THE IMPLEMENTATION OF ICT IN SECONDARY SCHOOLS IN CATALONIA

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Theoretical framework

Schools and Education in the 21st Century

One of the features that characterises our society is that ICT is present worldwide, specially in all productive processes and daily activities [1, 2, 3, 4, 5]. In the last decades there have been deep changes, such as the uprise of the world wide web and globalization [6], along with the convergence of new forces, including knowledge tools, thinking tools, digital lifestyles and learning research, that have led to new learning ways to live in the 21st century [7]. Furthermore, Europe today is immersed in a transformation period, due to an important economic crisis that has made the European Union to establish strategies to foster an intelligent, sustainable and integrating economy [8].

As far as education is concerned, the European Union has developed two strategic frameworks in 2000 and 2010 to improve the quality and efficiency of school systems and the access to education and training [9]. In Spain there have also been several national programmes of educational reform that follow the European strategies [10, 11, 12]. Europe 2020 is the EU's growth strategy for the present decade with specific targets in education that focus on learning as a continuous process associated to lifelong learning, learning ecologies, invisible learning and student centred learning [13, 14, 15, 16] so as to overcome what many authors have defined as a crisis of traditional educational systems [17, 18, 7, 19].

Students need new skills and competences to be fully integrated in the 21st century society; this is why ICT must be integrated in curricula [20] and why one of the key points in European education strategies is digital literacy, which is defined as the ability to effectively and critically navigate, evaluate and create information using a range of digital technologies.

The implementation of ICT in schools has been enhanced by European, national and regional programmes and laws. In Catalonia, the use of computers in schools started three decades ago. The most recent and important initiative has been the programme Educat2.0. It provided schools with interactive whiteboards in all classrooms, high-speed Internet connectivity and grants for students to buy a personal laptop [21], this is why it was also known as 1:1.

ICT and School Organization

The educational legal framework in Catalonia and Spain integrates the eight key competences established by the European Union at the end of the 1990s [22, 23, 24]. The EU defines a key competence as "*a combination of knowledge, skills and attitudes appropriate to the context*" [22], that is, the integration and application of theoretical and practical knowledge in a practical way to solve problems and react appropriately in settings outside the academic context. One of the key competences is digital competence, which "*involves the confident and critical use of information society technology (IST) and thus basic skills in information and communication technology (ICT)*" [22].

Despite the use of ICT in schools, there has been neither improvement nor innovation in the teaching and learning processes [25]. To take advantage of the educational opportunities of ICT, schools need both a global educational model at professional development, organization and curricular levels [26] and a strategic and effective use of ICT to improve outcomes [17, 19, 27]. Following this idea, the National educational authority in Catalonia has developed a programme to set strategic plans to implement ICT in schools [28].

E-Maturity in Schools

When organisations make strategic and effective use of ICT to improve educational outcomes, they can be considered e-mature [29, 30, 31]. To study e-maturity four dimensions have been set: infrastructures and digital culture, school organization and management, teaching processes and professional development [32, 33, 34]; but to become e-mature, schools pass through different stages of ICT implementation: initial, e-enabled, e-confident and e-mature [33, 35].

These levels of e-maturity can be explained as follow: In the initial level, schools have a basic ICT infrastructure and have started to use digital resources in teaching and learning, but there is little reflection on ICT use. Teachers have followed some training courses but less of 50% of the teaching staff are skilled enough to use ICT effectively.

E-enabled schools have a better ICT infrastructure and have started to develop ICT plans. Teachers integrate ICT in the curriculum and use digital resources more frequently. In this level, schools have started their way to e-maturity.

E-confident schools have digital classrooms, a reliable network and resources are available throughout the school and remotely. Technical support is provided. ICT is integrated into school through ICT plans, which are led by the head teacher. Teachers have participated in ICT professional development programmes and they use a large variety of digital resources. Students use ICT regularly with their own portable device.

Finally, in the e-mature level, all e-confident level features are reinforced and ICT is embedded in all the school. There is a shared ICT vision by all stakeholders. All teachers are ICT confident and use ICT in their daily plans. Students use ICT to support and assess their learning.

It has been shown that the frequency of use is irrelevant [36, 37]. However, the role of the principal [38, 39, 40] and the quality of teaching [39] have arisen as key elements in the setting of e-maturity in schools.

Methodology

The main research questions of this study are the following:

- How are schools organized to take advantage of the use of ICT and what is the role of the head teacher?
- Which educational practices empowered by the use of ICT are used in schools?
- How is ICT used to progress in their e-maturity level to foster the positive impact of ICT in the teaching and learning processes?
- How can educational policies enhance the school vision of ICT as an agent of educational innovation?

To answer these questions we have followed an inductive and holistic qualitative perspective [41, 42], which will be complemented with quantitative instruments according to the kind of data that we want to collect. We align this research with the interpretative paradigm, which states that reality is an observable subjective element built in a social way [43, 44]. But we also believe that reality has objective structures and features, whose critical reflection provides knowledge, that is, the socio-critical paradigm [44, 45].

Although these two paradigms may have a different ontological and epistemological basis, both can be used [46] to complement the research process [47]. From an interpretative perspective, we want to describe and analyse the organization of ICT in different schools and from a socio-critical perspective, we want to reach a global vision of reality, identifying key factors in the use of ICT in schools, from which guidelines for other schools can be developed.

Several methods and techniques are used to collect and analyse data. We use a triangulation of methods based on questionnaires, interviews, documentation analysis and focus groups to check data objectivity [48]. At present, three secondary school leaders have been interviewed and surveys for students and teachers have been designed and validated.

The research is based on three study cases. They are three schools of secondary education with technology rich environments that are recognized by their pioneer use of ICT. The school leaders of these schools have already been interviewed. The instrument that has been used is a semi-structured interview, which is useful to collect data in depth [41]. The interviews have a planned script to avoid bias [49] and unstructured responses were expected. The objectives of these interviews were the following:

- To know the school vision and organization of ICT.
- To know the role of the school leader in the management, planning and implementation of ICT.
- To know how the school evaluates the use and impact of ICT.
- To know how national educational policies can guide the use of ICT in schools.

Analysis of the first results

Although this PhD research has not been finished yet, we can explain the preliminary results of the interviews to the three school head teachers. We present below the findings of these three interviews, organized into four categories: school organization, school leadership and management, impact and evaluation of ICT, and educational policies.

School organization

In the first study case, the school started to implement ICT more than ten years ago as an initiative of the head teacher. She defines the school as innovative and in a continuous process of improvement. They embed ICT into the curriculum and the pedagogic school project to make them invisible, using a wide variety of digital tools. The head teacher believes that ICT must be present in the school, as they are in everyday life and they must foster learning inside and outside of the school.

In the second study case, the school started to implement ICT more than ten years ago also. The head teacher defines the school between innovation and tradition, where ICT is important methodologically. They make efforts to achieve a digital mentality and look after that teachers follow this path, using a wide variety of digital tools. The head teacher believes that ICT are essential and they have great potential in connecting education with reality.

In the third study case, the school is a new school and they started with ICT being a strategic feature of the school. They define themselves as inclusive and innovative. ICT is completely embedded in the school and they allow students and teachers to do things that couldn't be so well done before. They use a wide variety of digital tools and resources as an input to look up for information and also as an output for students' productions.

School leadership and management

In the first school there is an ICT committee in charge of making decisions and convincing teachers through improvement plans. They have made strategic decisions such as getting rid of textbooks and organising specific teacher development courses. They think that teachers must be good ICT users and be open to professional improvement.

In the second school there is also an ICT committee. They share information with teams of teachers to reach agreements on how to use ICT. The head teacher thinks he must be a keystone on this topic to make it work. They organise internal teacher development courses to support teachers. They think that teachers must have an open mind and be willing to learn.

In the third school there is also an ICT committee to detect problems and solve them. The head teacher is a keystone; he has made important decisions such as using iPads and getting rid of textbooks. They support staff with teacher development courses and individual advising. They think that teachers must be ICT users and be open and willing to learn.

Impact and evaluation of ICT

In the first school, they have many indicators to measure progress. They pass a questionnaire to teachers and students every term. Their students are very good at digital literacy and have very good academic outcomes but they cannot affirm whether it is because of the use of ICT.

In the second school, they pass a questionnaire to teachers and students at the middle of the school year. Their students have good digital skills, but they don't know the influence of ICT in school results.

In the third school, they pass a questionnaire to teachers, students and families at the end of the school year. The head teacher says that students have better literacy and numeracy skills and thanks to the use of ICT, they can know students better and personalize their learning.

Educational policies

The head teacher in the first school thinks that at present there are few educational policies that foster the use of ICT. They would like more help from the educational administration in terms of advising and support

The head teacher in the second school thinks that the educational administration should encourage the use of ICT in schools. He also affirms that the head teacher is also responsible for it.

The head teacher in the third school thinks that educational policies must be based on defined actions and at present there aren't. He thinks that the educational administration should stimulate the use of ICT and explain the benefits of it.

Table 1:   Preliminary results for each study case

	Study case 1	**Study case 2**	**Study case 3**
School Organization	- Innovative school - Make ICT invisible - Learning inside and outside school	- Between innovation and tradition - Efforts to achieve a digital mentality - Great potential of ICT	- Inclusive and innovative school - ICT completely embedded
School Leadership & Management	- Existence of ICT Committee - Strategic decisions by the committee - Specific teacher development courses - Teachers good ICT users and open to improvement	- Existence of ICT Committee - Teachers reach agreements - Internal teacher development courses - Teacher willing to learn	- Existence of ICT Committee - Strategic decisions by head teacher - Teacher development courses and peer advising - Teachers good ICT users and willing to learn
Impact & Evaluation of ICT	- Indicators to measure progress - Term questionnaires - Good academic outcomes	- Mid-year questionnaire - Good digital skills	- End-of-year questionnaire - Better literacy and numeracy skills thanks to ICT
Educational Policies	- Few educational policies - Need more advise from administration	- Responsibility divided between administration and head teacher	- Need of defined actions

Discussion and first conclusions

The first analysis of these three interviews to school head teachers seems to confirm some points of the studies on e-maturity and the role of principals in the implementation and use of ICT in schools. From the interviews, three main topics arise: the vision of ICT, the role of the principal and the importance of teacher professional development.

In these schools there is a shared clear vision of ICT by all stakeholders, which is considered one of the indicators of e-mature schools [31]. ICT is embedded in their daily activities using a wide variety of digital tools and resources to support, facilitate and personalise learning [33]. The reason why these schools started to use ICT is to narrow the gap between school and present society, so that students can master the skills needed in the 21st century [7]. This makes them consider themselves as innovative schools [34].

The head teacher in these schools has a key role in the implementation of ICT [40, 31, 35]. In the three schools, the head teacher was the person who decided to start using ICT in the teaching and learning processes, but they have developed a distributed leadership [33]. All of them have an ICT committee to make decisions and they use both a top-down and a bottom-up approach to share information and decisions [28, 40].

Finally, the three head teachers point out the importance of teacher professional development and teacher support [33, 34]. Three schools have organised ICT professional development activities for their staff. The three agree with the fact that the worthiest is in-house training and individual support for teachers, although each school has organized their professional development training according to their resources and needs.

As we have already said, these are the results and conclusions of the first analysis. The data must be completed and verified with the other instruments explained in the methodology section.

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