# Information and Communication Technology Changing Education

Edited by

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Icfai Books™

The Icfai University Press

# Information and Communication Technology: Changing Education

Editor: Debashree Mukherjee

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First Edition: 2009
Printed in India

*Published by*

**The Icfai University Press**
52, Nagarjuna Hills, Punjagutta
Hyderabad, India–500 082
Phone: (+91) (040) 23430368 – 370
Fax: (+91) (040) 23435386
E-mail: icfaibooks@iupindia.org
Website: www.books.iupindia.org

**ISBN:** 978-81-314-2308-0

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# ICT in Education in Portugal
## A Review of 15 Years of Research

*Clara P Coutinho*

***ICT in education has developed in Portugal since mid 70s. Although it was integrated in teacher education curricula, a definite impulse in the field can be traced to the beginning of the post-graduation teacher training courses in the end of the 80s. Many research studies in the field have developed since then. Nevertheless, there has neither been a systematic survey of the research studies being carried out so far, nor a meticulous analysis of its contents and evolution. However, we know that such work is needed if we want ICT in education domain to be recognised by other educational partners and departments in Portugal. This has been the main goal of the project we present here: 460 Portuguese papers which were published between 1985 and 2000 were analysed.***

***More than a simple portrait of what has been and is now ICT in education in our country, we believe that the analysed data point out interesting cues that should promote 'food for thought' and a wide debate among all our research community.***

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## 1. Introduction

Systematized studies developed around the potential of technology in education have a few decades of existence, but only from the mid eighties did the first attempt to detect "trends" in the research carried out occurred with the aim to unify the work of professionals in the field around a research "agenda" [1], [2]. It was not, however, an easy task for those who embraced the organization and systemization of the research conducted in the field of ICT in education and divulged in the most varied media of scientific dissemination. Plurality and diversity of the areas of research on ICT in education is an undeniable reality that placed some serious difficulties to the systematization in spite of the paradigmatic examples that are the solid monographs of Donald Ely or of Alice Brennan in the USA [3], [4], or the vast synthesis done by Alonso & Gallego in Spain [5].

In our country, the relative young field of Educational Sciences somehow justifies the scarceness of studies that report synthesis of previous research. Nevertheless there are very good examples in Portugal about the use of computers in education [6], special education [7], or curriculum studies [8].

It was in the mid seventies that the field of Educational Technology has increased, when it started to be integrated in teacher education curricula. Nonetheless, the beginning of the post graduated courses represented better conditions for the research studies on this area. However, until now there hasn't been conducted a study about the scientific production its contents and evolution. Yet, we defend that such tasks are fundamental so that the ICT's potential becomes evident among the Educational Sciences in Portugal, assuming its important role in the educational context of the information society we live in.

A research project has been developed in order to understand the purpose and the identification of this field and to characterize its priority areas of research for the near future. This paper describes the content analysis (at thematic and methodological levels) of 460 scientific papers published by Portuguese authors on journals and conference proceedings between 1985 and 2000. The content analysis has been carried out to answer the following research questions:

- What are the characteristics of the research community in ICT in education in Portugal?

- What are the objectives of the research conducted and methodological frameworks?
- Is it possible to identify research trends for this area?
- Which repercussions at national and international levels?

## 2. Methodology

The study is an *analytic*al one the fieldwork is based on the analysis of the content of written documents [9]. Somehow, its characteristics make it similar to what is known in literature for "bibliometric studies" whose main object of analysis is the scholarly communication and the purpose to know and to characterize a certain research community [10], [11].

## 3. Documental Data Base

In order to constitute the documental corpus the most important journals for the Educational Sciences were researched (about 40 titles), as well as the conference proceedings of the most representative congresses that took place during the fifteen years mentioned above.

The corpus integrated 460 publications in which 330 authors have participated (publishing individually or in co-authorship). From those issues, 184 (or 40%) correspond to publications in conference proceedings and 276 (60%) to publications in "Journals".

Most of the papers (427) were published in national conference proceedings and journals; only 33 were published abroad from which 33 in conference proceedings and 8 in journals.

We could also verify that most of the international papers (81%) were published after 1995, specially in the year 2000.

## 4. Instrument of Analysis

To collect data an instrument of analysis was created and validated in order to answer the research questions. The instrument was designed in order to allow independent observers to codify and to quantify units of textual information of the written papers. All items were of multiple choices except for two which were open ended questions.

The following Table presents, in synthesis, the basic structure of the instrument of data analysis (categories of analysis defined according to each of the research goals).

| Objectives of the Empirical Categories of Analysis Study | |
|---|---|
| To characterize the research community in ICT in education in Portugal | Origin of the publication |
| | Year of publication |
| | Title of the review |
| | Co-authorship |
| | Institutional Affiliation |
| | Partnership |
| | Association to projects |
| | Scholarly exams |
| | References |
| To identify the most focused themes | Problematic in ICT in education (open ended) |
| | Key words |
| To identify theoretical referentials | Theoretical frameworks (open ended) |
| To distinguish types of scientific publication in ICT in education in Portugal | Theoretical<br>Empirical |
| | Several |
| To characterize research at paradigmatic and methodological levels | Research goals |
| | Methodological designs |
| | Instrument for data collection |
| | Reliability and validity |
| | Population and sample |
| | Experimental management |
| | Statistical analysis |
| | Discussion of results |
| | Conclusions |

The validity of content (or logical) of the instrument was evaluated by two specialists in the area. As a consequence of this evaluation process the instrument was reformulated and enlarged, resulting in a new version. To evaluate the credibility of the instrument we used a method that, in the literature, is designated by "judges agreement" [12], "rater agreement" [13] or "reliability of the consensus" [14]. Three judges were specially trained to analyse the papers content; after three tests were done to the equivalence among the raters and when agreement coefficients around the 80% were obtained the process was considered finished.

On conclusion of this process of evaluation, the instrument was formatted using the computer software TELEform Standard, version 10, marketed by Cardiff SoftwareTM that makes it possible the creation of automated files for the data treatment and exportation of data to programs of statistical analysis as the SPSS 11.0.

## 5. Data Analysis

Due to the nature of the variables on study the data analysis attempted to identify what is typical and atypical in the data, as well as to show up the differences, relationships and/or data patterns [15], [16]. The relational analysis started up from the contingencies tables obtained with the distribution of two (or more) of the categorical variables or of the attributes of these. The statistical significance of the relations/associations was obtained by the application of the Chi Square test of independence that allows to verify if the resultant occurrences are from categorical variables or from attributes of these are (or not) significantly associated [17].

Three periods of time were considered in the analysis: the first one included the papers published from 1985 to 1990, the second one from 1991 to 1995, and the third papers published between 1996 and 2000.

## 6. Findings

**What is the actual situation and how did the scientific publication develop in ICT in education in Portugal?**

The study came to show that the first evidence to keep is the widespread increase of the interest in ICT in education as an area of study and research.

It must be noticed that the increase was not just in number of publications but, especially, in the quality of the papers that give evidence of genuine research works. Another data to take into consideration is the fact that the research in ICT in education in Portugal is deeply related to the work developed by individual investigators and restricted to academic contexts, since it is directly connected with teacher education programs. In that sense the research developed in this area in our country reflects the curricular integration in the teachers training courses in the mid seventies, and in the nineties the post-graduated teacher education programs. This last period coincides with the increase of the research in the area.

**"Who", "where", "how" and "what" is researched in ICT in education in Portugal?**

Our research came to show that the authors that publish scientific papers for the domain of ICT in education in Portugal: a) are divided analogously according to gender (54,8% male and 45,1% female); b) are affiliated preferentially to Universities (51,6%), and c) almost always publish individually (68,5%) especially in Journals. However, if we look over the chronological evolution during the considered period, we identify an increase in the number of co-authorship publications that are associated with the accomplishment of research projects supported and financed by external entities.

In relation to "Where" we verify that the Portuguese authors published more in "journals" than in "proceedings" of scientific congresses/reunions until 1994. Afterwards the situation becomes reversed: more publications in "proceedings " than in "journals".

Considering the "How" question and according to Reeves [18] and Gerk-Carneiro *et al* [19], three categories were considered to define the "type" of published paper:

- Theorical: does not include empirical data gathering; the main goal is to analyse and discuss theories or synthesize previous research.
- Empirical: includes systematized original data gathering and analysis by the researcher.
- Several: papers that do not represent a true research project and only present general topics related to the domain.

In the analysis we could verify that the most published type papers are of the "Several" type (38,7%), followed by the "Theoretical" papers (33,3%) and finally the "Empirical" (28%), which reflect, we think, the level of underdevelopment of this new scientific area of research in Portugal. In fact, we must admit that the dominant modality – the "Several" papers – concern publications considered of low scientific quality in the sense that they constitute, most of the times, simple reports of experiences or fragmented descriptions of contexts and activities, lacking in a "meta-reflection" and a true scientific spirit [18]. Nevertheless, an analysis of the chronological evolution allows to verify that this profile changes significantly in the period of analysis , converging in the loss of the relative hegemony of the papers classified as "Several" for the papers that point out true research studies in the area ("theoretical" or "empirical" papers).

It must be said that "theoretical" papers hold its relative position through the whole period similarly to what has been verified in other countries concerning the field of ICT in education: to create and defend an independent intellectual space among the educational sciences. In what concerns "empirical" papers the increase is exponential tripling the number of records in the period of analysis.

About the domain of "what" is published the study highlighted as general characteristics of theoretical frameworks for national research in ICT in education: a) includes the authors and the most representative theories recognized as related to this recent domain inside educational sciences, and b) reflects and accompanies the parallel evolution of what in the domain is researched at the international level, also revealing a strong national dependency relatively to what takes place abroad.

In relation to point b) it is noticed that the concern to defend and to create an intellectual space within the educational field, as one could expect about this recent area of research, was verified especially during the decade between 1985-1995, turned in the reflection and theoretical discussion of the domain's conceptual bases (Communication and Learning Theories) and inspired in authors renowned internationally as more relevant within the domain. In the same way, and similarly to what has happened in other contexts of research reflecting the lack of identity of a domain which was still "fuzzy" in terms of epistemological boundaries, it made the ICT's in education research, in an initial phase, to be understood as a considerable variety of focuses, not only to the level of the selection of research questions, but also to the level of the methodological and conceptual frameworks in which research leans on.

**Is it possible to identify research trends for this area?**

It was not possible to identify, in that context, research lines shared among universities or among these and other teaching institutions, constituting the majority of individualized works/projects, developed most of the times on the extent of the accomplishment of the investigators scholarly careers, and whose practical results few represented in terms of using it to solve real and concrete educational situations. However, we think that in the subsequent period to 1996, the situation has changed considerably and in a sense that we consider to be positive: an increase in the number of publications that reveal good research projects, an increase in the number of publications inserted in projects, an increase in "co-authorship" and "institutional partnership" publications.

Besides this ascending line in the number of research works accomplished and published, it is possible, at a thematic level, to distinguish two periods clearly: an initial period (that corresponds to the eighties) during which the few research works had to do with a strait thematic variety, closely circumscribed to the work of solitary investigators (during the previous period to 1990, of the 90 papers only 8 correspond to publications in conference "proceedings").

The following period (the whole nineties) was characterized by a notable variety of papers not only at the level of the selection of themes and research problems, but also at the level of the conceptual frameworks. Studies were developed on the most varied areas and traditionally connected to the ICT's in education domain (from the educational uses of the image, audiovisual media, computers in teaching to the exploration of the potentialities of the "hypertext" and "hypermedia" systems in pedagogical communication; 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 especially between the several modalities of quantitative research (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 find a conductive trend in the research. After the "conceptual vagueness" began a phase that can be called, the same way it has been referred to by others, as the "technological fascination" because, similarly to what was verified in many other countries, the problems of the "information society" are common to all educational systems from the western world. In other words, the evolution of the ICT in education in our country followed a direction similar in everything (to the scale of our country, obviously) to what has happened in other countries, what, in a general way can be resumed on the following lines: initial evolution in the direction of the increase of the thematic diversification and of definition of borders for the educational field. After this came a phase of maturity, the interests of the researchers tended into an inclusive thematic axis: the internet educational applications and uses.

Manuel Area [20] calls it "Effect 2000", but the truth is that if ICT in education was born in a time, technology didn't have the same value and social impact it has

today. Today's reality is very different: nobody questions the great social, cultural and educational impact of the communication technologies, the need of specific education in the area and the school's role in the search of answers and solutions for the questions of the information society [21].

**What about a paradigmatic evolution in the research goals?**

To talk about paradigms is the same as to talk about referential for the research, in other words, it is the same as to set out the reasons that take the researcher to develop his study: what am I looking for when I do research? Is it the truth? Is it the knowledge? Is it just information? Or do I expect to understand deeply the "reasons" for what happened?

In our study the intention was to determine if, for the Portuguese case, it was legitimate to talk about a paradigmatic inflection relatively to the traditional positivist paradigm which, in the opinion shared among most of the renowned authors, had been ruling the research developed in the ICT's domain until quite recently.

We could verify that, though the positivist paradigm still continues to be the dominant paradigmatic referential for the Portuguese researchers in ICTs in education domain, nowadays, it is possible to talk about a paradigmatic evolution in the sense of a gradual loss of importance held by the positivist paradigm which started to appear from the early nineties and became clearer from middles of that decade, and that inflection had been compensated by the emergence of alternative methodological stances. Among these last ones, besides the increase in the research inspired by the interpretative paradigm and the emergence in the first studies inspired by the critical paradigm, one must highlight the role assumed by now in Portugal by research projects seeking the methodological integration which has revealed to be very productive in the research developed in the domain in other countries [22], [23].

**How to characterize, in methodological terms, the empirical research accomplished in the domain? Which is the typology of the designs used by the Portuguese researchers?**

We could verify that more than a half of the analyzed works (57%) prepares the conclusions from the statistical treatment of tests or questionnaires, in other words, it follows a general methodology of quantitative trait; the experimental designs (studies comparing an experimental and control group, with pre-post test administration and variables supervision) stand out as preferred modalities, followed closely by the

plans of survey type representing both of the categories more than ¾ of the total of the accomplished empirical studies. As to designs that do not follow the dominant methodological orientation, we verified that they are divided among the qualitative methodologies (being the "case study" the dominant type) and the multi-methodological designs [23], [24].

An analysis of the temporal evolution confirms the paradigmatic inflexion previously mentioned: a relative percentile decrease in the quantitative studies compensated by a progressive increase in studies that follow a general methodology either of qualitative or mixed methodologies, once they combine quantitative with qualitative methods . The integration of methods is being defended nowadays as the "ideal model" for the educational research in general, and for ICT in education particular; as Pérez Serrano [25] defends, we overcome the dichotomy qualitative/ quantitative, if we want to improve the bad reputation for the utility (and quality) of educational research that has been strongly criticized by many of the international scientific community's sectors that still consider education to be in the state of the "embryonic" science to which Popper made reference in the sixties.

Focusing the attention only on the quantitative designs we can verify that, in a general way, the Portuguese case fits in with the general parameters of the studies that follow this methodological orientation in the ICT's domain: the plans of experimental type and the survey make up the preferred modalities; the "questionnaires" and the "objective tests" make up the instruments used more often; typical research designs are one short test with "convenience" samples and no control group; the data analysis is characterized by the use of diversified techniques of statistical analysis, especially of descriptive type [24], [26].

The picture of the qualitative investigation developed can also be framed in the general pattern of the interpretative designs , in other words, studies that affect small samples, non-standardized instruments, results that take the format of thick descriptions without statistical data analysis. In relation to "mixed" studies we can see that these are also framed in what is considered in ICT's in education literature to be characteristic of the multi-methodological plans (combination of procedures for the data gathering, diversity samples in type and in dimension, use of a vast array of techniques of quantitative and qualitative statistical analysis) [22], [24], [26].

**What can be said about the importance of the results (evidence) obtained in terms of practical uses and/or to the progress of the scientific knowledge? Which repercussions at national and international level?**

Our investigation showed that the most important research goal for educational technologists is to focuse in "practical problems", according with the "applied science" spirit that traditionally has been associated with this scientific domain since its origin.

The information obtained let us see that the diffusion of the results of the investigation in ICT in education in Portugal as confined almost exclusively to the national extent (93,5%); only 32 papers were recorded in international journals, specially after 1996.

## 7. Conclusions

Research in ICT in education in Portugal opens, in this beginning of millennium, a phase of huge expansion that lets one foresee a prosperous future. The image we have tried to draw demonstrates that the increase is big not just in the number of publications but also in the quality of the research which is the most relevant note to point out. In fact, a provisional balance of research in ICT in education in Portugal enables to recognize a considerable evolution in this field related to: a) the emergence of specific research trends; b) the use of diversified methodologies (both qualitative and quantitative) that fit better the complexity of educational settings, and c) the concern for well designed studies in the area.

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## Education Status of Portugal

*– Sushree Das*

Portugal became an independent country after forty years of dictatorship by the colonial empire. With this came the re-establishment of political democracy along with some economic transformations such as the opening of the Portuguese market to the external world. As a consequence of its entry into the European community in 1976, Portugal got the opportunity to reap the benefits of industrial restructuration and receive social, financial and economic benefits. The global changes that followed, paved the path for the Educative Reform of 1973. The educational system that earlier followed the teachings of the Roman Catholic Church, gradually expanded as primary and secondary schools were established in larger settlements. The ministry of Education holds the administrative responsibility for these schools. Compulsory education in Portugal comprises of nine years of education for students ranging from the age of six to fifteen. Basic education is free in state-run (public) schools. For families who have a low standard of living, the government provides financial support for additional expenses such as mid-day meals at school, courseware and conveyance. In the 1990s, education in preschool levels was limited. However, there used to be increased regulation and involvement by the government. For those living in rural areas, primary schooling was the only education they received. Preschools are run by state organizations, charitable organizations, private or cooperative organizations. After completing the nine years of compulsory education, students may opt for secondary education either for taking up higher education or technical/volatile education. Successful completion of three years of secondary education paves the way for higher education. Earlier higher education included four older universities as well as six newer universities. In addition there were special post-secondary schools and academies, engineering institutes, agricultural colleges, technical universities. Admission to the universities was a highly competitive process and was mainly meant for the elite class. The Portuguese educational system was highly centralized with all the rules and regulations, curriculum, policies being set at the national level. There are also a number of international schools in Portugal to provide education to international as well as Portuguese students. In Portugal's lower and upper secondary schools, access to technology was very less. The ratio of teachers and students for computers was disproportionate. To address these limitations the Ministry of Education, Portugal in association with Microsoft, distributed laptop PCs in schools for students as well as for teachers. The Ministry also developed an on-line training program for teachers about using ICT-based course curriculum. As per reports from the Department of Computers, Networks, and Internet in Schools (CRIE), Ministry of Education, a number of programs have been initiated which support the implementation of ICT and other innovative techniques in the course curriculum; improve the efficient use of ICT in the classroom; encourage teamwork between teachers and educational groups; help teachers organize daily activities; and support their educational projects for the future. The development of technology skills and the application of ICT in education are said to be essential components for the progress of Portugal's educational system.

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