



OCDE / CERI I.C.T. PROGRAMME

A Case Study of ICT and School Improvement

Executive Summary

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Introduction

This summary forms part of the International Programme "ICT and Quality in Learning" carried out in 28 countries by the **Centro de Investigação e Inovação Educacional - CERI** - of the Organisation for Economic Cooperation and Development (OECD) and concerns five case studies carried out in Portuguese schools. The study's overall objectives were to examine the different forms in which ICT relate to the school reforms and the conditions in which ICT operate as a catalyst of these reforms, to identify the critical variables that enable an effective implementation of the school reforms and ICT and to detect undesirable impacts of ICT in the running of the schools and student learning. The study was developed using as a basis the methodology presented at the "Manual for Case Studies in Organisational Change", under the responsibility of Professor Richard Venezky of the University of Delaware (USA) who coordinated this international study.

The research was carried out according to the plan drawn up by the Scientific coordination of the studies and the data were gathered between June and December 2000.

General Organisation of the Portuguese Educational System

According to Oliveira (1998), whose work we closely followed in this summary on the organisation of the Portuguese educational system, the **Lei de Bases do Sistema Educativo (LBSE)** - Law no. 46/86, of 14 October, changed by Law no. 115/97, of 19 September, - establishes the general framework of the educational system (ES). This system is the set of means whereby the right to education is realised, which is expressed by the guarantee of a permanent training action oriented towards favouring the overall development of the personality, social progress and democratisation of society.

The ES is developed according to an organised set of structures and diversified actions, on the initiative and selection of different institutions and public entities, both private and cooperatives, and covers the entire Portuguese territory.

The ES includes pre-school education, school education and extra-school education. In its formative aspect, **pre-school education** is complementary and/or supplementary to the educational action of the family, with whom it works in close cooperation.

School education includes (cf. Diagram 1) basic education (9 years, 3 sequential cycles), secondary education (3 years) and higher education. Apart from this, school education integrates special modalities [\[1\]](#) and includes free-time activities.

Extra-school education involves teaching how to read and write and basic education, cultural and scientific upgrading and updating and vocational initiation, reconversion and upgrading and is carried out in an open framework of multiple formal and informal initiatives.

Along with this description, it is equally interesting to note that the Portuguese educational system, and in particular the basic and secondary education sub-systems, are undergoing a phase of deep reforms. As regards the levels that have a direct interest to this study, the **Flexible Curriculum Management** and the **Alternative Curricula**, among others, are worth mentioning. Additional information may be found at <http://www.deb.min-edu.pt/Legislacao/DL6-2001.htm> .

Diagram 1 - THE PORTUGUESE EDUCATIONAL SYSTEM

DOCTORATE

HIGHER

MASTERS
EDUCATION

CESE ^a

DEGREE

BACHELOR DEGREE

AGE ^b

18

12 th	SECONDARY
11 th	EDUCATION
10 th	

9 th 3 rd CYCLE

8 th
7 th

12

6 th 2 nd CYCLE	BASIC
5 th	EDUCATION

10

4 th 1 st CYCLE
3 rd
2 nd
1 st

6

PRE-SCHOOL EDUCATION

^a Curso de Estudos Superiores Especializados (Specialised Higher Education Course) (at degree level)

^b Merely of an indicative nature

ICT in the Portuguese education system

The current overview of ICT in Portugal may be characterised by the brief description of its main programmes and initiatives.

In Portugal, currently and as far as the educational use of ICT is concerned, there are two particularly important programmes: the Nónio XXI Century Programme (Ministry of Education and the Internet in School Programme (Ministry of Science and Technology). The former created and implemented a network of Competence Centres, based mainly in the higher educational establishments (Universities and Polytechnics) and in the Teacher Training Centres of School Associations. Through this network it offers technical, pedagogical and financial support to the School Projects oriented towards the application and development of ICT.

Besides this vital aspect of its mission, it further supports the creation and development of educational software, actions and events aimed at the dissemination of educational information in this field as well as international cooperation projects in using ICT in Education.

The main objective of the Internet in School Programme is to ensure the installation of a multimedia computer with Internet connection in the library and/or mediatec of public and private Portuguese schools from the 5th to the 12th grades (not including higher education), contributing in this way to greater equality and better access to information. Some schools from the 1st cycle, libraries and socio-educational and cultural associations were also included, totalling over 1600 connected schools at the start of the 97/98

school year. The Programme further ensures the availability of materials produced by the schools and makes available services to ensure telematic animation, promoting sharing and cooperation among schools, through the national scientific and academic community network.

In a second phase, already in course, the Programme is being extended to all schools of the first cycle of basic education.

Other actions of the initiative of State organisations, and in many cases in cooperation with the European Union (through the communitarian funds of the III Community Support Framework), as well as private initiatives are already in full development, with the Portuguese Government trying to ensure the articulation among the various initiatives.

There are various Operational Programmes that contribute to the mission of facilitating citizens' access to the information society's tools, and particularly as concerns the School's contribution to significantly increasing the ratios of students per computer and access to the Internet, in a period of 4 to 6 years. One example is the PRODEP III (Operational Programme for the Development of Education in Portugal), namely Axis 3 - the Learning Society through Measure 5 Training of Teachers and Other Agents, Continuing and Specialised Education in Basic and Secondary Schools and Measure 9 Equipping Schools with Computers and Development of Multimedia Contents, of the responsibility of the Ministry of Education; another example is the POSI Operational Programme of the Information Society, under the responsibility of the Ministry of Science and Technology.

To conclude these brief notes on the current overview of ICT in the Portuguese educational system, it is necessary to refer to some data on the conditions of the equipment and use of ICT in Portuguese schools, recently published in a report by the DAPP of the Ministry of Education.

This report contains the results of a survey carried out between April and July 2000^[2] where the conditions of equipment and the educational use of ICT were assessed. Three thousand four hundred and ninety-nine (3499) schools and 658,033 students from all levels of education took part in this survey. One of the aspects assessed in the report is the amount of computers that currently exist in Portuguese schools. We were able to conclude that there are a total of 2,368 computers in schools of the 1st cycle (with a ratio of 56.4 students per computer) and 21,883 computers in schools of the 2nd and 3rd cycles and secondary schools (with a ratio of 23.3 students per computer). Besides revealing the very low level of equipment in schools of the 1st cycle, DAPP's report also shows that most of the equipment is located in computer laboratories and libraries/resource centres, in the case of secondary schools, and in the classrooms, in the case of schools of the 1st cycle of basic education.

A second aspect refers to the connection conditions of Portuguese schools. As far as the 1st cycle is concerned, the report reveals that only 3.1% have a local network (LAN) and that only 10% of these schools have Internet access. As regards schools of the 2nd and 3rd cycles and secondary schools, the report points out that 70% have a local network (LAN) and approximately 89.2% of these schools have Internet access.

A third aspect that was looked at was the type of educational use of ICT. In this regard the report points out that in most schools the percentage of teachers who use ICT indicated by the school is less than 25% of the total number of teachers in the school (which is consistent with the data obtained in these case studies).

A final note on the technical media and the maintenance of the computer equipment in schools. In the 1st cycle, the percentage of schools that have contracts with companies from the sector corresponds to approximately 7%; in the case of schools from the 2nd and 3rd cycles and secondary schools, this percentage is 37%.

A second report also under the responsibility of the DAPP of the Ministry of Education analyses the offer of continuing training for teachers in Portugal and particularly the offer of training in ICT. The data refer to 1998 and 1999 and concern the offer of training by the Teacher Training Centres of School Associations. From a total of 199 centres, 119 answered the survey, in other words 60%.

The sample corresponds to 8,926 schools (from a total of 13,642) where 85,235 teachers (from a total of 139,949) are represented.

As far as the offer of training in ICT is concerned, in the two referred years, the teachers from these schools received in total 53,007 hours of training corresponding to 314 training actions. These actions were attended by 7,082 teachers in the 1998 school year and by 8.950 in the 1999 school year.

General Conclusions of the Studies

According to the data gathered in all of the cases studied, we can draw the following conclusions:

Hypothesis 1

In four of the cases studied, the data gathered seem to support the main hypothesis: **technology is an important catalyst of the educational reforms, especially when these involve the Internet.** The evidence presented in favour of this hypothesis is essentially based on the strong association between the reform, innovation and use of ICT, in the cases studied. This is the pattern that was observed and in these cases ICT act as a support to the development of the reforms, contribute to increase student motivation and make up new work tools to be used by the students in acquiring and producing knowledge. ICT are acknowledged by teachers, parents and students as vital in the processes of modernising the school and particularly in the emergence of innovative pedagogical and methodological practices.

The limitations can be observed in the case where the reform is perceived as a change imposed on the teachers from outside the school. In this case ICT are not a catalyst of the reform but rather a recourse, and a poor one at that, in view of the needs of the reform and of the school and are only used by a small group of teachers in learning situations.

Hypothesis 2

The set of case studies supply data that favour the acceptance of the main hypothesis: **The dissemination of the reform (and consequently of ICT) follows the traditional dissemination pattern of the reforms and innovations described by Rogers.**^[3]

The pattern observed rests once more on the strong association between the reform, the innovation and ICT, in perceiving the existence of phases in the dissemination process of the reform and ICT, corresponding to the progressive involvement of the teachers, in the importance of the interpersonal communication channels in disseminating the innovation, in the existence of small groups of adopting teachers, with the typical behaviour of early adopters, etc..

The limitations refer to the case where the reform is seen as something from outside the school, which means that the adoption and implementation follow the pattern prescribed by the entity that coordinates and implements the reform, with consequences in the involvement of the teachers who in many cases merely use ICT as a personal work tool and not in the classroom.

Hypothesis 3

The data obtained in all the case studies put together are favourable to accepting the main hypothesis: **the effective implementation of ICT depends essentially on the skills of the teaching staff in integrating ICT in learning.**

The evidence that supports this hypothesis is based on the strong association between the results of the reform and the pedagogical competence of the teachers (in using ICT, but not only). However, this pattern does not appear to be based on the relationship between these two factors alone but rather on various factors. Thus, the effective implementation of ICT also seems to depend on the ICT infrastructures that exist in the school, on the culture and on the social climate of the school, on the social recognition of the innovative work of the teachers, on the support of the school's managing bodies, on the role of the ICT's transversal curricular structure (non-monopoly of a subject) and on the time available to the teacher, among others.

Hypothesis 4

The data gathered on all the case studies put together are not conclusive as far as hypothesis 4 is concerned: **If all students have equal access to ICT, the differences in academic performance between the poorer students and the less poor should not increase. The alternative hypothesis is that if all students have equal access to ICT, students who are less poor will tend to increase the difference in academic performance in relation to the poorer students.**

In four of the studies carried out, the main hypothesis should be accepted, although under certain conditions (in two cases) and the alternative hypothesis should not be excluded (in more than two cases). The pattern observed has contradictory elements: in some cases the dominant perception refers that the poorer students have a tendency to use ICT more effectively, precisely because they have less time to use them; the students' perception is also relevant: it is not due to the fact that students who are better off socially have more and better means that they perform better.

In one of the cases, the perception is precisely the opposite: it seems that the students who are better off are those who benefit more from the innovations and tend to increase the differences in academic performance, in relation to the poorer students.

What is common to these two perspectives is the idea that the school should have the conditions to perform its social function, contributing to lessen potential differences between students from various social origins, providing the necessary opportunities to all its members and not limiting itself to reproduce the **status quo** that exists in society.

Hypothesis 5

The data obtained in all of the case studies put together seem to support the main hypothesis: **an effective implementation of ICT will cause academic standards to remain the same or to increase in spite of the poor quality of many ICT materials.**

The pattern observed is based on the perception that the increase in academic standards is associated to the ICT implementation models. This pattern is reinforced in those cases where there was an increase and improvement in the ICT infrastructures.

This patterns also seems to be associated to important factors such as the attitudes of the teachers in relation to innovation, the development of strategies to integrate ICT in the syllabus and the critical thinking of students in using ICT.

Final notes

The sample of schools is not representative of all Portuguese schools as far as the introduction of ICT is concerned. They are all innovative schools, with a stable teaching body, with a reasonable amount of computer equipment, teachers with ICT training and a project culture that has been established in the school for several years.

Most Portuguese schools are far from having these characteristics, although programmes to equip schools with computers (QCA III PRODEP), connect them to the Internet (MCT-UARTE), develop educational software, and projects to supply educational information on the Internet (DAPP-NÓNIO), etc. are currently in course.

Some points we would further like to refer:

- Within the framework of the curricula, ICT represent the role of the **transversal area**, in all subjects and at all levels of schooling; there are advantages to this perspective, but there are also some disadvantages: everyone is responsible for introducing ICT, but in practice "it doesn't form part of the programme", which means that the teachers may or may not take initiatives in this field.
- The existence of exams at the end of the secondary education and on admission to University acts as a stumbling block to the use and dissemination of ICT or of any other "innovation" that may "distract" the students from the exams. This is a critical factor and is frequently mentioned by teachers of these teaching levels as an obstacle to integrating ICT in the curricula;
- A note of originality in the field of the educational use of ICT can be found in the strategic partnership that has been developed and deepened over the years between schools and higher education institutions in this matter. Certainly this relationship is a strategy of enormous potential and which ends up being very positively reflected in Portuguese schools, teachers and students.

Main hypotheses per case study

Hypothesis 1	André de Resende	Santa Clara	Cabreiros	Lanhoso	António Vieira
Technology is an important catalyst of educational reforms, especially when these involve the Internet. The alternative hypotheses is that when a true reform is in progress, technology serves merely as an additional resource and not as a catalyst, i.e. the driving forces behind the reform also encourage the application of the technology to resolve specific educational problems.	The main hypothesis should be accepted. Evidence in favour: association between the teachers involved in ICT and the curricular reform; availability of computer means used in the framework of the reform (in a greater amount than in the regular teaching situation); recognition of the benefits of the reform and of the role of ICT in this process.	The main hypothesis should be rejected. Evidence in favour: the manner in which the reform was "imposed" on the school, in practice it is a compulsory reform; shortage of computer resources assigned to the reform.	The main hypothesis should be accepted; ICT are seen as the support for the development of the reform; on the other hand, the reform has made ICT essential; one example is that the bureaucratic work of the class director is much relieved by ICT; this hypothesis is further upheld by the support of the school's management board and by the group of specialists, the emphasis on the transversal use of ICT; the generalised recognition of the use of ICT in the reform.	The main hypothesis should be accepted; ICT are seen as the support to the development of the reform and to the educational use of ICT; evidence in favour: the awareness of the management body in supporting the establishment and development of alternative curricula and in supporting the intensive and explicit use of ICT as a support of the reform; recognition of the usefulness of ICT by the school community.	The main hypothesis should be accepted. Evidence in favour: existence of a small group of early adopters; group of decisions that progressively facilitated the reinforcement of the catalytic role of ICT in the reform (creation of computer rooms, modernisation of the library, transforming it into a resource centre, training of teachers in ICT, creation of new subjects, implementation of an Intranet).

Hypothesis 2	André de Resende	Santa Clara	Cabreiros	Lanhoso	António Vieira
<p>The dissemination of the reform (and consequently of ICT) follows the traditional dissemination pattern of the reforms and innovations described by Roger (1995). The alternative hypothesis is that technology operates differently from the traditional reforms and innovations and that its dissemination pattern therefore has distinct characteristics.</p>	<p>The main hypothesis should be accepted; evidence in favour: strong association between the reform of alternative curricula and ICT; the exposure, adherence to and adoption of ICT; behaviour of early adopters; the importance given in the school to the interpersonal communication channels in disseminating and adopting the technology.</p>	<p>The main hypothesis should not be accepted. Evidence: the adherence, adoption/implementation processes of the innovations do not appear to follow their "normal" pattern, but rather appear to be conditioned by the fact that they were "imposed" by entities outside the school; the alternative hypothesis can be accepted; some of its characteristics are conditioned by sufficiently strong factors which bring about "deviations" to the technology's dissemination pattern; a second factor concerns the amount of resources available in the school and which also condition the technology's dissemination process.</p>	<p>The main hypothesis should be accepted. Evidence in favour: the existence of a group of early adopters; the existence and functioning of interpersonal communication channels and the progressive involvement of the school community's members.</p>	<p>The main hypothesis should be accepted. Evidence in favour: adoption of the reform by the initiative and will of the school; existence of a small group of adopters; the reform is strongly associated to the educational use of ICT; existence and functioning of interpersonal communication channels in the school community both in relation to the reform and in relation to the technology.</p>	<p>The main hypothesis should be accepted. The evidence in favour: stability of the teaching body and the existence of compatibility or the capacity to negotiate among the members of the school in relation to the importance of the curricular innovation through ICT; the innovators are members of the school; the school will have 34% of teachers who use ICT in their activity (initial</p>

Hypothesis 3	André de Resende	Santa Clara	Cabreiros	Lanhoso	António Vieira
<p>The effective implementation of ICT depends essentially on the skills of the teaching staff in integrating ICT in learning. This hypothesis assumes that the effectiveness of ICT is associated to the mediation of teachers and that their academic value is positively related to the teacher s skills. The alternative hypothesis is that the school s technological infrastructure and the skills of the students, and not the skills of the teaching staff,</p>	<p>The main hypothesis should be accepted. Evidence in favour: the strong association between the reform, the competence of the teaching staff and the educational use of ICT within the framework of alternative curricula (reform); the fact that the target population of the reform is composed of students with great learning difficulties implied the high degree of involvement of the teachers in the school in</p>	<p>The main hypothesis should be accepted. Evidence in favour: the importance of the teachers' role of mediation (students between the ages of 11 and 13. The teachers clearly lead the process of integrating ICT in the curriculum and the results obtained are due to the teachers; the alternative hypothesis should not be totally excluded, namely in what concerns the importance of the technological</p>	<p>The main hypothesis should be accepted, but the alternative hypothesis should not be excluded. Evidence in favour: the implementation of the reform was only possible due to the existence of teachers with high pedagogical skills. If the implementation depends on the skills of the teacher in integrating ICT, then it is also true that in order to effectively implement ICT technological infrastructures are needed in</p>	<p>The main hypothesis should be accepted. Evidence in favour: the existence of teachers with high pedagogical skills, the strong association between ICT and the reform. The technological infrastructure is a condition for the implementation of the reform.</p>	<p>The main hypothesis should be accepted. Evidence in favour: besides the skills of the teaching staff, it is also necessary to consider as determining elements in the effective implementation of ICT in the reform the school's culture, the social climate in the school, the social recognition of the effort of the innovators, the support of the managing bodies and the technological infrastructure.</p>

<p>in ICT determines the results of implementing ICT.</p>	<p>resolving the problems of these students; the results obtained are due to the competence and dedication of the teachers of these students; despite everything, the technological infrastructure is a condition given that ICT are used as a systematic support in the implementation of the reform.</p>	<p>infrastructures as a condition for the integration of ICT in the reform.</p>	<p>both quantity and quality.</p>		
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<p>Hypothesis 4</p>	<p>André de Resende</p>	<p>Santa Clara</p>	<p>Cabreiros</p>	<p>Lanhoso</p>	<p>António Vieira</p>

<p>If all the students have identical access to ICT, the difference in academic performance between the poorer students and the less poor should not increase. The alternative hypothesis is that if all students have equal access to ICT, students who are less poor will tend to increase the difference in academic performance in relation to poorer students.</p>	<p>The main hypothesis should be accepted, under certain conditions. The potential differences that exist may not be a consequence of greater or lesser difficulty of access. The poorer students have a tendency to use ICT more effectively than the less poor and to lessen the potential advantages of these over the others. Despite everything, it is recognised that the time dedicated to the task is favourable to the poorer students and that the school can contribute to lessening the potential socio-economic differences.</p>	<p>The main hypothesis should be accepted, under certain conditions. An effort was made to guarantee equal access to ICT among all the students; the differences in academic performance are not due to these inequalities. However, the school cannot entirely eliminate the differences resulting from the students' socio-economic origins, although it may contribute to lessen them...</p>	<p>The main hypothesis should be accepted, without excluding the alternative hypothesis. The evidence gathered show various perceptions in relation to his aspect. The differences may not be accentuated in the school, due to the guarantee of equal access to ICT, but the differences in relation to the social origins may cause insurmountable differences. The differences observed in academic performance may be assigned to the differences in socio-cultural environment and family background which is expressed in less quantity and less quality of means, resources and opportunities</p>	<p>The main hypothesis should be accepted, without excluding the alternative hypothesis. The evidence gathered show various perceptions in relation to this aspect. The differences may not be accentuated in the school, due to the guarantee of equal access to ICT, but the differences in relation to the social origins may cause insurmountable differences.</p>	<p>The main hypothesis should be rejected and the alternative hypothesis should be accepted. The data show that the less poor students benefit more from the innovations and tend to increase the difference in academic performance in relation to the poorer students.</p>
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		available. The students nevertheless feel that it is not due to the fact that students who are better off socially and economically have better means that they have a better performance.	
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Hypothesis 5	André de Resende	Santa Clara	Cabreiros	Lanhoso	António Vieira
<p>An effective implementation of ICT will cause academic standards to remain the same or to increase in spite of the poor quality of many ICT materials. Academic standards depend on the expectations of the teachers and of the school and not on the level of manuals, of ICT materials and others. The alternative hypothesis is that the use of ICT will lead to a reduction in academic</p>	<p>The main hypothesis should be accepted, under certain conditions. Evidence in favour: The strong motivational effect exerted by ICT in youths with learning difficulties that lead to a general increase in the academic standards expected of this population. However, other elements should be taken into account in this analysis. The quality of the</p>	<p>The main hypothesis should be accepted, although under certain conditions. Evidence in favour: the perception of the teachers reinforces the positive effects of ICT on academic standards. These however seem to depend on many other factors. It is very difficult to relate the performance of the students, expressed in academic</p>	<p>The main hypothesis should be accepted. The evidence shows that the increase in academic standards is associated to the ICT implementation models, namely the increase and improvement of ICT infrastructures, contributing to the existence of a dynamic in the school which is reflected in the positive perception of the teachers, parents and students on the performance and academic</p>	<p>The main hypothesis should be accepted. Evidence in favour: the increase in academic standards is directly associated to the ICT implementation standards through the following aspects: teachers' attitudes towards the innovation, the development of strategies in the integration of ICT in the curriculum, the</p>	<p>Not conclusive. The data obtained do not make it possible to accept the main hypothesis but they also do not support the alternative hypothesis.</p>

standards insofar as the students will spend more time on research with marginal benefits and on surfing Internet sites or curricular materials of low-quality.	learning does not appear to depend on the effective implementation of ICT alone, but also on the manner, diversity and richness of the learning experiences (with and/or without ICT) offered to the students and not so much the effective implementation or the quality of the materials used.	standards, and the effective implementation of ICT.	standards. The ICT implementation models, based on their role as tools in the building of knowledge are those that most contribute to the increase in academic standards. The teachers do not make academic standards depend on the ability to use ICT but rather on the attitudes and skills of the teaching staff.	critical thinking of students in the use of ICT.	
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[1] Special education, vocational training, night school for adults, distance learning and Portuguese school abroad.

[2] These data do not include the recent actions as a result of the PRODEP III intervention, and therefore do not reflect the results of the actions carried out to equip schools with computers.

[3] Stages of the Innovation decision process for the adoption of technological innovations: Knowledge (knowledge of the innovation, selective exposure, selective perception, availability of information on the assessment of the innovation); Persuasion (adoption of attitudes by the potential adopter; differences in symbolic adoption versus behavioural adoption); Decision ; symbolic adoption and passive rejection); Implementation (attempt or behaviour to adopt the innovation; re-invention versus re-discovery); confirmation (search for reinforcement); discontinuity due to the replacement and to the disenchantment; discontinuity due to changes in the scientific evidence.