ICT and new educational horizons in the complex society

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Introduction

A wide variety of terms are currently used to describe the present-day society model: communication society; information society; knowledge society; digital society (Sánchez *et. al.*, 2015) and, very rightly, Castells (2001) additionally coined the expression 'informational society.' In this case, a reference is made to the attribute of a specific social organization where the generation, processing and transmission of information become the sources of productivity and power (Gros Salvat, 2000: 20). As for information society, the emphasis is laid on the role that information plays inside society. Be that as it may,

> we are entering the so-called post-industrial society, knowledge society or information society, which demands a suitable response from school education as the only way to avoid being left aside from the culture and knowledge communication circuits. [...] We are already, and we will be more and more strongly immersed in a world where

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> education is bound to become a decisive activity when it comes to being able to participate and form part of that universe or to being excluded from it. Information society actually designates a condition of society in which a specific type of knowledge and data circulate at a fast pace, breaking the barriers of defined cultures and the frontiers of distance, as well as the limits associated with information storage and processing (Gimeno Sacristán, 1999).

With regard to our society, information does not appear as the most outstanding element of present-day society; what happens is that the latter has undergone a profound transformation. Gros Salvat (2000: 21) argues that "information and communication technology is transforming society not only from an economic and a political point of view but also at a more personal, individual level. This transformation affects the ways to access knowledge, the forms of learning, communication, and personal relationships, as well as our own identity". A transformation is simultaneously taking place across research contexts as a whole and, more precisely, in educational research (Duart & Mengual, 2014). Faced with this environment, our focus will be placed on research into Information and Communication Technologies, insofar as technology constitutes a basic pillar of knowledge society (Mallorquí-Ruscalleda, 2015).

Approaches and scopes of action for the educational research devoted to ICTs

The aim sought with this section consists in providing an eclectic description of the topics around which ICT-centered research has revolved. Thus, three broad approaches or perspectives have traditionally been defined within research into ICTs (Area, 2000):

- Technical-empirical perspective about comparative media effectiveness or behavioral approach. It is worth mentioning

media analysis from behaviorist approaches which developed during the 1950s and 1960s. Questions like the following arise from this perspective: Which teaching medium is the most effective one? Which instructional technique provides higher effectiveness when using specific media?

- Symbolic-interactive perspective or cognitive approach. The emergence of a cognitive paradigm (in the 1960s) together with information processing led to revise the foundations on which the study about the effects of media on teaching was supported, the emphasis being placed on the analysis of the interaction between subjects' cognition, the systems used for the symbolic representation of media, and their context of use. This approach results in questions such as: Which media attributes turn out to be relevant for students, with which educational treatments and for which learning tasks?

- Curricular perspective. The previous perspective started being rethought from the 1980s, with the incorporation of curriculum as the most important referent for the study about media. These works examine real situations of media use and thus pay attention to a variety of aspects, amongst them the design of materials by the teacher, the teacher's perception about the media, or the institutional conditions for the integration of computer resources.

- It also becomes necessary to highlight the diverse existing interpretation perspectives described by Berger and Luckman (1991):

- Semiological. Analysis about symbolic media systems; expressive, aesthetic and communicative loads, amongst others... Organizing the media—color, planes, implementation, etc.—makes it possible to improve communication.

- Marxist. Examination of aspects such as alignment, class conflict, consumerist society... Media not only transmit information but also have a social manipulation capacity.

- Psychoanalistic. Personal contributions of people to the media.

- Sociological. Impact caused by the media as cultural, pattern-shaping elements, and learning of those behaviors which characterize the society that we live in. Media determine both culture and ways of thinking.

Cabero & Llorente (2015) adds the didactic-curricular one to the four perspectives mentioned above. In this respect, the bibliographic production about ICTs may prove illustrative of the research undertaken in this field, and that poses a real challenge—with some advantages and quite a few difficulties too.

Educational research into ICTs in Spain. Background and current situation

The consultation of databases and bibliographic repertoires has proved to be the most fruitful way to investigate research themes and topics (Delgado *et al.*, 2014). It is true that direct information from lecturers or researchers will probably offer valuable information, even on reflection topics which have not been dealt with yet, but consulting such sources seems more than problematic; hence the consideration of documentary bases as a more effective though incomplete way, especially when—as it happens in Spain—no general database exists, and those which are actually available have a fragmentary nature and cannot be endorsed in their functions, entries and descriptions.

"A remarkable variety of approaches existed [in the late 1980s] both regarding the selection of study topics, scopes and problems and in terms of the methodologies and conceptual platforms on which research was supported" (Area, 2000). Amongst the main topics covered by research at the time stand out: educational television; application of audiovisuals and computers to teaching; teacher's thinking and practice in the use of technological media; integration

of these resources into educational centers; systems of symbols for the media; analysis of textbooks; and design, development and evaluation of audiovisual and computer-based materials. In turn, the methodological approaches were quite diverse too, since methodologies of a quantitative or a qualitative nature were adopted depending on the problems under study and the teachers' own epistemological stances.

Since the early 1990s, the different publications about the Education Theory and the New Technologies applied to Education have not left the visions of Education Theory as the science of instruction (Sancho *et al.*, 1998) and, therefore, as a way to plan teaching, even though most of them delve deeper into the analysis, the proposals and the suggestions for the utilization of New Technologies in teaching. As for research content and methodological trends, those presented in the study by Sancho (1994) still remain valid. As a general rule, research works focus on:

- Models
- Intervention programs
- The actual media: the medium itself, the equipment, the applications web, the programs, and the didactic application modes
- Analysis from the social context perspective
- Research and development

With regard to methodological perspectives, the media comparison paradigm persists together with the tendency to stress the complexity of the different phenomena and the views of those involved, as well as 'the theoretical' perspective, which try to bring the readers closer to the characteristics of new developments, spreading their 'wonders,' appreciating their social impact, identifying their limits and dangers, or proposing them as the new panacea for the everlasting problem of teaching and learning (Koehn, 2014).

Teseo, the database of the Spanish Education and Science Ministry (MEC for its initials in Spanish) which constitutes the main repository of doctoral theses defended, the topics revolve around descriptors such as: audiovisual and pedagogy; television and education; technology and educational; multimedia and education; or computer and education. The topics examined refer to aspects like the following: evaluation of technological intervention programs, either through the design of new technological formats or through the assessment of already existing programs in teaching and learning situations; analysis of media and the effects derived from their utilization; didactic models or approaches that include the incorporation of new tools for the treatment of information into the educational process, etc.

The results obtained from our search on the 'ERIC' database using the indicators Spain AND Multimedia, Spain AND Computer AND Education, Spain AND Educational AND Technology include: interactive multimedia; information society challenges; networks, collaboration and teacher training; hypermedia; computer-assisted animation; education with special (auditory, motor) needs; rural education; new technologies; learning and innovation; video; community education and mass media; CD-ROM and databases; curriculum development; distance education; problem solving; and self-adapted tests.

As far as scientific publications are concerned, the *Revista de Educación* [Education Journal] published by the Education and Culture Ministry, with over 324 issues published—apart from several extraordinary issues (for instance, the one dedicated to the Spanish educational system during the Enlightenment period)—constitutes an unquestionable reference when it comes to reflection, research and innovation associated with education in Spain. In addition to this journal, a wide range of publications—

such as *Comunicar*, *NAER-Journal of New Approaches in Educational Research*, *Píxel-Bit*, and *Edutec* to quote but a few—have chosen ICTs as their predominant study object, paying attention to areas such as the ones listed below:

- ICTs applied to educational center management
- ICTs as a working tool for the teacher
- Support classrooms: diagnosis and rehabilitation
- ICTs as a didactic means for content development
- ICTs as a curricular content (computer utilization)
- ICTs as a communication tool
- Educational applications

As can be seen, a plurality or diversity of 'genres' or types exists. This seems highly convenient, insofar as it can become a symptom of the varied strategies (and tactics) that researchers have thought about and devised in order to be able to give a response both to the educational needs and to the convenience (and—once again—the need) to make the most of the large potential that ICTS own, so that education can largely benefit from it (Guri-Rosenblit, 2009).

It would thus be interesting to carry out exhaustive bibliographic inquiries about various issues of interest such as: Is it possible to observe the evolution followed by research into ICTs? Which topics or matters or aspects related to ICTs and their educational application on different levels have aroused greater interest amongst critics/scholars, researchers or teachers? Which ones have been the most neglected? Which aspects should deserve more attention in the future?

Educational research in the new digital scenarios

The accelerated consolidation of 'information society' approaches in all the spheres of our environment, along with the consequent spreading of computers and the Internet across every layer of our society has resulted in a convergence of the researcher's interest towards a priority

thematic line or context: the educational integration of ICTs (Castaño *et al.*, 2012; Castaño, Duart & Sancho-Vinuesa, 2015). Several issues of interest can be highlighted within this broad thematic area, namely:

- Gender issues
- Students' attitudes towards the utilization of new technologies
- Effectiveness of systems
- Development of cognitive skills (construction of concepts, cognitive styles, etc.)
- Cognitive benefits of programming (with hypermedia tools this time)
- Thus, trends revolve around the following ideas:

Technology, understood as the use of resources for the treatment of information and communication, has entered all the spheres of school and academic culture, and both in terms of topics and across educational levels (from infant education to University, initial and permanent vocational training, and non-formal education).

Research applies all sorts of methodologies, although experimental vision and questionnaire utilization predominate. The interpretative vision (ethnographies; action research; case studies with qualitative data treatment...) continues to be present.

One can discern the appearance of new computer-assisted teaching environments: 'Virtual learning environments' and all the problems related to organizational, cognitive or technical aspects, to collaborative learning environments, etc.

On the whole, a reflection could be made about the fact that computer-based thinking implies mental operations other than those involved in reading a book—and therefore a specific pedagogical proposal as well. It does not make sense to assume that the power of technology alone is going to make the old processes work better. Its use should help

organizations to have the capacity to break the old molds and create new working and operation forms. The approach must focus on how to use the new technologies to do the things that we still cannot do, and not only on how to be able to utilize them in order to improve the ones that we already do.

Within the educational system, information constitutes an element which is transformed, knowledge being the main element produced. The use of current ICT's poses certain questions: How/To what extent is the teacher's role modified in knowledge society? What role will be played by educational institutions? What is the role of these technologies inside institutions? What impact are they going to have on the different modalities? How can ICTs be utilized?

This technology is firstly modifying the way in which knowledge production takes place. For this reason, teachers have to acquire new capabilities and skills which allow them to become professionalized in the use of these resources which are typical of knowledge society, since these technologies play a fundamental role in the whole educational transformation. And, most importantly, they are also transforming the teaching-learning process.

All in all, it is our conviction that the future research prospects revolve around finding ways to:

Provide students and teachers with relevant examples and media-based or people-based resources so that they can improve their practice; and to help them utilize those examples and resources in the best possible way.

Design learning environments and materials which make lifelong learning easier with a model 'at the right time', either at the working position or where students need to learn.

Anticipate the challenges involved in the organization of education, training, the teacher's role in teaching models

'at the right time', and constructive learning, where students acquire an increasingly high degree of self-responsibility.

Make progress in design and assessment methodologies with the aim of achieving an ongoing improvement of both usability and the cost-quality ratio in computer-based learning resources.

Develop theories about the nature of learning and its implementation within an ever-changing situation.

The Horizon reports which are published on a yearly basis cannot be overlooked when it comes to identifying the aspects that can eventually become the object of research in our opinion—as well as the future trends for ICTs.

By way of conclusion...

The present paper had as its aim to modestly shed some light on the old and new frontiers within the framework of educational research into ICTs (Karagiannidis, *et al.*, 2014). Faced with the dilemma between the particular—concrete or specific—vision and the general one, our purpose is modest and previous: simply to establish a vantage point which can serve as a basis or reference for us to orient ourselves in the truly pelagic sea that the panorama of educational research into ICTs can be. A sea which is only part of the ocean formed by educational research on one side and the ICT context—subject to permanent and continuous updating—on the other.

Our analysis leads us to believe that a sort of 'Ariadne's thread' exists through which it is possible for us to move in a relatively safe way, conferring a certain degree of unity upon the aforesaid analysis. This can be achieved if, firstly, our specific frontier lines are fixed on the basis of specific research objects associated with ICT educational integration. And secondly, it becomes necessary to establish overall perspectives which can integrate these research works into other fields, so that interdisciplinary studies can be

undertaken for the purpose of defining new global frontiers around educational research inside knowledge society.

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