Critical Review of Research in Educational Technology in Portugal
(2000-2005)

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Abstract: Educational Technology has developed in Portugal since mid 70s. Many research studies in the field have been developed since then and most of these were reviewed in a meta-analysis conducted by one of the authors that covered the period between 1985 and 2000. A great deal of work, nevertheless, still needs to be done, if we want educational technology in Portugal to flourish, becoming a recognised and established area of research.

This has been the main goal of the project we present in this paper: 466 documents (papers and dissertations) published between 2000 and 2005 were analysed in order to identify the main areas of interest and research of educational technologists in Portugal.

More than a simple portrait of what has been and ET in our country, we believe that the analysed data point out interesting cues that should inform governmental decisions and define priorities for research in this educational domain.

1. Introduction

Systematized studies developed around the potential of technology in education already have a few decades of existence. Nevertheless, the first attempts to detect research "trends" in the studies carried out occur only from the mid eighties, with the aim of unifying the work of professionals in the area, around a research "agenda" (Hannafin & Hannafin, 1991; Brennan, 1992; Bartolomé & Sancho, 1994). It was not, however, an easy task for the ones who embraced the organization/systemisation, from a thematic and/or methodological point of view, all the research conducted in the field of Educational Technology (ET) and divulged in the literature. Plurality and diversity of the areas of interest and of research in ET is an undeniable reality that placed serious difficulties to all systematisation efforts. Still this did not prevent the appearance of comprehensive and solid reviews of which the monographs of Donald Ely or of Alice Brennan in USA are paradigmatic examples (Ely, 1992, 1997; Brennan, 1992) or the vast synthesis conducted by Alonso & Gallego (1994) in Spain. In Portugal, the relative "youth" of educational sciences somehow justifies the scarceness of studies that report synthesis of previous research. Nevertheless there are very good examples like the compilations coordinated by João Ponte as to the use of computers in education (Ponte, 1991), or even, more recently, the analytical study conducted by Coutinho (2005) about the state of the art of fifteen years of scientific publications in the field of ET in our country.

2. Theoretical Framework

If we want to systematise the research developed in the field of Educational Technology we need to go back to the decades of 50`s and the 60´s, when the first systematized studies began to emerge. At that time, behaviourism determined the theoretical framework for research and educational researchers were interested in determining which technological medium was more effective for helping students to learn. On this perspective, it was expected that new audiovisual media could function as additional sources of stimulation and motivation to student learning process, and for 2 decades research was conducted through comparative studies analysing the impact of different media on learning (visual versus scripto, film versus still picture). However research results were disappointing when compared to initial expectations because no single media proved to be better than the other, because as Clark (1983,

p.445) claimed "media are mere vehicles that deliver instruction but do not influence student achievement any more than the truck that delivers our groceries causes changes in our nutrition".

Although the "media and learning" question continued to be one of the most "researched" problems in the history of education and communication systems, in the following decades the focus of research in ET changed completely. The new principles of cognitive theories determined research focus to concentrate into the reciprocal influence of instructional media, the instructional setting, and the learner: each medium is capable of conveying content via inherent symbol systems that interact with the individual characteristics that determine what information is selected and how it is interpreted.

Analysing how and what can be learned in technological learning environments become the goal of research in the field. The development of hypertext and hypermedia systems allowed the integration of different media in sophisticated learning systems that encountered the principles of constructivist learning environments, and that became the focus of research in ET from mid 80´s to the end of the century. In a review of hypermedia-based learning, Ayersman (1996) discussed four strands of research into learning and hypermedia: research based on perceptions or attitudes about hypermedia; research based on individual differences or learning styles; research based on system analyses (which examined the most effective ways to structure hypermedia); and, research based on performance which ranged from use of pre-made software to the construction of one's own software.

Again, the optimistic results of the potential of hypermedia for learning did not correspond to initial expectations. In fact, McKnight, Dillon & Richardson (1996) after reviewing various studies on learning with hypermedia, concluded: a) few significant differences between results for linear instruction and hypermedia; b) need to focus less on the process of learning and more on the outcomes (student achievement); c) an evolutionary approach to design based on user-centered task-based design should be taken.

Current constructivist learning theory values interactivity, activation of prior knowledge, connecting the theoretical to the empirical, and using relevance and efficacy to assess information; learning is not simply assimilating knowledge transmitted by textbooks and instructors but personally building and communicating knowledge (McKnight et al, 1996).

In learner-centered environments, teachers are seeking to develop a broad understanding of the learner. There is a focus on the knowledge, skills, and attitudes the learner brings to the environment. Teachers create challenges for students that are engaging but not so difficult as to result in student discouragement. Attention paid to the progress of individual students and instruction is differentiated (Donovan, Bransford & Pellegrino, 1999).

2.1 Learning Environments in the 21st Century

The beginning of the new century determined a new focus in research. In fact, and although the object and the subject of study of the more recently published studies are still diverse, one can say it is building mainly on the capacities of the internet (Area, 2000). The Internet and its applications in education and industry have significantly influenced the way we teach and learn. This has all occurred as a consequence of emerging technologies and the demands for online instruction by consumers. In the midst of this environment of rapid growth, a new form of pedagogy has emerged; e-Learning is a new popular mode of instruction and learning is a systematic approach to researching the pedagogy of online instruction, interface designs, the application of technologies to e-Learning. Much of the existing educational research on print materials, telephone, radio, television, video, and computer, in one way or another can carry over to the Internet. However, since all of these media converge on the Internet, a new and challenging area of educational research is emerging (Moursund & Smith, 1999).

Laferrière et al. (2001) review emphasizes the network capacity of classrooms and schools, and not only the simple fact that resources and tools are online. A comprehensive framework emphasizing extreme circumstances of use is brought forward, followed by propositions that organize results found in scholarly works and other highly relevant studies, pointing to emerging observations in the process. The main constituents of the organising frameworks are based on Schwab's four constituents (teacher, content, learner, and context) but elaborated on along a continuum that is relevant for treating the role and effects of online technology in the classroom: a) the teacher (continuum: from transmission to facilitation); b) the content (continuum: from "pre-organized" or "canned" to "constructed"); c) the learner (continuum: from limited access to online resources to high access to online resources); d) the context (continuum: from low external support for online use to extensive external support for online use).

Markauskaite (2002) reviews the theory and practices of research in ET. The author investigates general theoretical research methods and the main peculiarities of ET implementation analysis. It presents the main concepts and definitions of research theory and it discusses possible evaluation aspects of technology use in education, classical features of ET research frameworks and their main components. While analysing the elements of research

frameworks, structure and peculiarities of education systems briefly discussed. The article also reviews the main types of research in technology use in education and analyses evaluation problems of ET implementation. The author, in another article published in 2003 (Markauskaite, 2003), reviews in the field carried out in the world. First, the author presents the retrospective of research on implementation of ET in education. Summarizing them, it reviews main research findings in five areas of implementation some of them similar to the ones analysed by Laferrière et al. (2001): 1) the impact of technology use on students achievements and attitudes; 2) the impact of ET on teachers; 3) the effect of teachers' factors and instructional methods on efficiency; 4) the influence of infrastructure and organizational factors; 5) the effect of specific software design features. Then, the paper reviews the main recent and future directions of researches on the field of Educational Technology in the world.

Some other studies are centred in more specific areas of research such as Computer Supported Collaborative Learning – CSCL (Lehtinen, 1998), the use of Virtual Learning Environments - VLE systems (BECTA, 2004) or special education and computers (Roder, 2004). The BECTA report examines the potential benefits of online learning platforms that are claim, across various educational sectors.

In Portugal, the review conducted by Coutinho (2005) and related to the period 1985-2000 allowed to trace a general view of the field at the turn of the century. In fact, although the author could not identify research lines shared among universities or among these and other teaching institutions, it was possible to organize research studies into three different periods. An initial period (that corresponds to the eighties) during which the few research works had to do with a strait thematic variety, constituting the majority of individualized works/projects developed most of the times on the extent of the accomplishment of the investigators scholarly careers, with few application in terms of using results to solve real, concrete, educational problems. The following period (the whole nineties) was characterized by a notable variety of research problems and conceptual frameworks (from the educational uses of audiovisual media, computers in teaching to the exploration of the potentialities of the "hypertext" and "hypermedia" systems in education; studies on media uses in schools, complemented with studies focused on the thought and on the teacher's / student's practice using the audiovisual media, etc.). In consonance with this thematic diversity, the research designs were ruled for the methodological diversity within quantitative designs (experimental designs and surveys that, all together, represent more than 75% of the empirical research). However, in the late nineties, this tendency of the thematic diversification began to change, making it possible to identify a trend towards a main thematic axis: the internet educational applications and uses.

We are now at the beginning of the year 2006 and a lot of research studies and projects have been conducted and published since then by educational technologists in Portugal but we still need to verify what really has happened in the field of ET. This is the purpose of this paper: to review and systematise studies conducted in Portugal and published in the literature of the field from the beginning of 2000 to the end of 2005.

3. Method

In order to pursue the research goal we decided to use the literature as the best comprehensive coverage of current thinking in the field. The basic premise we assumed was that thematic research trends in ET can best be determined by analysing what professionals in the field investigate and publish through journals, conference proceedings and dissertations abstracts.

We followed the general principles of content analysis using trained coders to make independent judgements about the literature being reviewed. Group discussion about findings has to reach high interrater reliability for each item before it was placed in an agreed-upon category. When items fall into more than one category, the dominant content or emphasis determined placement in the most appropriate category.

The literature sources of information included papers published in highest-ranking education journals in Portugal, conference presentations given at major national and international meetings attended by Portuguese authorship between 2000 and 2005, and dissertations abstracts of master thesis concluded in two of the most relevant universities for the field of ET in Portugal (Universities of Minho and Aveiro).

We believe that although research trends are more likely indicators that foreshadow the future, they can be very helpful in order to systematize what has already been done and inform the future policies and the research in the field of ET.

3.1 Documental Data Sources

Four hundred and twenty and three articles and 43 dissertations abstracts were included for analysis. The educational sources for the documental database were:
- Journals: Revista Portuguesa de Educação; Revista Portuguesa de Pedagogia; Educare.
- Conference Proceedings: Symposium International Informática Educativa (2001, 2002, 2004, 2005); International Conference - Desafios/Challenges 2001, 2003 e 2005; Conference e-Learning on Higher Education, 2004; Congress Galaico-Portuguese of Psycopedagogy (Congresso Galaico-Português de Psicopedagogia, 2001, 2003, 2005); Colloquies AFIRSE (2002, 2004)
- Abstracts of master degree dissertations presented at the Universities of Minho and Aveiro between 2000 and 2005.

3.2 Units and categories of analysis

Although we could find in the literature several previous studies analysing thematic topics in the field of Educational Technology (cf. Clark & Sugrue, 1991; Ely, 1997; Coutinho & Chaves, 2001; Coutinho 2003; Coutinho & Gomes, 2006), the recording units we used in the analysis did not follow any specific pattern from previous projects.
In fact, the thematic categories we used emerged from data analysis and so corresponding more to the specificity of the object of the research synthesis. One first content analysis of the documents originates the thematic categories list we present in table 1.

Thematic Categories	
	Virtual learning environments
	E-learning/Distance learning
	Internet/www
	Hypermedia
	Multimedia/educational software
	Image/Video/Audiovisual
	Teacher Education
	Curricular Integration
	Research
	Other topics

Table 1: Thematic Categories

A consistent methodology was used following the general principles of content analysis and the authors, experts in the field, served as independent coders for analysing the literature being reviewed; title and abstracts were the main sources of information but when they were not sufficient in order to identify the main topic analysed, the whole text was taken into the analysis. When records fall into more than one category, a discussion between the two coders determined placement in the most appropriate category.

4. Results and discussion

The first evidence we could find out from data is that Portuguese educational technologists publish their educational projects and research findings essentially in conference proceedings (85,2%), a feature that characterises the field of ET in Portugal. Probably one reason for this is related with the fact that many studies in ET are forms of applied research, related to classroom settings and teachers/researchers prefer to attend conferences where then can debate and discuss with their peers. This also justifies the high levels of recording units in the years of 2001 (34,98%) as well as in 2005 (26,36%) as in both years occurred some of the most important conferences in the research area of IT in education (SIIE 2001, 2005; Challenges 2001, 2005; Galaico 2001, 2005) (see Table 2).

Year	Frequency	Percent	Cumulative Percent
2000	27	5,79	5,79
2001	163	34,98	40,77
2002	32	6,87	47,64
2003	55	11,80	59,44
2004	66	14,16	73,61
2005	123	26,39	100
Total	466	100	

Table 2: Conference papers published by year

Table 3 shows the 10 thematic categories for each year of the period 2000-2005. As one can see, the top thematic was "E-learning/Distance Learning" with 102 recording units representing 21,9% of the total recording units. We can also verify the increase of the number of units for this topic that counted one only record in 2000 but 24 and 36 in 2004 and 2005 respectively. "Internet/www" and "Teacher Education" with 13,9% each, as well as "Curricular Integration" with 13% of total records, where the leading themes in the documents included in the database.

As to the less published thematic -"Research" - with 9 units only, we believe that is justified by the relative youth of the field in Portugal and the relative scarceness of research projects whose object of study are previous studies in the field (Coutinho, 2005). The evolution in recording units along the period seems to confirm our assumption (56% for total units in this category were registered in 2005).

"Image/Audiovisual/Video" and "Curricular Integration" are themes that slightly decreased in number along the period; "Hypermedia", "Multimedia" and "Teacher Education" maintained a sustained position all the period around.

Another interesting cue is relative to dissertation (a total of 43) and the thematic they versed: in fact, "Image/Audiovisual/Video" with 9 records was the most focused thematic (21%t), followed by "Hypermedia" with seven records (16%).

	2000	2001	2002	2003	2004	2005	Total
Virtual L. Environments	2	19	1	6	11	11	50
E-learning/Dist Learning	**1**	**24**	**7**	**10**	**24**	**36**	**102**
Internet/WWW	2	23	4	7	4	24	64
Hypermedia	5	6	5	3	2	6	27
Multimedia/software	1	23	5	5	5	10	49
Image/Audiovisual/Video	3	11	4	5	2	5	30
Teacher Education	4	23	3	6	12	14	62
Curricular Integration	6	30	2	11	5	10	64
Research	1	2	0	0	1	5	9
Other Topics	2	2	1	2	0	1	8
Total	27	163	32	55	66	123	466

Table 3: Thematic categories by year

In order to obtain a more precise picture of the field in Portugal we decided to assemble some of the 10 initial categories in larger thematic topics using the same conceptual logic referred in a recent study developed by the authors (Coutinho & Gomes, 2006).

"Virtual Learning Environments", "e-Learning" and "Internet" were integrated in a broader category that was named "Web-Based Learning" integrating all learning strategies that have in common making use of the network facilities of the web as a teaching tool (Kahn, 2001).

"Hypermedia" and "Multimedia" themes were grouped together into broader category integration both designations - the conceptual basis for such a fusion is widely justified in the literature of the field (Galbreath, 1992).

Finally, "Research" was integrated in "Other Topics" due to the irrelevance of its relative proportion in the total of the recordings units.

The 10 initial topics were reduced to final six as schematised in table 4.

Initial categories	Final categories

Virtual learning environments	Web-based learning		
E-learning/Distance learning			
Internet/WWW			
Hypermedia	Hypermedia/multimedia		
Multimedia/educational software			
Image/Video/Audiovisual	Audiovisual Learning		
Teacher Education	Teacher Education		
Curricular Integration	Curricular Integration		
Research	Other topics		
Other topics			

Table 4: Initial and final thematic categories

Table 5 shows results for recoded categories. We can verify that "Web based Learning" represents almost half of the total documents (46,4%) published by Portuguese educational technologists in the period of analysis; in 2000 this thematic counted around 18,5% of the total articles for that year but, in 2005, it counted more than 57% of all units for that year. All other categories either sustained or decreased their relative weights along the period, except for "Hypermedia/Multimedia" that, in 2005, registered a slight increased in the percent of recordings units for that year.

Main Topic	2000	2001	2002	2003	2004	2005	Total
Web Bas. Learn	5	66	12	23	39	71	216
Hyper./multimedia	6	29	10	8	7	17	77
Audiovisual Learn.	3	11	4	5	2	5	30
Teacher Ed.	4	23	3	6	12	14	62
Curric.Integration	6	30	2	11	5	10	64
Research & Others	3	4	1	2	1	6	17
Total	27	163	32	55	66	123	466

Table 5: Final thematic categories by year

5. Conclusions

Educational Technology in Portugal is now a flourishing field of research. If in the 80`s and mid 90´s research in field (and its impact on teachers, students, contents and contexts) was very limited to academic contexts and was often left "to rest" in libraries, without leaving the academic realm on to the potential settings of application, the turn of the century reflected, as reported by Coutinho (2005), a crescendo in volume and a stage of maturity visible both at thematic and methodological levels: a) the emergence of research lines ; b) the use of diversified methodologies that fit better the complexity of educational settings, and c) the concern for well designed studies in the area.

Six years have passed since then. Even admitting all the subjectivity associated with content analysis methods – in our study the number of documents by category formed the basis for identifying the most frequent topics – we believe that the actual profile of what is now investigated in Portugal in the field of ET can be organized around three main thematic areas. The most important one – Web Based Learning - congregates research on e-learning (theory and practice); blended learning solutions; support of communities of learners (collaborative learning); development and testing of virtual learning experiences, among others. The second thematic axis, analyse the design and evaluation of educational software (multimedia and hypermedia; design of instructional websites; usability testing). The third one we could call "Teachers and Technologies" concentrates on questions related to teacher education (attitudes, opinions, uses), experiences and practices of learning with ICTs particularly with the internet services (webquests, weblogs, etc); organizational topics related to the management of school infrastructures (computers, wiring-networking, internet access, media centers among others.

The profile we have traced for the field of ET in Portugal shows that what concerns and interests educational technologists in Portugal is not very different from what worries researchers in other countries and educational settings; the review we reported in the theoretical framework confirms that. In fact, the basic requirement for education in the future is to prepare learners for participation in a networked information society in which

knowledge will be the most critical resource for social and economic development. This is a major concern for all educational systems of the western world, so the search for the best answers and solutions must be a common goal to all professionals in the field.

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