSE included some references to training in the field of audiovisual language and the training of students to analyse critically the messages through the different media, within the framework of what was called "new technologies", but there was no proper curriculum for this subject. Thus, the forms of literacy associated with media and ICTs was not a core element of the educational trajectory, but relegated to two optional subjects (Process Communication and Communication Studies) that appeared and disappeared from the school curriculum (Bernal & Lobera, 2015). LOE (2006) provided to the concept ICT its own identity from early childhood education through the end of the education period.

a) A functional analysis of the current legal framework (coherence and relevance)

Educational Laws

Spanish Education Law

At a general level in the **Spanish context**, the current educational law is LOMCE: *Ley orgánica para la mejora de la calidad educativa* (Organic Law for the Improvement of Educational Quality 8/2013, of December 9), was approved in 2013. LOMCE seeks to place ICTs as a core component of the curriculum and to address them in concrete ways. In the legal text, ICTs are considered one of the most fruitful vectors for the overall goal of the law: the transformation of the education system. The subject ***Tecnologías de la Información y la Comunicación*** (Information and Communication Technologies) was included as one of the specific optional subjects offered in compulsory secondary education curricula (ESO). This subject is also present at the Secondary level, when students may continue their training and develop in terms of contents and skills, or enroll in the subject for the first time.

According to the tenth point of the law's preamble: "It is necessary to highlight three areas on which LOMCE makes a special impact in order to transform the education system: **Information and Communication Technologies**, the promotion of multilingualism and the modernization of vocational training". LOMCE's prioritization of ICTs as the first factor for transformation is extremely relevant since, for the first time, there's the recognition of the importance of those technologies as necessary for contemporary social life and as overarching elements of the educational system.

The eleventh point of the preamble is dedicated exclusively to ICT and the process of digitization of education:

> Technology has historically shaped education and continues to shape it. (...) The widespread incorporation of Information and Communication Technologies (ICTs) into the education system, which will take into account the principles of design for all people and universal accessibility, will allow the customisation of education and adapt it to the needs and pace of each stu
>
> dent. (...) The Information and Communication Technologies will be a fundamental piece to produce the methodological change that leads to achieve the objective of improving the quality of education. Likewise, the responsible and orderly use of these new technologies by the students must be present throughout the educational system (…).**Information and Communication Technologies** will also be a key tool in the training of teachers and in the learning of citizens throughout life, by allowing them to combine training with personal or work obligations and, the management of the processes. (...) Having valued previous experiences, it is imperative that the digitization model of the chosen school is economically sustainable and that it focuses on the creation of a national digital ecosystem that allows the normal development of the options of each educational administration.

With LOMCE, the application of ICTs in pedagogy seeks to go beyond devices in the classroom and aims at improving the quality of education through change in teaching methodology. However, the broader articulation of ICTs with education and teacher training, issues related to citizenship, and the sustainable digitization of schools have not been jointly addressed in practical interventions. That lack

of unified approaches means that the policies related to integrate ICTs in education and methodological change are mostly limited to legislation and not practical initiatives.

The law has been the target of protests by students and teachers. According to the El País (Álvarez, 2017) newspaper, the 24th strike since 2012 (and the third in which families joined teachers and students) took place in 2017. The law's approach to ICTs has also been the target of criticism from teachers as well. In an article, a teacher from a IES in Teruel (Soria, 2014) claims the law contains rhetoric that devalues teachers' work and skills, along with grandiloquent promises about the fundamental role of ICTs without ever explicitly articulating it in concrete ways. While there seems to be a move to promote online and commercial teacher training actions, he continues, the knowledge and experience of previous work done by voluntary teacher training networks is being neglected.

Catalan education Law

Due to the research team's geographical location and familiarity with the Catalan context, this report is focused on the educational reality of the region. The **Llei d'Educació de Catalunya** (LEC, in english: Education Law of Catalonia) is an autonomous law approved by the Parliament of Catalonia in 2009 and published in the DOGC on the 10th of July of that same year. Catalonia has been historically a site of pedagogical innovation, putting the regional legislators ahead of the national ones in terms of fostering digital skills.

In LEC, ICT are addressed explicitly, and are considered (Article 52) as a main objective "*to train students for the critical analysis of the media and the use of **new technologies***", in addition to considering that curricula "*should be oriented towards the acquisition of basic skills, which should contribute to the personal development of students and to the practice of active citizenship, and must incorporate information and communication technologies in the learning processes*". Thus, a critical perspective on ICTs usage and its connection to citizenship is already included in the law of 2009.

ICT are cited in the different levels of education. The aim of the **primary education** and the **compulsory secondary education** stage is (Article 58 and 59) "*to provide all students with an education which, in accordance with the basic competences established in the curriculum, allows them (...) the necessary skills for the use of new technologies and audiovisual communication*".

According the article 61 "*the curriculum and the educational activities of **baccalaureate**, in order to consolidate the basic competences acquired by students at the end of basic education (article 61), should favour the development of (...) the use of information and communication technologies, besides the acquisition of the own and specific competences of the modality taken*".

Regarding adult education (article 69), "*adult education programs and related training actions should include at least the following areas (...) c) **introduction to information and communication technologies** and the training in the use of strategies for the acquisition of the basic competences*".

Another important feature of this law is that, as mentioned, ICTs are integrated throughout the learner's formative and biographical trajectories: from primary schooling to adult education.

In specifying **pedagogical innovation projects** (article 84), the Department is oriented to "*favor initiatives for the development of pedagogical and curricular innovation projects with the objective of (...) particularly encouraging research and innovation projects in relation to the use of information and communication technologies for learning and knowledge and in relation to the training of students in multilingualism*". While multilingualism is also mentioned at the national Spanish level, the Catalan law

is focused on pedagogical innovation. Therefore, the law already implies the development and deployment of teaching innovation programs.

It can be found several references to the **role of teachers in ICTs**. Concretely, in the article 104 on **teaching function** it is indicated that "*the teachers and professors have, among others, the functions of (...) using information and communication technologies, which they must know and master as a methodological tool*". Also, with respect to teacher training in the text, it is specified that "i*nitial teacher training should include (...) mastery of information and communication technologies*". In the legal text's framing of ICTs in teaching, technologies themselves are not considered the primary vector of intervention but become subordinated to the roles of the teacher and pedagogical methodology.

According to article 168 "*the Government and the universities of Catalonia must establish collaborative relationships to enhance the excellence of the education system*" incorporating, among other aspects, ICTs.

b) An assessment of the available national resources (funding/ support mechanisms)

Governmental support plays a central role in fostering ICT usage in schools at national level. In turn, the ideologies that guide political parties and their policies dispute the role of the state in education. When the Popular Party was elected in 2012, the national program (*Escuela 2.0*) was discontinued and presently there is no defined and generic program across the territories of Spain.

The Program Escuela 2.0 (Spain)

The *Programa Escuela 2.0* (School 2.0 Program), which took place between 2009 and 2012, was an initiative included in the so-called E-Plan, aimed at reactivating the Spanish economy, with a **budget of 200 million euros** financed between the central government and the Autonomous Communities (Alonso, 2012).

The School 2.0 Program in Spain sought to keep up with a globalized educational context which, in the middle of the first decade of the 21st century, began be the target of policies aimed at incorporating technology in the classroom. These policies began to shape what became known as the "1 x 1 model", that is to say one computer per child.

The objectives of the program were:

1. The acquisition of skills and competences based on ICT by young generations;
2. Reducing the digital divide between individuals and social groups;
3. Improve students' educational practices and academic achievement.

The **autonomous communities** that participated in the program were Andalusia, Aragon, Asturias, Cantabria, Castilla-Leon, Castilla-La Mancha, Catalonia, Galicia, Extremadura, Balearic Islands, Canary Islands, La Rioja, Navarra, Murcia and the Basque Country. The autonomous communities that didn't want to adopt this policy were Madrid and Valencia.

The School 2.0 Program was intended, in principle, to students in 5th and 6th grade Primary Education, although in Catalonia and Extremadura it focused on the first courses of Compulsory Secondary Education (ESO).

Some of the **results** of the School 2.0 Program program have been (Alonso, 2012):

1. About 650,000 students in the third cycle of Primary Education and the first cycle of ESO have a laptop as a learning tool.
2. 30,000 digital classrooms have been put into operation.
3. More than 160,000 teachers have participated in ICT-related training activities.
4. Significant boost has been given to the production and use of digital educational content by both educational administrations and the publishing industry.

At the autonomic level, this program was linked to the following projects in the following autonomous communities, and in general lines, the programs coincided with the objectives of the School 2.0 Program (Area *et al*, 2014): Educastur (Asturias), Escuela TIC2.0 (Andalusia), Clic-Escuela 2.0 (Canary Islands), Educat 2.0 (Catalonia, which will be analysed in a subsequent section) and Eskola 2.0 (Basque Country).

The Program Escuela 2.0 fell victim to something our interlocutors claimed to be one of the threats to the modernization of education and it's relation to ICTs: the dependence of the continuation of educational programs on the electoral reconfiguration of the parliamentary arch. In April 2012, the *Secretaría de Estado de Educación, Formación Profesional y Universidades* (State Secretariat for Education, Vocational Training and Universities) of the Ministry of Education, Culture and Sport published the budget cuts for the Spanish education system. It was then when, among the various educational policies, **the extinction of the so-called School 2.0 Program was announced**. Currently, there is no successor to the Program Escuela 2.0 that sustained a coordinated effort for the integration of ICTs in the Spanish school system, expanding across the country's Autonomous Regions. That extinction was accompanied by a reduction of financial aid for traditional didactic material and school center connectivity, and the promotion of private digital platforms; (Area et al., 2014).

The Program Educat 1x1 and 2.0 (Catalonia)

The EduCAT1x1 project (2009-2011) can be considered as Catalonia's own specific actual adaptation of the Program Escuela 2.0 (Government of de Catalonia, 2010), mentioned before. The initiative focused its first actions in secondary schools (1st and 2nd grade of ESO) and later in primary education (5th and 6th grade). There were no enrollment conditions for educational centers in the EduCat1x1 project (Alonso, 2012). The Educat 2.0 project was the continuation of the Educat 1x1 program, with an investment of 42 million euros (Departament de Ensenyament, 2011). Unlike the Educat1x1 project, there were assessment criteria for the centers to integrate Educat2.0.

Within the framework of these projects, the Catalan educational administration proposed four main lines of educational update (Alonso et al, 2012):

1. **Digitize the classrooms**. This effort was focused generally in the first courses of Secondary education and punctually in some Primary centers. A laptop was provided for the students and teachers participating in the project, the classrooms were equipped with projectors and interactive whiteboards, and the electrical installation of the centers was adapted.

2. **Ensure the connectivity of all secondary schools**. The classrooms of the schools were provided with connectivity to the network.

3. **Promote access to textbooks and other digital content**. The creation of the educational portal ATRIA was promoted: a platform that made it possible for teachers, students and families to access textbooks and other educational content in digital format.

4. **Provide training and advice to teachers**. ICT-related courses were offered and a TAC (Learning and Knowledge Technologies, LKT in english) consultant was assigned to the visit the responsible department at each center on a regular basis.

The STEMcat Plan (Catalonia)

The STEMcat (a portmanteau which contains the English acronym for Science, Technology, Engineering and Mathematics) Plan is part of the broader SmartCAT strategy of the Government of Catalonia, which is aligned with the Europe 2020 strategy of the European Commission. The Plan seeks to foster vocational education in STEM related fields, putting an emphasis on girls, and to train teachers. Announced in early 2017, its implementation began in the 2017-2018 school year. The main drive of the Plan is to integrate STEM subjects in compulsory stages of schooling.

The Plan identifies 4 main collectives. It seeks to aid **teachers** improve the teaching of STEM subjects; adapt STEM subjects to make them stimulating for **students** and prejudices; promote STEM through fostering the collaboration of **companies** with the educational system; promote STEM in **society** and fight gender stereotypes. The measures laid out in the Plan's text are:

1. Improve teacher training in STEM, both initial and continuous;

2. Foster student engagement through the update of the curricula associated with STEM subjects and skills, change evaluation, vocational guidance and connect student with research facilities;

3. Involvement of companies through mentor networks and participation of professionals;

4. Activities for increasing the social visibility of STEM fields.

The Spanish state's INTEF is also starting to promote ChicaSTEM, a similar program of initiatives aimed at diminishing the gender gap in STEM fields.

c) An analysis of the organisational structure (i.e. specific roles and responsibilities monitoring, assessment, planning, implementation) of actors at all levels

ICT Coordinators in the spanish Context

During the last years, the role of the ICT coordinator has been involved in the implementation of digital technologies and promoting their correct use within educations centers in Spain. In the different autonomous communities, the role of the coordinator is considered differently.

In the region of Madrid, for example, the ICT coordinator's role is promoting and coordinating the actions related to the curricular use of ICT in centers. In order to be a ICT coordinator, candidate teachers' experience in the development of didactic activities with the Information and Communication

Technologies, as well as their training and knowledge in this respect are assessed. A basic guide for ICT Coordinators can be found online .

Other examples are the region of Andalusia, where the ICT coordinator assumes the role of technical adviser, organiser of training activities for students and teachers (Boza, 2011) and the Canary Islands, where ICT coordinators support and advice their colleagues involved in the process of educational innovation with ICT. In the latter setting, that role materializes in tasks such as: providing information about what to do, how to do it, when to do it; initial teacher training; implementation practice in the classroom; emotional support, encouraging involvement and autonomy, minimizing resistance and fears; and streamline internal coordination meetings at the center level (Hernández Abenza and Hernández Torres, 2011).

The TAC Plan, an instrument for introducing ICT in the educational centers of Catalonia

The decree that restructured the Catalan department of education approved in 2007 prompted a change in the way ICTs were conceived (Alonso *et al*., 2010a). The *Servei de Tecnologies per l'Aprenentatge i el Coneixement* (STAC, which in English stants for Service for Learning and Knowledge Technologies) was created, which brought the technical and pedagogical aspects related to ICT to the same level. It was structured in four subareas: digital inclusion, collaborative projects on the internet, digital resources and programs, and standards and pedagogical innovation. According with the same document, the educational policies of the Department of Education began to reflect the new LKT policy, promoting more cooperative educational environments that give students and teachers a more active role.

The TAC Plan (*Pla de Tecnologies per l'Aprenentatge i Coneixement*) is a plan from the Catalan administration that took place between 2011 and 2014. The ultimate objective of the Plan is offering an integrated vision of the technologies in educational centers and to promote the development of digital competences among students. The TAC Plan was intended to facilitate the integration of ICT in Primary and Secondary Schools. While the TAC plan was not mandatory, it became increasingly widespread. The Plan ended in 2014 but it is still currently implemented in schools.

The central axis of the TAC Plan was the adoption of ICT in the school at the service of learning and knowledge, guiding the acquisition of digital competence in a broad sense and in the acquisition of knowledge. It seeks to incorporate technologies in the school in order to facilitate students autonomous and personalized learning, requiring different teaching roles.

The full integration of ICT in an educational institution can be approached as a process of managing innovation and change, affecting all the staff members and some practical aspects: **pedagogical**, **formative**, **organizational** and **technological**. The Center TAC Plan (figure 1) is the document that includes all this process and serves as a guide for its implementation:

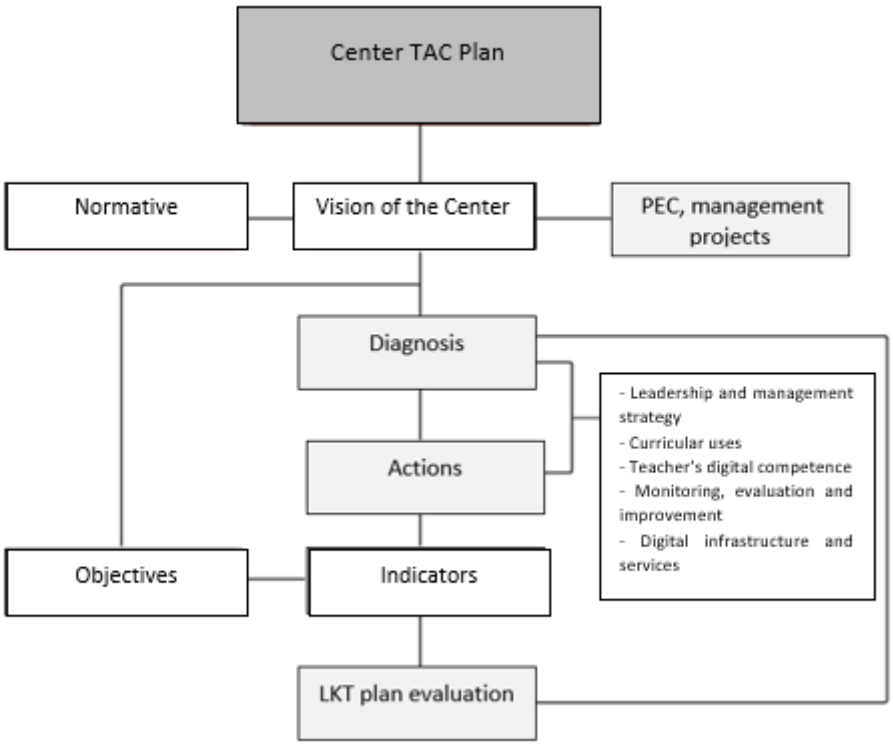


Figure 1: Center TAC Plan

In the TAC plan, decision-making is carried out based on **shared responsibility** in different areas: management team, pedagogical coordination, TAC coordination or TAC commission, department heads in the case of secondary education, school council or AMPA (in English: Association of Students' Mothers and Parents). The conception and application of the TAC Plan was intended to involve the whole educational community, relying on a management team to propel and lead the whole process (Fornell and Vivancos, 2010). Thus, although the TAC coordinator is the main agent of technological implementation, follow up and evaluation, the whole educational community is summoned to participate.

The TAC plan also collects evaluation and assessment practices with detailed analysis of possible answers, which are shared in its portal. The plan's different phases are:

1. Definition of the vision of the center with regard to TACs in accordance with the specificity of the educational project of the center, the current regulations and a specific time period.
2. Diagnosis of the digital maturity of the center (both its curricular area and its management, organization, etc...).
3. Definition of objectives.
4. Planning priorities.
5. Identification of the necessary resources.
6. Allocation of tasks and responsibilities to different actors.

7. Plan application.

8. Evaluation of the process and establishment of new objectives.

The TAC coordinator takes on a special role on the TAC plan and can be part of a TAC commission. All centers, whether or not they have a TAC Plan, have a **TAC coordinator**, whose functions are (Fornell and Vivancos, 2010):

1. To have the use license of all the software that is used in center's computers, fomenting free software.

2. Take into account the respect for copyright and accessibility criteria in the digital materials published by the center.

3. Ensure that the website of the center incorporates the adequate graphic identification according to the Visual Identification Program of the Government of Catalonia.

4. Ensure the correct application of data protection legislation principles and promote conduct that preserves ethic values.

Catalonia is an Autonomous Region that has prioritized the processes of ICT integration and, at least from the regional government, guidelines have been given for its implementation in the centers. Logically, the degree of implementation depends on the possibilities of each center.

3. Further opportunities for integrating ICT in the Curriculum

3.1 Defining and deploying basic digital competences

In the Spanish and Catalan contexts, a way of fostering digital competence has been through the definition of the place of ICTs in education, i.e. in which way and by what means these technologies may be integrated in the classroom.

The Spanish context

As already mentioned, LOMCE contemplated **Tecnologías de la Información y la Comunicación (Technology of the information and communication)** as one of the specific optional subjects in compulsory secondary education. This educational reform sought to follow the European reference frame, the DIGCOMP project (Ferrari, 2013). The *Real Decreto 126/2014* (February 2014) and *Real Decreto 1105/2014* (December 2014) established the curricula for Primary and Secondary school based on LOMCE. Those documents establish seven specific competences that the curricula of each education stage should promote and digital competence is among them.

Despite being specifically treated in some subjects, such as audiovisual education, ICTs are considered transversal competences and are a part of all the other subjects. The instructions regarding how different subject matters should be taught specify particular uses of those technologies. In Primary education, they can be found in the description of almost all subject matters for searching information, presentation and interpretation, learning about key concepts, and even creating simulations and representing phenomena that are hard to integrate in experiments. In Secondary education ICTs are also a transversal competence but there are optional subjects specifically about Information and Communication Technologies.

However, according to Meseguer and others, the present development of digital competence in the curricula of primary and compulsory secondary education is basically limited to some specific aspects information and content creation. It neglects other areas, those authors claim, that are required for students to develop a basic digital competence as defined in the DIGCOMP Framework (Meseguer et al., 2015).

The Catalan Context

In order to introduce and implement ICT in the classroom efficiently, the definition of basic digital competences becomes a key component for strategies that assure students will take the maximum profit of the process. The department of the government of Catalonia provides a definition of those competences for students already in the normative deployment of the Law of Education (LEC, Law 12/2009, of July 10, on education). That law regulated the acquisition of basic skills in the digital field by students of the Catalan Education System. According to what is established in articles 58 and 59 of LEC in "*the competences necessary for the use of new technologies must be developed at an appropriate level in both primary and compulsory secondary education*".

Two additional documents were published by the Government of Catalonia for the identification and development of basic digital competence both in primary and secondary education. The elaboration of these documents counted with the participation of university professors and teachers of public and

private centers of Catalonia. According to the regional Government, digital competence is linked to all subjects of the curriculum.

Regarding **primary education**, four dimensions and ten competencies associated with the role of technologies in pedagogical work were established (Departament d'Ensenyament, 2013):

1. "Instruments and applications" Dimension
    a. Competence 1: Select, use and program digital devices and their functionalities according to the tasks to be performed.
    b. Competence 2: Use the basic functions of applications for text editing, numerical data processing and multimedia presentations.
    c. Competence 3: Use programs and applications to create drawings and edit images, sound and video.
2. "Information processing and organization of work and learning environments" Dimension
    a. Competence 4: Search, contrast and select digital information considering different sources and digital environments.
    b. Competence 5: Build new personal knowledge through information processing strategies with the support of digital applications.
    c. Competence 6: Organise and use personal digital work and learning environments.
3. "Interpersonal communication and collaboration" Dimension
    a. Competence 7: Carry out virtual interpersonal communications and publish digital content.
    b. Competence 8: Carry out group activities using online collaborative tools and environments.
4. "Habits, citizenship and digital identity" Dimension
    a. Competence 9: Develop healthy habits of technology usage.
    b. Competence 10: Using ICTs in a critical, prudent and responsible manner, considering ethical, legal, security, sustainability and digital identity aspects.

In **secondary education** four dimensions and eleven competencies were established (Departament d'Ensenyament, 2015). While the first three dimensions were common in primary and secondary education, there were some changes in dimension 4:

4. "Habits, citizenship and digital identity" Dimension
    a. Competence 9: Carry out acts of citizenship and personal development using the digital resources of today's society.
    b. Competence 10: Promote habits of healthy use of the ICTs from an ergonomics perspective, for the prevention of risks.

c. Competence 11: Using ICTs in a critical and responsible way, considering ethical, legal, security, sustainability and digital identity aspects.

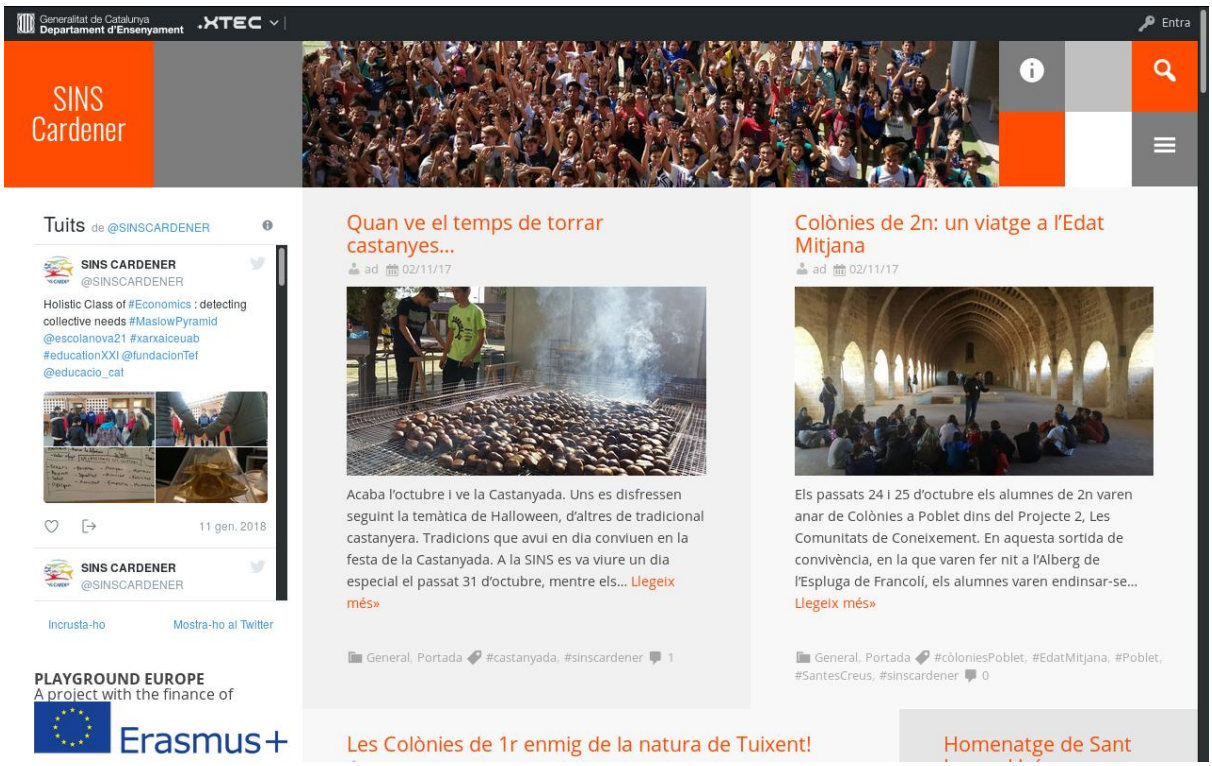
The document identifies certain competencies that place ICTs at the core of all subject domains, namely tools for editing text documents, presentations and numerical data; selection and assessment of digital information sources; information processing; techniques and instruments for knowledge creation; personal learning environment, personal digital learning portfolios; collaborative working and learning environments; and continuous learning. Thus, in the Catalan context, new technologies are not taken in isolation but approached from the perspective of broader digital competences and methodological innovation.

4. How is ICT integrated in the educational practices

This section focuses on some of the educational practices integrating ICTs identified in interviews, the focus group and documentary analysis. The following programs are examples of what's being done in this direction within the Catalan context. The section is an enlargement of the experiments explained in IO2.

a) Genuine communication learning with ICT (Language Arts)

Global innovation project of the SINS Cardener

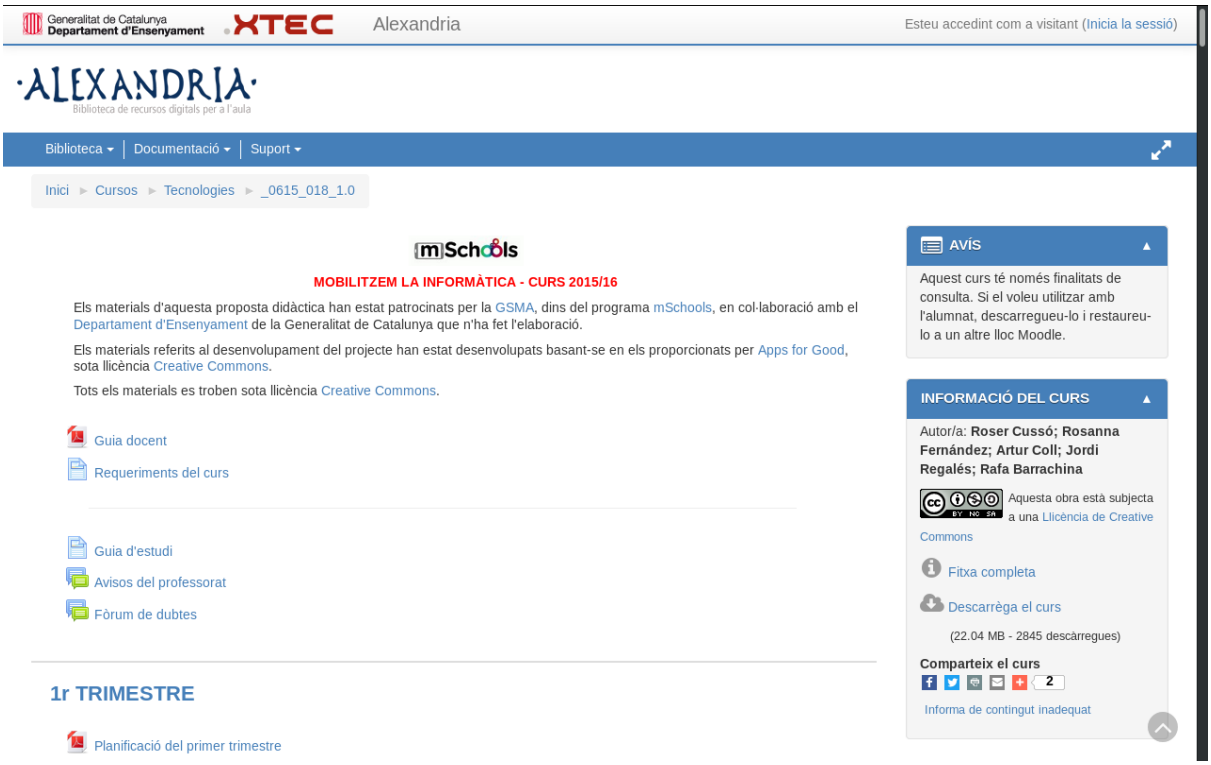


A remarkable practice is a global innovation project of the SINS Cardener which makes intensive use of ICTs. The project aims at developing basic competencies that facilitate learning in the digital context through methodologies and materials that take advantage of internet resources. It also contemplates the creation of a digital personal learning environment for gathering and sharing those learning and knowledge contents. The global innovation project's framing of technologies tries to go beyond the use of ICTs as an end in itself. Rather, this experience considers other important pedagogical issues such as methodological innovation and inclusive education - ICTs are also conceived as a form to achieve a more fine-grained approach to inclusive and personalized education which more efficiently addresses the educational needs and learning rhythms of students. While students' capabilities and difficulties, learning and psicomotor disabilities are mentioned, the project seeks to increase the personalized attention given in school to every student. ICTs are also explored as enablers of foreign language learning, either in a more traditional format or in the web 2.0 collaborative online environments. The project's main priorities is to transform the scope of instruction activities. Promoting personal

development and the digital competencies needed for using ICTs is among the mentioned important elements for pedagogic transformation.

b) Virtual labs (Science & Technology)

Mobilitzem la Informàtica



The Mobilitzem la Informàtica (Mobilise computing) experience is an optional subject in Informatics of the 4th year of ESO. The project consists of designing and programming an app for mobile devices. Students work in groups of 5 and the use of different tools and applications is considered throughout the course. The course is structured along the following lines: multimedia creations, publication and dissemination of content, and tools for communication.

The didactic proposal is approaching a project through group work, focused on the design and programming of an app for mobile devices. While the development activities follow a linear process, sometimes students will have to replan or revise their previous decisions. The app should be meaningful for the students, i.e. it should provide a solution to a problem identified by the group. The definition of this problem and the tried solution are the base for all the activity. Students are asked to make a characterization of possible users, which is then a fundamental factor to consider in interface design and in the development of the provided services. Finally, it also integrates a commercial and entrepreneurial component. Different tools and applications are used throughout the process, in a contextualized and guided way, until the final product is created. Therefore, the project fosters not only the integration of ICTs in education it also promotes a very wide range of skills: audio and video processing, website creation, apps programming languages, economics and marketing concepts, cinematographic scripts, security and digital attitude, and ethical codes in the use of the TIC.

Summem.cat

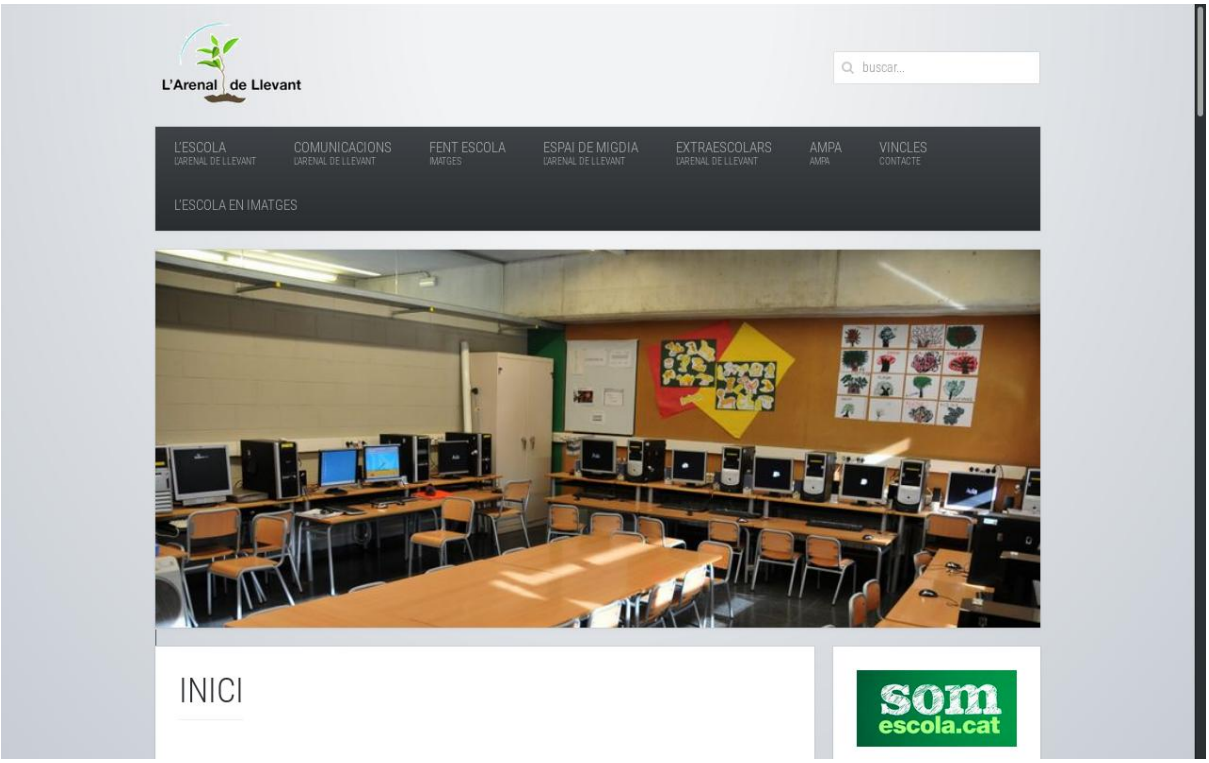
Summem.cat is a project of the *Escuela Pia de Catalunya* for interdisciplinarity in the classroom, both in teaching and learning paths. The project promotes a cooperative structure of work, making use of communicative tools. It seeks to offer practical, real, contextualized and transferable learning that ensures the acquisition of skills and positive attitudes. It relies on active methodologies based on:

- Problem-based learning;
- Project-based learning;
- Research;
- Service learning.

Summem devotes at least 50% of the time to interdisciplinary learning paths in pre-school and 25% in Primary, Secondary, and Professional Education. The role of ICTs is highlighted in the interdisciplinary work, since as the guide document of the project states, "the areas of Social Sciences, Citizenship, or Experimental Sciences and Technology will usually be the nuclear areas of each one of the blocks of the interdisciplinary didactic proposal". This project seeks to use ICTs in a preeminent way to progressively implement an innovative educational praxis, based on other key foundations, project learning and research. Learning and Knowledge Technologies (LKT) are also considered to be facilitators for the diversification and enlargement of trajectories and contexts that multiply personalized learning possibilities. The project specifically claims that digital competencies are fundamental and that ICTs are a tool for learning - it integrates an online tool that supports learning and the specific objectives of each interdisciplinary learning path. The goals of the project are related to the promotion of:

- Interdisciplinary and globalizing methodologies (practical, integrating learning in real contexts);
- Competencies, understanding the world and acting upon it;
- Inclusiveness and peer cooperation in pedagogical situations.

Educational project in Escola Arenal de Llevant

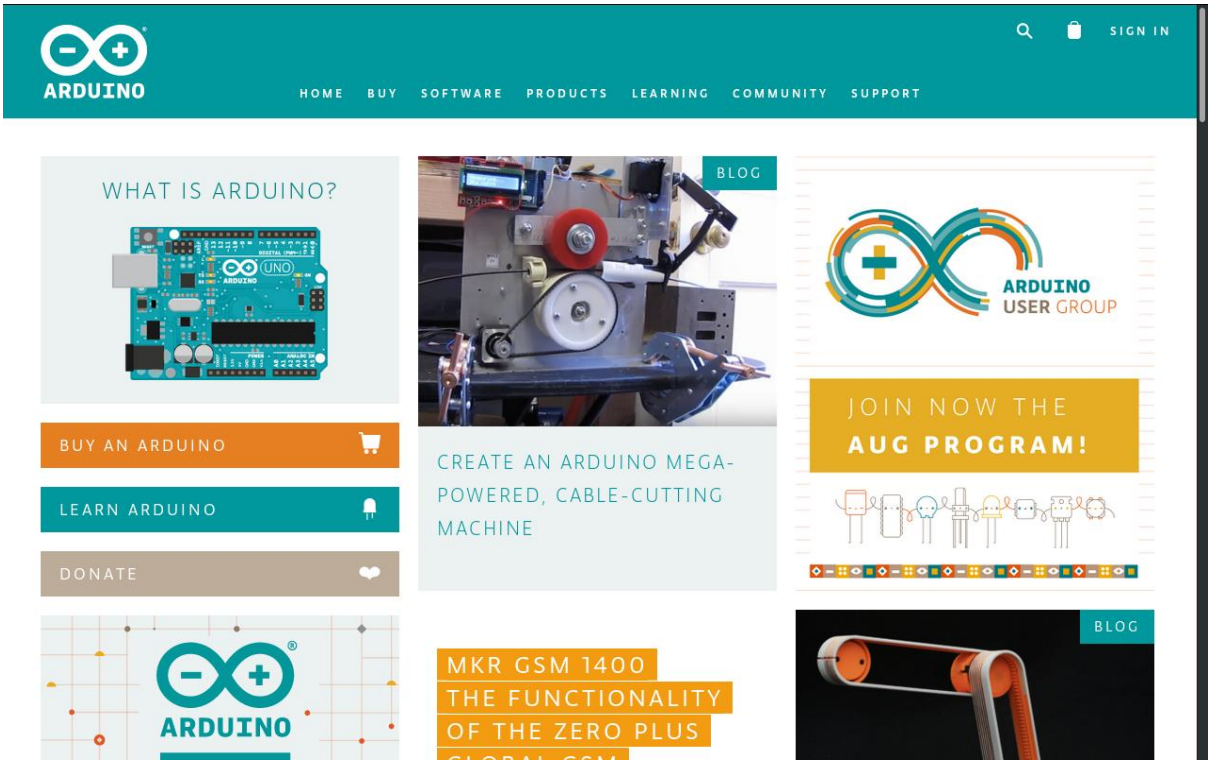


Another project is an educational one based on the double axis of science and technology, carried out by the Escola Arenal de Llevant. The school's educational project places Science and LKTs at the backbone of learning. It is based on basic principles that aim at making the school:

- Open and plural;
- Ingrained in the reality of the country;
- Concerned about the formation of values and attitudes;
- Implicated in the intellectual formation of students so that they become competent people;

Students do not have individualized textbooks and the main methodology of the center is project-based learning, through which students have to learn to answer their own questions. The goal is to foster innovation processes and keep curiosity alive as key factor for lifelong learning.

App for Android to control 10 robots assembled with Arduino



One of the focus group participants mentions her collaboration with students of the technology optional subject to design an app for Android (using App Inventor) that controls 10 robots assembled with Arduino (an open electronic platform to create prototypes based on free software and hardware). The students' goal is to be able to perform real teamwork in two teams, putting together technique, computers and teachers, to make the robots play a soccer match.

c) Digging far and beyond with several clicks (History, Geography, literature)

World Mobile City Project

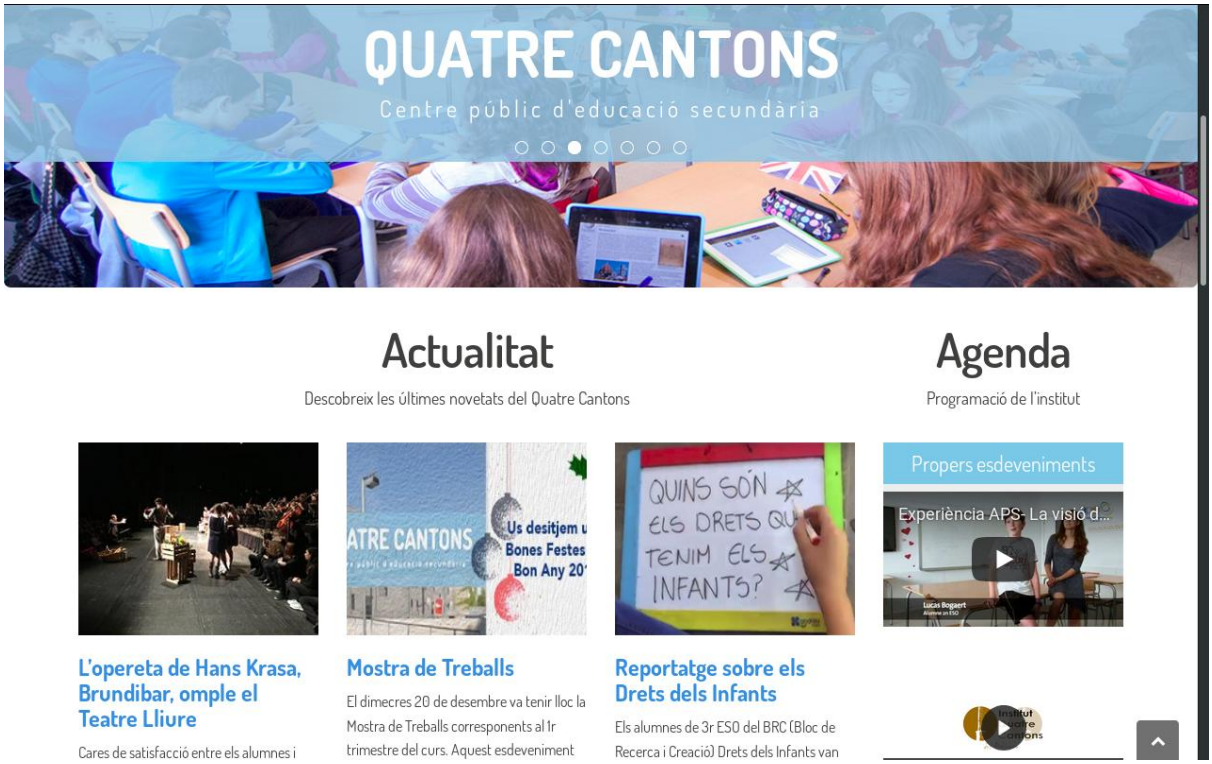
The World Mobile City Project is a collaborative project of georeferencing and mobile technology. Managed by the LaceNet, 1Entretants and Novadors teacher networks, the project involves 70 educational centers in Catalonia and the Valencian Country, the Polytechnic University of Catalonia and more than 5000 children and young people. It is based on an activity aimed at young people that allows them to locate any point in the city by combining classic media (charts, maps) with the latest technologies (Internet mobile, geolocation, QR codes, augmented reality), developing cooperative work in small work groups.

During a whole week, students work in groups of 4 to discover their cities by themselves, using their mobile devices, selfie sticks, power banks and paper maps[1]. The experience enables them to perform their own city route without ever feeling insecure. App usage supports easy and continuous communication with teachers while performing the activity. In addition, they share their discoveries (photos and videos) on a virtual shared map, hosted on Instagram. The project seeks to offer opportunities for the acquisition of digital competence (among others) and for getting to one's city both digitally and physically (using the public transport services). As a technological and activity model, it is a transferable initiative that can be replicated in any city.

[1] Bring Your Own Device (BYOD) is the philosophy guiding the project's device use strategy.

g) Other projects/initiatives

Project of the Institut Quatre Cantons of Barcelona



The Globalized Work from External Proposal (Treball Globalitzat de Proposta Externa - TGPE) is a part of the ordinary curriculum of the Institut Quatre Cantons of Barcelona. It is based on a work proposal from an external entity: social institutions (museums, institutes of culture, research, technological innovation, services, companies) make a project proposal that simulates the commissioning of a project. The Globalized work from an external proposal brings authentic real-world tasks to the school, putting students in contact with the real world and in situations which require the resolution problems, the creation of a service and performing research. Students engage in literature review and bibliographic research, collect and analyze materials and documents, interviews, workshops, experimenting, creation of new content, and preparing a service or activity. This way, learning situations are created that connect to the daily life of other people which work in the areas of culture, communication and research. The project seeks to offer a totally contextualized way of learning and integrates technology in an almost invisible way. Its main goals are related to conceptual learning and the development of cognitive skills related to methodological competencies (learning to learn, autonomy and proactivity, information processing, and also digital competence).

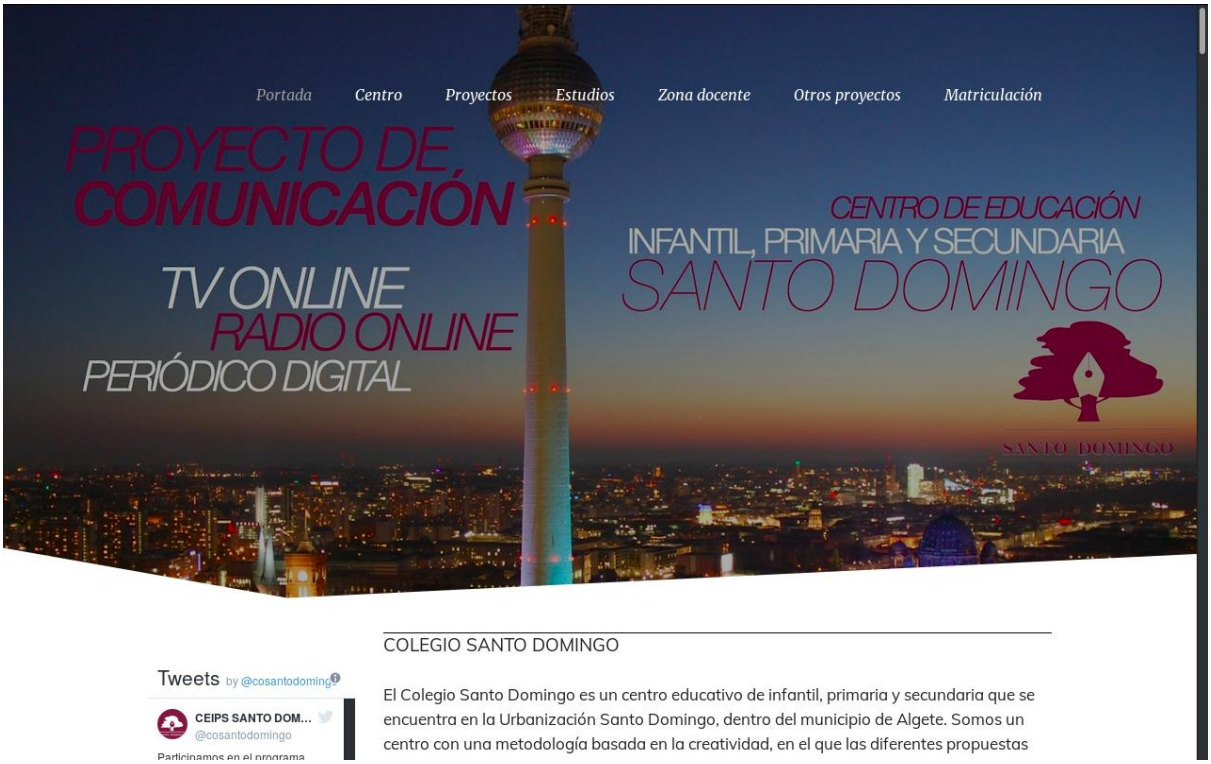
TECNO 12-18

TECNO 12-18 is a digital textbook that allows users to modularly configure independent chapters as the book of each course. The book allows students to learn with animated contents and to carry out self-evaluation activities on their knowledge of each subject. The book of each group or class is formed by selecting 6, 8 or 10 from a total of 30 chapters (the entire ESO technology curriculum is covered)[2], allowing teachers to adapt to different curriculum designs.

The digital book is designed to be used in conventional computers, mini-notebooks, Windows tablets and digital whiteboards. When the student logs in with his / her individual access key, he / she visualizes the structure of his / her book, which will have the chapters chosen by his / her teacher. It can be used from any computer with Internet connection, from the center or from the homes of students and teachers. The book is also available as a printable / offline version (PDF). The majority of activities are available in a "free" version, allowing screens to move forward or backwards without restrictions, and a "dynamic" version, in which multiple tests are required to move through screens and reach the end. Each chapter also contains a global test that can be used as study material or as a test. Student activity is recorded in a database and teachers can know which activities the student has successfully completed (in the their dynamic version) and the marks obtained in the global tests of each chapter.

[2] Curriculum: Technical Drawing, The Technology Process, Wood and Paper, Metals, Plastics, Electricity 1, Electricity 2, Energy, Mechanics 1, Mechanics 2, Motors , Structures, Computer, Operating system, Text processors, Spreadsheets, Presentations software, Databases, Internet, Website editing, Computer drawing, 3D printers and design with SketchUp, Installations in homes, Analog electronics, Digital electronics, Communication technologies, Control and Robotics, Programming with Scratch, Pneumatics and hydraulics, and Technology and society.

Use of ICT of the public school Domingo de Algete in Madrid



The CEIPSO Domingo de Algete in Madrid is a public school that uses ICTs intensively. The center's innovative usage of technologies entails five internet TV channels, one online radio and one digital newspaper that are managed by students. Students' expressive abilities (e.g. oratory skills) are promoted transversally in the center's initiatives. The center offers the Technology, Programming and Robotics subject in the compulsory Secondary education - like all other regional centers - but it also integrated Programming and Robotics in Pre-school and Primary education through the inclusion of these topics in subjects such as Language and Literature, Plastic and Musical education. Furthermore, Pre-school students write stories and invent fictional characters which will be designed and recreated as robots by the Secondary education students. The center has acquired tablets, laptops, digital blackboards, high speed internet access and a 3D printer. Pedagogic digitization is developed to the point that textbooks are no longer used between the 5th year of Primary schooling until the 3rd year of compulsory Secondary education – educational materials are produced by the students themselves under the supervision and organization of the teacher.

ICT Workshops in Escola Projecte

Another focus group participant mentions a program of the educational center l'Escola Projecte (a school in Barcelona named Project School) which entails a series of workshops with videogames to from a playful vision about learning through the use of technologies. The school's integrates the use of technologies from a playful approach in its educational project as a methodology to promote learning. The school uses LKTs as an educational resource in the service of curricular contents and as a tool to promote a series of competences and values that students need in today's society. Among those are creativity, the ability to work in a team, the resolution of problems and the interest in technology and technology. It has specialized computer rooms, uses different interactive digital whiteboards according to the activities carried out in the different subjects, and older students have access to laptops.

For each cycle of primary and pre-school education, workshops are carried out that focus on promoting digital competences. Aspects such as problem identification, goal setting, planning, learning by trial-error, etc., are approached using LTKs. Collaboration and exchange of ideas are an important dynamic of the class.

The workshops currently taking place are, according to each cycle:

- Late pre-school education: Tux Paint. Drawing program that allows children to familiarize themselves with the use of a program: its menu, controls, tools, etc. The goal is to present the basic functioning of a program as a device for creation and expression.
- Initial cycle: Analysis of video games as an activity that promotes observation, learning by trial-error and analysis of situations. Carry out a short animation to work on sequencing and planning, as well as aspects of language and creativity.

- Middle cycle: The workshop entails developing a computer program (video game creation) using Scratch, developed by MIT (Massachusetts Institute of Technology). Planning, sequencing, error detection and review processes are emphasised during the task. This activity won the 3rd ITworldEDU 2010 Award for the best technological solution developed by educational centers, in the category of teaching tools and applications for teaching and digital content.

- Upper Cycle: The work with the previous workshop (Scratch) is continued, using sensors to create extended digital narratives, a type of narrative in which the history happens both on the screen and in the real world.

Placing video games and LKTs as the main axis for pedagogical innovation and collaborative work between students, the school also promotes collaboration among teachers in order to help establishing common goals and improve learning.

5. Exemplification of uses of relevant resources

This section is focused on relevant educational resources for teaching and managerial purposes in the Catalan context.

XTEC – Xarxa Telemàtica Educativa de Catalunya

The XTEC – Xarxa Telemàtica Educativa de Catalunya (Educational Telematic Network of Catalonia) portal of the *Departament d'Ensenyament* of the *Generalitat de Catalunya* (Department of Education of the Generalitat of Catalonia) offers a wide variety of educational resources and services. It is a public service aimed at for both teaching staff and different educational groups of non-university levels dependent on the *Departament d'Ensenyament*. Its main purpose is to make available educational resources, information, materials, procedures and other specific products and tools based on *TAC* (LKT, Learning and Knowledge Technologies) that contribute to facilitate, update and improve teaching strategies. To improve and promote learning, the access to learning technologies and knowledge, the portal provides, without any costs, several services and tools that allow members to develop their skills, connect and collaborate.

- Access to multimedia and didactic materials;
- Hosting of websites for centers and teaching staff;

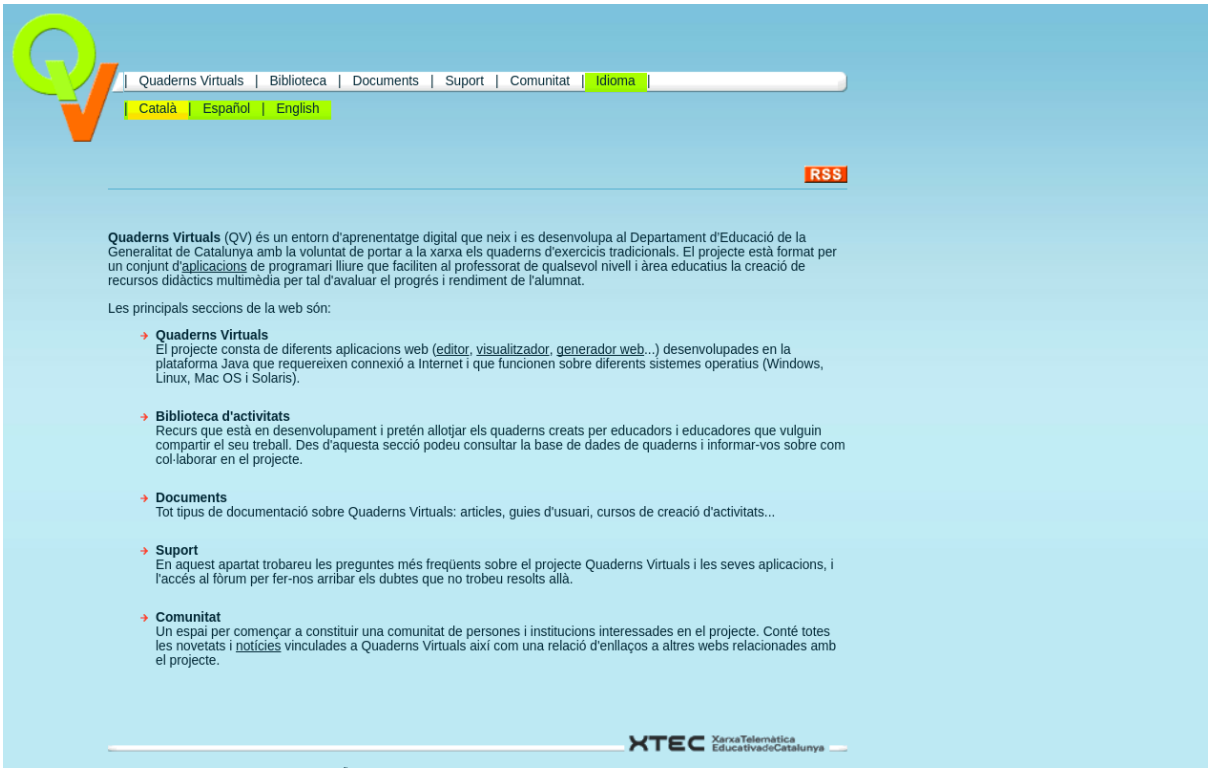
- Online instructions for guidance and counselling on various issues related to the use of learning and knowledge technologies;
- Information of general interest for the educational world
- Management of enrollment in training courses and other activities organized by the Department of Education;
- Blogs, forums, email to third parties, RSS feeds, syndication and access to social networks and derivative products;
- Access to the edu365.cat and edu3.cat portals;
- Access to Merlí's own educational resources search engine;
- Information to the educational centers and professionals regarding security and risk prevention on the Internet, privacy of data, image rights and minors protection;
- Access to collaborative tools: Moodle services, corporate intraweb, virtual library, etc.
- Access to corporate media;
- Access to external, national and international services, offered by entities and organizations resulting from agreements or collaboration pacts.

Edu365

Edu365 is another portal of the *Departament d'Ensenyament* aimed at students of the schools and institutes of the country, their families and other interested parties – anyone who access the website can make use of its resources. It was created as a portal to provide students with resources for all areas of the curriculum so they could be accessed from anywhere, requiring only internet access. The portal contains mini-didactic resources, resources and applications for almost all areas, as well as those activities made with their own applications such as JClic and other third party external resources with sufficient quality. Over time, edu365 has ceased to be restricted to home usage to be a reference portal in Catalan schools, integrating cross-sectional aspects such as internet security, health education, or first-day-of-class materials. The website has also become a showcase for educational innovation

through ICT, containing textual and audiovisual information about innovative practices that involve such notions as Web 2.0, augmented reality, video games, programming or mobile device applications.

Quaderns Virtuals



Quaderns Virtuals (QV, Virtual Notebooks) is a digital learning tool that is born and developed in the Ministry of Education of the Government of Catalonia with the intention of bringing traditional exercises workbooks to the internet. The project makes use of a set of free software applications that help teachers from any area and level to create didactic multimedia resources which allow the evaluation of student progress. *Quaderns Virtuals* are created by teachers and used by students, like traditional workbooks. They are formed by a set of pages containing questions and additional reference and practice materials. In addition, questions can have dialogue points, allowing the students and teachers to write comments and clarify doubts. The types of activities defined by the Instructional Management System (IMS) project's Question & Test Interoperability (QTI) standard and currently supported by Quaderns Virtuals are:

- Selection of the answer or correct answers among a list of options, which can contain texts, images and/or sounds;
- Ordering a set of jumbled elements correctly by moving objects to the adequate position (materials can be images or texts);
- Fill in the gaps (blank spaces) to form the answers;
- Drag and Drop each answer to the correct position;
- Sensitive areas which can be marked or image dots which can be joined;
- Drawing lines and polygons on an image.

Tiching

Tiching is a school teacher educational network to find and share the necessary resources for the improvement of learning and teaching. More than 1,000 teachers participated in the launch of Tiching, in early 2011. The network seeks to be a reference space in which the educational community can find and share resources. It is currently spread across 19 countries and aims at operating in proximity to the key educational actors: teachers, students and families. The Tiching web portal is structured around resources (created, shared, used, and valued), community (status updates from people in the same school, class, or interest group) and profile (to access the library and classes, and to edit one's educational profile).

6. Recommendations for effective integration of ICT in the teaching and learning processes

This section contains guidelines identified as possible vectors of improvement. They are based on the interpretations and reflections expressed by interviewees and document analysis. These selected privileged informants integrate, in one way or another, the Catalan educational context and the present guidelines should reflect the specificities of that reality.

a) National decision makers

Our informants identified an urgent need to reduce the current instability of education policies, namely their erratic, *ad hoc* and improvised character - which is also reflected in the role of ICTs in schools. In this regard, they argue that policy strategies are often short sighted or circumscribed to a single parliamentary / governmental configuration and its respective duration. Our interlocutors identified the need of modernizing the Education Law considering the necessity of strategic consensus across the parliamentary arch, and the need for medium and long-term perspectives on pedagogic issues. Threats to the integration of technology in pedagogical settings are often related to deficitary budget and investment. One of the mentioned risks is related to the exposure of the educational system to external factors, namely economic crises - to which we could add political crises.

Another preoccupation expressed by informants concerns the overspecialized character and limited scope of the broader strategies for integrating technology in education. Participants expressed their belief that the overall organization of the national education model has become anachronistic. There is a lack of critical reflexion and effective strategies for making the broader educational model benefit from technological innovation. Education should be reformed in ways that address the needs of the 21st century, taking into consideration the dynamics of the labor market, the importance of a modernized education for democratic citizenship, and the challenges related to improving literacy, numeracy and computational thinking. An emphasis should also be placed in fostering the development of broader digital competence.[3] Thus, national decision makers should take into account that any updated educational model must integrate ICTs and foster the critical stance and reflexive digital culture that today's world demands, with an emphasis on:

a) Reinforcement, through changes in curricula, of the dimensions of critical thinking; problem solving; learning to learn; communication and collaboration; digital, information and media literacy; and digital citizenship at a local and global level.
b) Promotion of the integration of ICTs in both instrumental learning and methodological innovation.
c) Informational overabundance, namely searching, contrast/comparison, selection, and interpretation.
d) Knowledge of the possibilities and implications of intellectual property rights (copyright) in software and content.
e) Ability to maintain privacy and security while using technologies.
f) Fostering the construction of sustainable networks that support technologized educational projects in one or more centers, among teaching staff or along with other practitioners in ICTs.
g) Devise strategies to shelter education from broader societal, political and economic dynamics.
h) Increasing investment in infrastructure, including ICTs, that suits the needs of educational centers.

[3] Making the current education system apt for an accelerated rate of social and technological change is extremely important, requiring constant integration of novel content and innovative approaches to address relevant issues in a timely manner. Said reform must take into account the contextual differences in which educational centers are socially embedded, including how they may enable or prevent the intensive use of ICTs in teaching.

a.1 Teacher's professional development

National education bodies play an important role for the improvement of continuous and compulsory teacher training / update in terms of ICTs. The current accelerating pace of innovation, particularly under the "disruptive innovation" paradigm that has been driving technology-intensive economic activities, highlights the importance of keeping up with a constantly changing technosocial environment. If the educational system must capacitate students to face such changes, the teaching staff should continuously update skills and knowledges. Such updating, however, typically relies on voluntary personal initiative regarding self-updating and is often considered to be the teacher's individual responsibility. Public education policies could help achieve better results in terms of teacher professional development through:

a) Accreditation of innovation projects and disruptive pedagogical practices around ICTs use.

b) Teacher training:
   i) Intensify efforts for integrating compulsory continuous development training. This could be achieved with policy strategies that promote the creation of small courses and integrate teacher updating in educational centers and as an important part of the teachers' working time.
   ii) Periodic evaluation of teaching activity, which should be used as an important criterion for career and professional category progression.

c) Develop, support and promote collaborative teacher professional development initiatives.
   i) Accreditation of voluntary training and other teacher professional development activities (e.g. participation in projects, collaboration and networking, and self-training).
   ii) National bodies should create both small courses and accreditation mechanisms that articulate specific tasks with the required level of technical knowledge.

b) School managers/leaders

Another important vector of intervention in the educational system is the daily organization of pedagogical activities of different cycles in educational centers, under the supervision of the respective direction and administrative staff. The following guidelines are meant to support school leaders who want to foster the usage of ICTs for transforming education:

a) School management from a technological perspective[4]
   i) ICTs should be used under open management paradigms that improve and simplify the everyday managerial and administrative activities in schools.
   ii) Schools would benefit from an improvement in ICT infrastructure and their methodological integration. In addition, strategies for mobile phone classroom usage that go beyond the simple interdiction such as the *bring your own device* (BYOD) strategy can help to cope with the present day lack of devices and resources.[5]
   iii) Schools should avoid the constraints of restrictive intellectual property rights by using open source software and open educational resources whenever available.

b) Teacher professional development: in-school knowledge updating activities could strengthen teacher skills but they should consider and address strategically the existing teacher skillset diversity.

[4] The *Pla TAC* (in English Plan LKT - Learning & Knowledge Technologies) from the Education Department of the Regional Government of Catalonia contains a set of guidelines and objectives that seeks to assist educational centers to adopt technologies in their daily activities at the educational, administrative, and communicational level. That plan integrates an internet application that helps school directions to implement its guidelines.

[5] Nevertheless, such a move would greatly benefit from a reflexion (in connection with educational community and stakeholders) on related dimensions such as contextual appropriateness and how this could reinforce student inequality.

c) Integrate innovative projects and pedagogic practices around ICT usage as a core component of the center's educational project (with a focus on teaching methodologies and student acquisition of digital competence)

d) Education centers play a vital role in the creation and maintenance of informal networks and communities of practice around pedagogy and ICTs. Schools should be spaces that foster teacher collaboration and peer-based skill reinforcement activities.[6] Cooperation and networking focused on teacher training and innovative methodological practices should take place both within the center and between centers.[7]

e) School management should understand the (social, cultural, economic) specificities of their milieus, and address heterogeneity in teacher and student bodies in order to foster a positive inclusion of ICTs in the school's educational project.

c) Teachers (and the close promotion of digcomp in students)

c.1 Continuous training / professional development

In face of an ever changing technological landscape, teachers should focus on continuous self-updating activities in terms of their digital competences. These forms of self-updating should focus on both instrumental and methodological use of ICTs. The goal should be to adapt ICTs to strategies that enhance student collaborative and project skills, as well as to foster the active involvement of students and their families.

a. Participation in lectures, conferences, courses, meetings, associations, and professional networks. The internet also offers interesting possibilities for self-updating through online meetings and MOOCs, social networks, and virtual groups. Teachers should actively search for existing offers, which are often available online and free of charge.[8]

b. Active engagement with informal networks and communities of practice focused on technology and education are also helpful. Informal exchange and collaboration between teachers, or together with other practitioners, is fruitful for the development of technological awareness and practical knowledge.[9]

c. News media and academic research about technology related issues, namely those in the arts and humanities, are also important sources for teachers.

d. Teachers should improve their ability to produce teaching contents.

[6] Teacher networking is already emerging and schools leaders should foster those collectives, namely through incentives for teachers who are already familiar with technologies to share knowledge with their peers. Another possible path is to make the school a privileged place for cooperative learning, in physical proximity, around available online resources for teacher training.

[7] An example of interschool networks is the Escola Nova 21, a network of Catalan educational centers and other entities that emphasizes the role of technology for the modernization of the educational system.

[8] Important local instantiations of said offers are the online courses of the Xarxa Telemàtica Educativa de Catalunya (XTEC, Telematic Educational Network of Catalonia). Created by the regional government, the portal provides a wide variety of online courses for teachers and students to develop their digital competences and is specially focused on the general and continuous training of teachers.

[9] The construction of networks of practitioners depends on a proactive attitude towards networking and collaboration among teaching staff and other practitioners interested in promoting sustainable, comprehensive, multi-stakeholder approaches to technological pedagogy. The sustainability of such networks relies on the active collaboration between teachers. Therefore, teachers should also be prepared to share knowledge and experience related to technology among themselves, pointing to the importance of abilities such as the capacity to design training sessions.

c.2 Teaching methodology

Teachers should be able to innovate with methodologies and tools, integrating new resources in routine teaching practices. They should also develop awareness of technological resources and be able to evaluate them for specific implementations while designing learning objects and tasks. Thus, to integrate technology efficiently in education, teachers should focus on:

a. Methodologies and activities that promote active learning[10] and learning based on projects, problems and cases.
b. Exploration the real-time and dynamic simulation and visualization methods provided by computational technologies for introducing complex or abstract processes (e.g. from mathematics, physics, chemistry, social sciences).[11]
c. There should be an emphasis in capacitating students for autonomous lifelong learning and the evaluation methods should reflect student learning and evolution.

c.4 Fostering digital competences

Digital competences are plural, always in transformation and often very complex, which means their development, updating and transmission present hard challenges for teachers. Nevertheless, these professionals should seek to obtain instrumental knowledge related to digital competences but also to engender ways of integrating these competences in their pedagogic methodologies. Only that kind of work can help students develop such a complex assemblage of critical knowledge and skills that we refer to as digital competences. Despite their plurality, our interlocutors stressed important vectors for teachers to improve their digital competences:

a. Select, use and evaluate digital support technologies in the design, planning and didactic implementation of the teaching-learning process, inside and outside the classroom, to optimize dynamic organization of the experiences, activities and resources, guaranteeing the effectiveness of learning and facilitating collaboration and dissemination among the educational community.
    i. Proficiency in tools specially designed to introduce computational thinking at younger ages (such as snap! and scratch) is desirable.
b. Organize and manage, in a responsible and sustainable way, the digital technologies in a way that facilitates and improves educational management and the pedagogic activities.
    i. Important instrumental skills for teachers are the capacity to address technical incidents, to use tools correctly and efficiently, and to create / adopt new materials in the teaching methodologies.
    ii. Awareness of licensing and copyright protection mechanisms and adopt whenever possible the less restrictive modalities of open source software and open educational resources.
c. Knowledge, skills, attitudes, strategies and sensitization required to communicate, collaborate, create and share content and build knowledge when using digital technologies, in the context of the design, implementation or evaluation of activities.
    i. To help students deal with today's informational context, teachers should develop for themselves and be able to transmit accurate information search, contrast, selection and validation criteria. In order to achieve this, it is important that teachers get acquainted with with digital tools for information management and learn to create personal work environments.
d. Knowledge of the ethical and civic implications derived from the use of digital technologies in the educational field in terms of legality, security and digital identities.

[10] Any student centered approach in terms of technological pedagogy should integrate a strategic relation with student diversity, considering differences in learning rhythms, digital device repertoires, and economic and cultural background. It should also articulate skills and reflexive strategies for communication and interaction with students, both offline and online.
[11] Such possibilities create opportunities for better grasping ideas, situated debate and the identification of problems / disparities in student understanding.

i. Teachers should seek to develop, together with students, ethical reflexions on responsible use of ICTs, their benefits and risks. In order to engage students with these important issues, teachers should be able to promote classroom debate on human, ethical, civic and social concerns around technology.

e. Teachers should focus their professional development around the educational challenges posed by today's society, and make use of ICTs and virtual educational environments to configure their professional digital identities, contribute and disseminate educational resources and engage in continuous training activities.

7. Teacher training for ICT

According to several participants of the interviews in Catalonia, the **training** and **accreditation** of digital competences must be a overarching component in the teaching of broader pedagogical competences, and the teacher need to be able to use ICTs appropriately in all areas of their knowledge.

As some interviewees said, the state **budget** assigned to the training of teachers is a very important factor for improving the education system. Teacher training should be, in their opinion, compulsory, continuous, and increasingly inserted within the teaching staff working hours. Nevertheless, said efforts must not fall entirely on the teachers shoulders but also on education bodies and centers that must provide the resources that currently teachers lack or have lost. Thus, a budget increase in education, namely in the promotion of quality teaching staff is necessary.

7.1 Teachers' training and accreditation: recommendations from participants

There is consensus among our research subjects about **the need for teachers to be competent** in the instrumental and methodological use of ICTs in education. In relation to **accreditation** of competencies related to ICTs, interviewees criticised that the form of teacher accreditation in ICT privileges 'attendance' of very standardized and decontextualized courses, taking too many hours, rather than 'usage' capabilities. Several interviewees pointed out the lack of a clear accreditation system, noting that it's necessary to create mechanisms for the accreditation of these competences that allow the teachers to demonstrate that they have reached a set of established levels, appropriate to each task. Said accreditation mechanisms (i.e. certificates) can thus be used and valued in the processes of selection and promotion in terms of teaching career and professional category - according to the educational tasks to be performed - as an alternative to the seniority based progression model. As mentioned in the Recommendations chapter of this report (section 6), accreditation should also seek to go beyond the courses and integrate other activities such as voluntary teacher networking.

Teachers should also take advantage of the formative and training possibilities granted by ICTs. Our interlocutors proposed the following recommendations to foster teacher's acquisition of the Digital Competence and associated forms of training:

- Enhance instrumental and methodological use of ICT[12];
- Assure teachers' participation in transversal and meaningful learning situations that promote problem solving, communication or creativity.
- Promote its active role in the production of teaching contents;
- Be able to actively involve students in their training (e.g. o encourage students to become producers of their own content, to develop self and peer assessment activities, etc.)
- Improve interdisciplinary knowledge base within methodological skills;

[12] Training objectives should not simply focus on digital tools usage but mainly on new active methodologies and educational techniques that are enhanced by ICTs and foster student learning in collaboration and projects.

- Integrate asynchronous online resources (e.g. MOODLE) with synchronous online communication (e.g. videoconferencing).
- Foster the acquisition of online teamwork skills among teachers;
- Foster collaboration among students;
- Promote the critical reflection, together with students, on issues related to digital identity, privacy and security management;
- Encourage respect and tolerance;
- Enroll in specialized courses (e.g. nano courses) to address the need for a basic knowledge of methodologies and tools.[13]
- To provide the bases for autonomous training throughout their lives;
- Continuously engage in training and professional development activities.[14]

7.2 Dimensions of teachers' training in ICT

Basing on the document analysis performed, we can identify the dimensions that should be present in teachers training for the integration of ICT in teaching and, in consequence for the acquisition of their digital competence. The Catalan PICDD project (presented in IO2) analysed the initial and continuous training teachers in ICT with the goal of proposing improvements. In addition, the project defined five areas or dimensions of digital teacher competences that should be considered in any teacher training in ICT (Generalitat de Catalunya, 2015):

1. **Design, planning and didactic implementation**. Ability to select, use and evaluate support digital technologies in the definition and execution of the teaching-learning process, inside and outside the classroom; to optimize the planning and dynamic organization of the experiences, activities and resources to guarantee the acquisition of knowledge, and facilitate collaboration and dissemination among the educational community.
2. **Organization and management of educational spaces and resources**. Ability to organize and manage digital technologies in a responsible and sustainable way, which facilitates and/or allows to improve working conditions, both in terms of educational management and didactically.
3. **Communication and collaboration**. Knowledge, skills, attitudes, strategies and sensitization required when using digital technologies to communicate, collaborate, create and share content, and build a knowledge framework for designing, implementing or evaluating an educational action between teachers and the students.

[13] Said targeted professional development should be strengthened with peer education and follow the preferences and training in the center, projects and needs, previously diagnosed by the staff or by the management team

[14] Teachers should not only engage in discrete training in ICTs but also in forms of lifelong training where ICTs are not the focus of learning but integrated to improve teacher competence. Lifelong learning is perceived necessary for the education and updating of teachers in methodologies, classroom management and use of ICTs.

4. **Ethics and digital citizenship**. Knowledge and consideration of the implications derived from the use of digital technologies in the educational field along the dimensions of legality, security and digital identities. Training students on these subjects making sure they make an ethical and responsible use of those technologies.

5. **Professional development**. The competences acquired through teacher professional development must reflect professional practice in relation to the educational challenges posed by today's society. Involvement in virtual educational environments, where teachers configure their professional digital identities, contribute and disseminate educational resources and are formed on a permanent basis.

8. Official quality assurance and evaluation tools and procedures at the national level

Quality Assurance Processes

Spain

According to Eurydice, the external evaluation of schools in Spain is the responsibility of the Autonomous Communities and the Ministry of Education, Culture and Sport (in the case of the Autonomous Cities Ceuta and Melilla, and of Spanish schools abroad). The main body of external evaluation is the Education Inspectorate, dependent on the associated regional ministry/department of education (although some regions are divided territorial delegations), staffed by civil servants who act as school inspectors. The Inspectorate controls and supervises educational institutions and their programmes, teaching and school management, continuous improvement of schools, and the compliance with legislation, regulations and official guidelines (European Commission/EACEA/Eurydice, 2015).

In April of 2017, the education inspectors of the Canary Islands gathered to participate in a working meeting entitled *La innovación educativa. Un reto para la Inspección de Educación* (Educational innovation: A challenge for the Education Inspection), where the Modernization Plan of the archipelago's governmental department for Education and Universities was debated. In the opening statement, the Canary Government's advisor on those matters explain the plan's achievements: communication and networking between educational centers, new virtual spaces for teaching and learning, innovative initiatives, and distance, semipresencial and online teacher training. ICT support was considered as an integral part of efforts to adapt education to the new social contexts.

The Strategic Plan 2013-2017 of the Navarra's Educational Inspeccion Service, a body of the region's Department of Education, contains a list of core strategies for the service. The Plan's strategy number 9 mentions promoting methodological innovation following today's cultural and technological changes (Servicio de Inspección Educativa, 2013). In a document by the territorial delegation of Jaen of the Education Council of Andalucia, the first objective of school inspectors, the first objective laid out for the inspection work is related to the basic competences for social life. Among said competences, linguistic communication, mathematics, science and technology, digital competence, and social and civic competences are emphasized (Consejería de Educación/Junta de Andalucia, 2015).

Catalonia

As the main agent of supervision, evaluation and advisory of educational centers, the work of inspectors is central for positive and sustainable educational innovation. The *Subdirecció General de la Inspecció d'Educació* (the Catalan regional inspectorate) published an analysis of the *Suport Escolar Personalitzat* (SEP, Personalized School Support in English) initiative, which provides help to the students in need in order to fight insuccess. In the document, the usage of new technologies for student engagement, digital narration, and project-based work is considered a good and important organizational and methodological practice, alongside the VIDEOMAT project that allowed collaborative

development of mathematical, digital and audiovisual competences (Secretaria de Politiques Educatives, 2016)

Quality Assurance Tools

Portfolio of Teacher Digital Competence (Common Digital Framework For Teachers)

The Common Digital Competence Framework for Teachers, an initiative by the National Institute of Educational Technologies and Teacher Training (INTEF) of the Ministry of Education, Culture and Sport (MECD), holds regular meetings in which the project's progress is assessed by a group of experts, researchers, other institutions and stakeholders. The Framework devised the Digital Competence Portfolio for Teachers, an online service to endorse and certify the Digital Competence of Teachers. During the latest meeting, held on the INTEF on May 2017, participants presented their findings to the Learning Technology Workgroup (GTTA), a team which agreed to promote regulations that allow the acknowledgment and endorsement of the levels of digital competence proposed in the Common Digital Competence Framework for Teachers – and of a state recognized reference system for accreditation of teacher digital competence level through the Digital Competence Portfolio for Teachers. In Catalonia, the Learning Department of the regional government already recognizes those portfolios as a tool for teacher assessment. The Council of Educación and Culture of Estremadura published in 2015 the *Porfolio de la Competencia Digital Docente de Extremadura* (Digital Competence Portfolio for Teaches of Estremadura). This portfolio is centered around five main areas of digital competence:

1. Information: identify, locate, recover, store, organize and analyze digital information, evaluating its purpose and relevance.
2. Communication: communicate in digital environments, share resources through online tools, connect and collaborate with others through digital tools, interact and participate in communities and networks; intercultural awareness.
3. Content creation: Create and edit new content (texts, images, videos ...), integrate and re-elaborate previous knowledge and contents, produce artistic productions, multimedia contents and computer software, know how to apply intellectual property rights and use licenses.
4. Security: personal protection, data protection, digital identity protection, security strategies, safe and sustainable use.
5. Problem solving: identify needs and digital resources, make appropriate decisions when choosing digital tools according to the purpose or need, solve conceptual problems through digital media, solve technical problems, creative use of technology, update own competence and that of others.

The portfolio seeks to provide teaching bodies with an assessment of:

1. teacher competence level in each area (with respect to established standards);
2. knowledge, skills and attitudes that are missing in order to achieve the objectives;
3. the training and training itineraries that must be carried out.

9. Conclusions

The research that supports this report, mostly based on the analysis and interpretation of interviews to key actors and official documentation in the educational field, informs the following synthetic conclusions and general recommendations that are relevant from the national and regional perspective:

One main conclusion is that it is necessary to end erratic educational policies in the implementation of ICT in the classroom. Our interlocutors criticized the current Spanish educational law (LOMCE), claiming its emphasis on the connection between ICTs and the improvement of education and methodologies is mostly limited to rhetoric in the legislative text – the different dimensions of this problem[15] are not articulated in practical interventions.

Furthermore, the suspension of the Spanish Ministry of Education's *Escuela 2.0* Program resulted in the the absence of a unified educational policy and investment plan for the integration of ICT infrastructure and connectivity in schools at both state and regional level across the national territory.

In Catalonia, the Educat program – an adaptation of the Escuela 2.0 that continued to receive support from the regional government – continues that effort but does not cover the totality of the region's centers.

The Catalan department of education also promoted the TAC Plan, a program to foster student digital competence and positive articulations between technology and education in centers; despite having been suspended in 2014, schools still implement it.

The current curricula for primary and secondary education, inspired by and created within the LOMCE legal frame, already integrate ICTs as transversal elements. Nevertheless, some commentators have argued that the application of those technologies is limited to some specific aspects information and content creation, neglecting other areas required a basic digital competence as defined in the DIGCOMP Framework.

As explained in section 4, there are plenty small-scale pedagogic innovation projects that gather teachers and students of one or more educational centers, sometimes in cooperation with other entities and professionals. Among those we can find interdisciplinary education; contact with the real world, other institutions and organizations; implementation of LKT intensive methodologies; creation and usage of digital textbooks; on-site georeferencing; gamification; and working with tools for the development of computational thinking and programming (e.g. Scratch, Snap!, Arduino).

The Catalan government provides resources for teacher training, educational materials, and evaluation tasks (XTEC and Edu365 portals, QV Virtual Notebooks) but there are also interesting experiments that are mostly based in teacher networking and content production (Tiching).

The most important vectors for ICT-intensive pedagogical and methodological improvement in our context are related to the promotion of investment on infrastructure and devices, the continuous professional development in terms of teacher digital competence, educational networking based on innovative projects and teacher development. Said vectors for improvement should also be addressed in ways that articulate the management of centers, communication, teacher training and methodological innovation. These dimensions are reflected and developed in the recommendations in section 6 of this document.

[15] E.g. education and teacher training, issues related to citizenship, and the sustainable digitization of schools.

Accreditation, career progression and professional categories are also possible areas of intervention to foster digital competence in teaching staff, as explained in section 7. Participants highlight the importance of taking into consideration the heterogeneity in teacher skill sets and the knowledge and experience gathered by already existing forms of voluntary teacher networking around ICTs.

Quality assurance at the national level is the responsibility of the school inspectorate, which is organized by regions. As mentioned in section 8, school inspectors are increasingly integrating concerns related to ICTs in the assessment of schools in different regions of Spain. The Teacher Digital Competence Portfolio, generated within the Common Digital Competence Framework for Teachers initiative of Spain's Ministry of Education is a tool that is increasingly being used to assess teacher digital competence in some regions of Spain.

In conclusion, educational policies for the integration of ICT in Spain have been discontinuous, although necessary to digitize schools and educational institutions. Moreover, there is a complete consensus that teachers have to be competent in the instrumental and methodological use of ICTs, and not only be in disposition of computer and digital material, but also know how to use it for pedagogical and educational purposes.

For this reason, clear educational policies at national and regional levels seem to be necessary, with a strong economic support and stable over time, that can be complemented by more local initiatives and innovations that may appear in the technological market. This type of educational bet can be an inspiring and motivating element for the different agents of the educational sector.

References

Alonso, C. (2012). La evolución de las políticas de uso de las TIC en la educación en Cataluña. In J. M. Sancho & C. Alonso (Eds.), *La fugacidad de las políticas, la inercia de las prácticas: La educación y las tecnologías de la información y la comunicación* (pp. 21–33). Barcelona: Octaedro.

Alonso, C., Area, M., Guitert, M., & Romeu, T. (2012). Un ordenador por alumno: reflexiones del profesorado de Cataluña sobre los entornos 1x1. In J. Hernández, M. Pennesi, D. Sobrino, & A. Vázquez (Eds.), *Tendencias emergentes en Educación con TIC* (pp. 83–103). Barcelona: espiral.

Bernal, A. I., & Lobera, J. L. (2015). You Have New Connections Uses of Social Media among Children, Teenagers, and Young Adults in Spain. In *Agents and voices a panorama of media education in Brazil, Portugal and Spain* (Eleá, Ilan). Gothenburg: The International Clearinghouse on Children, Youth and Media - Nordicom.

Boza, Á., & Toscano, M. de la O. (2011). *Buenas prácticas en integración de las TIC en educación en Andalucía: Dos estudios de caso*. Retrieved from https://www.uv.es/aidipe/congresos/Ponencia_VIICongresoVirtual_AIDIPE.pdf

Consejería de Educación/Junta de Andalucia. (2015). *Plan Provincial de Actuación, Servicio de Inspección Educativa Jaén - 2015/16*. Retrieved from http://www.juntadeandalucia.es/export/drupaljda/planes/16/03/PlanP_Jaen_ 2015-16.pdf

Departament d'Ensenyament. (2015). *Competències bàsiques de l'àmbit digital: Identificació i desplegament a l'educació secundària obligatòria (2a edició)*. Retrieved from http://ensenyament.gencat.cat/web/.content/home/departament/publicacions/colleccions/competencies-basiques/eso/eso-ambit-digital.pdf

Departament d'Ensenyament. (2013). *Competències bàsiques de l'àmbit digital: Identificació i desplegament a l'educació primària*. Retrieved from http://ensenyament.gencat.cat/web/.content/home/departament/publicacions/colleccions/competencies-basiques/primaria/prim-ambit-digital.pdf

European Comission (2017). *The Digital Competence Framework for Citizens With eight proficiency levels and examples of use*. https://doi.org/10.2760/38842

European Commission. (2007). *E-Skills for the 21st Century: Fostering Competitiveness, Growth and Jobs*. Retrieved from https://joinup.ec.europa.eu/sites/default/files/document/2014-12/media2531.pdf

European Commission/EACEA/Eurydice. (2015). *Assuring Quality in Education: Policies and Approaches to School Evaluation in Europe*. Luxembourg: Publications Office of the European Union. Retrieved from http://eacea.ec.europa.eu/education/eurydice/documents/thematic_reports/178EN.pdf

Ferrer, G. (2014). Las TIC en la LOMCE o una LOMCE con TICs. *Fórum Aragón - Revista Digital Del Fórum Europeo de Administradores de La Educación de Aragón*, (12).

Flora, K. (2015). Internet addiction disorder among adolescents and young adults: the picture in Europe and prevention strategies. In *Perspectives on youth. Volume 2, Connections and disconnections*. Strasbourg. Retrieved from https://book.coe.int/eur/en/perspectives-on-youth/6345-perspectives-on-youth-vol-2-connections-and-disconnections.html

Fornell, R., & Vivancos, J. (2010). *El Pla TAC de centre*. Servei de Comunicació i Publicacions - Departament d'Educació. Retrieved from http://ensenyament.gencat.cat/web/.content/home/departament/publicacions/colleccions/tac/pla-tac-centre/tac_1.pdf

Generalitat de Catalunya. (2015). El Govern defineix quines són les competències digitals que han de tenir els docents per aconseguir el domini de les eines tecnològiques entre l'alumnat. Retrieved January 9, 2018, from http://premsa.gencat.cat/pres_fsvp/AppJava/acordgovernidioma/6101/ca/govern-defineix-competencies-digitals-tenir-docents-aconseguir-domini-eines-tecnologiques-lalumnat.do

Hernández Abenza, L., & Hernández Torres, C. (2011). Hacia un modelo dinámico y eficiente de formación del profesorado. *Revista Electrónica Interuniversitaria de Formación Del Profesorado*, 14(1), 53–66. Retrieved from http://www.redalyc.org/html/2170/217017192005/

Meseguer, P., Moreno, J., Moreno, J. J., Olcoz, K., Pimentel, E., Toro, M., … Vendrell, E. (2015). *Enseñanza de la informática en primaria, secundaria y bachillerato: estado español, 2015*. Retrieved from http://www.scie.es/wp-content/uploads/2015/05/Informática-Primaria-ESO-Bach.pdf

Servicio de Inspección Educativa. (2013). *Plan Estratégico 2013-2017*. Retrieved from https://www.educacion.navarra.es/documents/27590/123571/Plan+Estratégico+2013-2017.pdf/47b792c0-275a-4b91-94c9-affbee13746e

Tsitsika, A., Tzavela, E., Mavromati, F., & Schoenmakers, T. (2014). Research on internet addictive behaviours among European adolescents. Athene. Retrieved from https://www.narcis.nl/publication/RecordID/publicat%3A1002690