CONSIDERATIONS ABOUT THE INTRODUCTION OF ICT IN EDUCATION: HOW CAN TEACHERS OVERCOME THIS CHALLENGE?

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1 Introduction

This paper explores some aspects of the introduction of Information and Communication Technologies (ICT) in education that offer a challenge to teachers in their practices. ICT can be adopted in education for many purposes, and at all levels of formal education. The most important is its application in the classroom where it can serve as an instrument to teach and interact with students, and this raises some key issues regarding the way that technology can intervene in the processes of teaching and learning. ICT can be helpful in enhancing learning and teaching, as they can act as a vehicle for a co-construction of knowledge (Selwyn, 2008), although, owing to their specific features, they present challenges in the way they are implemented in educational contexts. These challenges are addressed in this paper.

The various factors involved in the use of ICT in education, the types of technology available and the different ways they can be applied, result in a complex experience for teachers, as they are not usually prepared to use digital technologies in their teaching practice (Laurillard 2008). This can make it difficult for teachers to adopt ICT as a teaching resource, and to engage in educational projects with the aid of these technologies. However, as can be seen in Laurillard (2009, p. 5), "in order to challenge digital technologies to deliver a genuinely enhanced learning experience, it is possible to use the educational theories already developed about what it takes to learn".

A characterization of the use of ICT in the educational field is outlined in the next section, followed by a description of some of the issues involved in its adoption for teaching purposes in the third section. In the fourth section there is an examination of how to overcome the challenges that are addressed. In the Conclusion, it is suggested that introducing ICT in education at an institutional level requires a multidimensional approach; it is also argued that teachers should rely on communities of practitioners and researchers in the educational field.

2 Characterization of ICT in education

New technologies are being introduced in education in developed countries, e.g. UK, (Walker and Baets 2008), as well as developing countries, e.g. Brazil (Almeida 2009; Ribeiro 2009). However, there has been little change in education with regard to teachers' needs; the reasons for this include the complexity of the educational system, which tends to be hierarchically organized, the rapid changes in technology, and the political characteristics of educational activities, which may also be determined by leaders who are not comfortable with the use of technology in education (Laurillard 2008).

2.1 Use of ICT in formal and informal learning

The informal learning sectors can make use of ICT for training personnel in the manufacturing and service sectors, although there are other fields of ICT application for learning purposes that are difficult to classify either as formal or informal, like the courses offered on an open basis, by governments, non-governmental organisations, museums, galleries, and other private or public institutions. Another issue in this analysis is how to classify courses or parts of the syllabus like university lectures that are now being

offered as open and free modes through the internet, e.g. Open Learn at OU-UK: (http://openlearn.open.ac.uk/), MIT Open Courseware: (http://ocw.mit.edu/OcwWeb/web/home/home/index.htm), and Open Educational Resources (http://www.oercommons.org/). The fact that all these types of "deliveries" can be regarded as learning supported by ICT is what education is about, and indicative of what role ICT should play in the learning process. Another view of this matter is referred to by diSessa (1988, p. 49), who points out that: "how one intends to use computers to aid learning depends in a dramatic way on what one thinks is important in learning".

The aim of this paper is to examine the issues related to the use of ICT in formal education, while taking into account that informal learning tools and techniques can be combined with a formal approach and that the boundaries between these two fields can be blurred. Moreover, formal and informal education can be regarded as a continuum as long as we take into account that in formal education people are being educated for their professional lives, and thus, they will continue with their education, on a lifelong learning basis.

Concerning the implementation of ICT in a formal system, from a module to a course or across a university syllabus, a number of issues regarding management and policies have to be taken into account, which is why the technical and managerial aspects of an ICT project are examined in this study, as well as its pedagogical applications. ICT is used both in formal and informal learning, and informal learning methods may be applied effectively in formal learning (Sefton-Green 2004). In a broad sense, formal learning stands for formal education, and informal for learning projects conducted outside the school. However, as Crook (2009, p. 30) argues, "dichotomising does not help", and formal and informal are categories that reflect a "certain way of talking and acting", that can occur in a formal environment, like the classroom, or in another environment outside school. Hence, in his view, the most important thing to recognise is that when we interact with the aim of bringing about learning , this can be in the classroom or outside it, and the classroom is a "device for intensifying and regimenting such [learning] experiences" (Crook 2009).

2.2 Dimensions of ICT in education

The term "dimension" in this context refers to the implementation of ICT systems at an organisational level, for programmes of distance learning or a software system for education management. In each case, it will be necessary to undertake the following: to define what kind of technology can cater for the needs of the project; to create, adapt or adopt software systems; to install, and maintain a technological platform; to make arrangements to organise courses and groups of students, to manage resources and logistics; and, to train pedagogical staff to create, design and teach courses. Thus, this enterprise comprises three ways of looking at the use of technology: technical, organisational and pedagogical. These three dimensions are interrelated, and have interfaces and overlaps. This means that people with different responsibilities should be engaged in the processes involved in the analysis, design, development, implementation and evaluation of the project of ICT for Education. Communication and team work are essential.

With regard to the technical dimension, this is important because often people from the school management and pedagogical staff do not have the skills to choose and use new technologies, so they depend on help from IT people. The value of this dimension is that teachers and school management staff are made aware of what skills are needed to use ICT for pedagogical purposes, and thus learn what to require from the technical staff.

As for the organisational dimension, the introduction of ICT requires changes in the organisation of classroom activities, pedagogical plans, and policies; the head teachers, administrators and teaching staff must be involved in the introduction of ICT. The planning of projects should be carried out by the management team which is ultimately governed by the school management, and cannot be left to the IT department, which is responsible for giving support, and not for planning educational technology projects, educational goals,, pedagogical schemes and the like. If teachers are involved in the discussion about the best way to implement technology to meet their objectives, they can express their needs and expectations about the use of ICT for pedagogical purposes. This means they will be able to participate in the project

design, and, as a result of their involvement, they are more likely to be motivated to adopt the project and have fewer difficulties in incorporating technology in the teaching and learning process.

These two dimensions have a great impact on the third, (the pedagogical), which, ultimately, is the main purpose of the implementation of any ICT project in formal education. Some important issues need to be considered here: the aims of implementing ICT, the resources that will be available for teachers, and the technical support available when teachers need it. In view of the fact that teachers are often unfamiliar with the technology, they face the challenge of learning how to use ICT and how to use it as a pedagogical tool. Teachers encounter new challenges, when they are required to acquire new skills to handle these new technologies. The learning of this new kind of language requires a new kind of literacy, (Crook 2009; Ingraham et al. 2007), consequently, incorporating new kinds of literacy poses new educational challenges. Furthermore, as digital technologies have not yet been devised for educational purposes, they must be adapted to and integrated with teaching methods.

ICT is used for managing, designing and teaching courses and modules, or for carrying out a wide range of learning activities. To support these activities, especially if they are undertaken in the school environment, users have to rely on technical support and a degree of organization of how the programmes should be run. A project must be devised to show how communication between the administrative and pedagogical staff and students will take place. Moreover, with regard to the area of logistics, there should be a plan for the delivery of the content and the teaching and learning activities, as well as to ensure attendance, to mention a few aspects of an educational system based on e-learning; thus, there are three dimensions of ICT applied to education: organisational, technical and pedagogical. These three dimensions have interfaces and overlaps, and are influenced by the socio-cultural features of the environment where education is contextualised; hence, according to Conole and Oliver (2007), these features determine the degree of complexity of the field.

3 Challenges

Given the complexity of the ICT both in the research field and in its application to teaching and learning, the question of how the technologies should be employed by teachers and students raises a number of challenges, e.g. terminology, technological development, range, the adoption of new tools, (Conole and Oliver 2007), and the teachers´ lack of confidence in using new technology (Wellington 2005). Moreover, as Conole (2007) points out, technological development is constantly changing with the availability of a wide range of new technologies, a fact that increases the difficulty of choosing and using ICT for educational purposes. One difficulty this causes is that some technologies are not created for teaching. According to Jonassen & Carr (2000), using computers as tools for learning "enables learners to think in ways that they otherwise would not and could not." (p. 167). Recently, technologies with features that allow different levels of participatory work, within the Web 2.0 concept, like podcasts, blogs, wikis, virtual worlds, and social networks, have been used to facilitate learning (Crook 2008). However, as Laurillard (2009) points out, these tools are rarely designed for educational purposes.

On the basis of this characterization of the use of ICT for educational purposes and the difficulties in using them for teaching and learning, engaging the interest of teachers, and supporting projects, it is essential to examine some procedures which can be effective in the endeavour of implementing and supporting ICT projects in education. Helping teachers to use ICT for pedagogical purposes is of great importance and a delicate matter, because apart from being trained, teachers must also be encouraged to engage in this task so that they can overcome the difficulties and frustrations that might prevent them from achieving desired outcomes.

The use of ICT requires a project that accommodates theory and practice; this requires adopting a theoretical perspective that can underpin the pedagogical practices. The next section discusses Constructivism as a theory that can be applied to help meet the challenges posed here and provide teachers with some guidance on what they can rely on when embarking on an ICT project for educational purposes.

4   How to overcome the challenges

The adoption of a multidimensional approach to the introduction of ICT in education – integrating technical, organisational and pedagogical areas – could help teachers employ technology in their pedagogical practices. However, as teaching is usually separate from educational research (Laurillard 2006), teachers tend to rely on their own practices to work out strategies for planning new teaching approaches. Here are some suggestions on how to overcome these challenges.

4.1   Teacher training

As the use of ICT can disrupt the teachers' work in designing and teaching learning activities, there are some essential issues that should be taken into account when introducing technology to the learning environment, three of which are as follows: teachers need to have the skills to use the technology; they must have the ability to know how to use it for certain subject-areas, purposes and audiences; and they must learn to become engaged in the task of evaluating their initiatives and tackling any problems that arise. Teachers must also learn how to use these technologies and accommodate them in the classroom and/or off-campus learning activities, as an extension of their studies or for assignments; hence, they must adapt and/or change their pedagogical practices.

Suitable tools should be chosen for certain tasks and audience needs, including the characteristics of the learning environment. Guidance on how to choose the most appropriate methods and tools can be obtained by adopting a theoretical approach, and examining experiments that have proved to be effective as good practices.

4.2   Constructivism for teaching and learning

The constructivist approach to teaching and learning has its roots in the theories of Piaget, who believed that knowledge arises from our actions and our reflections on these actions; the environment and the actions that take place in it constitute the experiential world (von Glasersfeld 1995). Another way of viewing constructivism is through Vygotsky's concern with the role of the adult and the learner's peers as they interact in conversation and negotiate meaning (Fosnot 1996a). In these two views, we can observe a cultural dimension to the learning process, i.e., the way people learn is conditioned by previous experience and the learning context. Dewey argues that the way we experience learning a particular subject depends on how the activities are organized and made accessible to the learner (Dewey 1997). Brown et al (1989) emphasise the situational aspect of knowledge, which is "in part a product of the activity, context, and culture in which it is developed and used". Knowledge is not separate from the situation in which it occurs. The authors also state that the situation in which knowledge is developed and deployed is "an integral part of what is learned", and thus not neutral. Learning and cognition are "fundamentally situated" (Brown et al 1989, p. 1).

As Fosnot (1996a) argues, Constructivism influences the teaching practice from the planning of the learning outcomes expected in a certain learning activity, to the didactics employed in achieving these outcomes, and the methods of assessment employed, when practitioners seek for "genuine learning". She sets out some principles for learning derived from constructivism that might be helpful if applied to educational practices, and which can be summarized as follows: teachers need to create meaningful, challenging learning contexts; they should provide the students with reflective activities through a wide range of formats and media that can enable abstract reflection to occur; learners should be responsible for entering into intellectual dialogues that make sense within the classroom community (Fosnot 1996b). As Conole et al (2007, p. 103) point out, technologies have the potential to enhance the learning experience, "but usually these opportunities are not being realised", due to a "a gap between the potential and actual use of technologies", and this gap comes together with "a failure to apply effectively the range

of learning theories that have emerged in recent years". However, Constructivism, "perhaps the most currently psychology of learning" (Fosnot 1995, p. 8), is probably the most applicable theory of learning for the introduction of ICT in education, owing to the experiential dimension of the use of new technologies in teaching and learning activities.

4.3   Collaborative work and action research

As well as the theoretical approach, teachers can also rely on good practices such as those found in communities of practices where they can encounter collaborative work among colleagues, who are experimenting with new tools in their teaching methods. They can share practices and discuss them in the light of the theoretical approach, and thus combine theory and practice.

As the use of ICT in education is a recent field of practice and research, teachers and researchers need a common ground of knowledge which can be acquired when the practice is dependent on the theory. If teachers share experiments which are applied in their practices, these can be enhanced by other practitioners in future situations, and then, shared and discussed, and tried out again, in an iterative circle. This means teachers can work collaboratively and count on the help of researchers in providing a theoretical background. In this way, experimentation and theorising can enhance the practice and research within a community of learning practice (Lave & Wenger 1991). Thus teachers should work as "action researchers", "collaborating to produce their own development of knowledge about teaching with technology" (Laurillard 2009, p. 1). As suggested by Oliver et al (2007), "Action research in educational settings involves practitioners researching their own educational situations and practices, as a means of improving these" (Oliver et al 2007, p. 33). With the same objective, according to Laurillard, (2006, p. 5) "all the characteristics of new technologies that make them good for learning make them well suited also to supporting the innovative reflective practitioner."

5 Conclusions

There are many factors to take into account when using ICT in education, as these technologies change the routine of the school and have a considerable effect on teaching practices. Teachers would be more willing to use ICT in their teaching methods if they were engaged in defining how the projects involving technology can be implemented for   educational purposes. As they are usually not familiar with the new technologies, teachers may find it difficult to adopt them. Regarding the organisational aspect of ICT in education, as teachers and the educational practices belong to a learning context, or, in other words, an institution (the school), it is essential to have a project that integrates the teachers, the school management and the technical staff, in a multidimensional approach. This poses a challenge to the people implementing or running projects that introduce the use of ICT in education, namely, what is the best way to involve the teachers and students, and maintain the continuity of the projects.

Some guidance to teachers has been outlined here to help   overcome these pedagogical challenges; this guidance is based on the application of constructivism as a theory of learning to support the choices of methods and ICT tools for pedagogical practices. It is also suggested that teachers rely on help from the research community, as well as other teachers. On the basis of a theoretical approach, teachers can rely on good teaching practices, as in communities of practices (Lave & Wenger 1991), where they can learn from other teachers' experiments. Thus, experimentation and theorising can be an iterative process, with teachers sharing teaching experiences within a community of practitioners.

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