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Abrantes, P.; de Almeida Alves, N.; Dias, P.C.; Ferreira Rodrigues, C.A.

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ICT IN PORTUGUESE SECONDARY SCHOOLS: FROM RESISTANCE TO INNOVATION

PEDRO ABRANTES, NUNO DE ALMEIDA ALVES, PAULO COELHO DIAS Y CARLA RODRIGUES[1]

There is a strong consensus on how central Information and Communication Technologies (ICT), especially computers and the Internet, are for virtually all dimensions of contemporary society – oftencalled the information or network society – includingthe economy, culture, and politics. However,the introduction of ICT and its effective use in schools have been slow and face complex challenges all over the world.

In Portugal, a major Technological Plan for Education was implemented since 2007, which has been partially funded by the European Union. Its goal is to place Portugal among the most advanced countries in world in terms of implementation of ICT in state schools. The Planlaidout ambitious goals, including a ratio of two students *per* computer, the availability of high-speed broadband in all primary and secondary schools across the country, and ensuring that 90 per cent of teachers have ICT certification.[2]

[1] Pedro Abrantes pedro.abrantes@iscte.pt Investigador del CIES-IUL y Profesor de la Universidad Iberoamericana, México DF. Nuno de Almeida Alves nalmeidaalves@iscte.pt Investigador del CIES-IUL e Profesor del Instituto Universitário de Lisboa. Paulo Coelho Dias pgdias@sapo.pt Investigador del CIES-IUL e Profesor del Instituto Politécnico de Santarém. Carla Rodrigues carla.af.rodrigues@gmail.com Investigador del CIES-IUL e Estudiante de Doctorado de la Universidad de Amsterdam.

[2] The Technological Plan for Education was established by Ministerial Resolution 137/2007. For complete information, see the official report (Ministry of Education, 2008). For updated information, see http://www.pte.gov.pt/pte/EN/OPTE/index.htm (available in Portuguese and English).

The *Learn-Tech: Learning with Information and Communication Technologies*research project was developed between 2010 and 2012 to analyse how ICT were being introduced and used effectively in Portuguese secondary education, and to assess its impact overpedagogical practices.Not surprisingly, a complex and heterogeneous picture has emerged, as the introduction and uses of ICT in schools appear to be conditioned and oriented by many different factors. This article focuses on the organizational dimension, namely how ICT educational use differs between schools, as the research project findings show that this is a key factor of explained variation.

Literature Review

Several recent studies and reports from different parts of the world examine ICT uses in schools. The culture of teachers, the availability of time and resources (human and technological) and the leadership of school headmastersare frequently cited as major factors explaining the intensity and kinds of ICT use in pedagogical work (Demetriadis*et al.*, 2003; Bauer & Kenton, 2005; Hsu, Wu & Hwang, 2007; Chang, 2012).

A prolific line of research undertaken in the US argues that technology appropriation in schools relies above all on teachers' perceptions and needs, which are conditioned by the social contexts in which teachers develop their life and their work (Zhao & Frank, 2003; Frank, Zhao &Borman, 2004). According to this view, the *social capital* produced through informal networks within a school organization vitally shapes decisions about how to use – or not to use – ICT in teaching-learning environments. However, other studies have found a more individualistic pattern in teachers' decision-making concerning ICT use, and view external support as irrelevant (Sugar, Crawley & Fine, 2004).

Researches on this field havealso concluded that ICT in schools arebeing rapidly appropriated for administrative and communicative purposes, while its daily use in pedagogical activities facesmuch resistance. Indeed, in many schools its use would involve a wholesale change in teachers' professional culture (CERI, 2001; Shi &Bichelmeyer, 2007). The challenge of having "digital students in a book-oriented school" (Ben-David Kolikant, 2009) arises in many regions of the world. Moreover, when ICT are used in teaching practice, they often support (or reinforce)a traditional *teacher-centered* pedagogy (Barron *et al.*, 2003), while their uses for constructivist and autonomous pedagogical activities are relativelyscarce(Palak& Walls, 2009; Means, 2010).

A review of 17 large impact studies and surveys undertaken from 2002 to 2006 (Balanskat, Blamire&Kefala, 2006), claims that despite strong investment in this area across Europe, only a minority of schools have embedded ICT into the curriculumand demonstrate high levels of effective and appropriate ICT use in support of and to transformteaching and learning (thus achieving so-called "e-maturity").By contrast, most schools are in the early phase of ICT adoption, characterized by patchy and uncoordinated provision and use, mostly to support traditional pedagogical practices.

However, this study also found evidence that schools with good ICT resources and "e-maturity" achieve better scores and faster improvement in students' performance tests.Although some of these works underlie the importance of teachers' and headmasters' dynamics, few empirical studies focus on school organization in order to explain the differences in ICT uses. One of the few exceptions to this rule is the study by Wong et al. (2008). Examining eight schools of Hong Kong and Singapore, the authors identify four types of ICT implementation strategies, which are strongly associated with leadership and the climate for collaboration: technologically driven, pedagogically driven, balanced, and uncoupled strategies.

From the 1980s onwards in particular, however, educational research began to focus on how local schools and communities informally reinterpret (and negotiate) public policies as a key element shaping educational realities in modern, democratic and "multi-regulated" societies (Archer, 1978; Ball & Bowe, 1992; Fernández Enguita, 2001). Change and innovation in schools aremainly explained by local interactions and isomorphic mechanisms rather than by formal guidelines (Rowan, 1982; Tyler, 1988; Gewirtz, Ball & Bowe 1995; Perrenoud, 2001). Further, some specific features are identified in what are viewed as "effective schools": (1) strong leadership, focused on learning patterns; (2) pedagogical strategies, institutional norms and autonomy; (3) teacher stability, cooperation and consensus about higher order skills; (4) student and family involvement and responsibility; (5) social capital and community ties (Fernández, 2004; Warren, 2005; Santizo& Martin 2009; OECD, 2010).

The architecture of each educational system must be taken into account in this context, of course, particularly the issue of the autonomy of school organization from local, regional and national authorities. Following the Mediterranean tradition, the Portuguese educational system is centralized and bureaucratic,and local schools have little scope for autonomy (Afonso& Lima, 2005; Barroso, 2006;Azevedo, 2008; OECD, 2010).However, this formal framework does notmean that strong and diverse school cultures cannot emerge (Torres, 2011). Further, although current autonomy policies hardly changed major patterns of power within the educational system, they are likely to affect newly emerging areas, such as ICT. Indeed, the Technological Plan for Education consists of many projects, and participation in some is based on individual school applications so that resources and support are adjusted to local needs, strategies and practices. Moreover, it is also expected that schools will seek additional resources, contacting the local community and private companies. These new trends may be a source of emerging differences – and inequalities – between schools and thus between students' learning opportunities.

Methodology

The survey examined in this study covers 12secondary schools. It included the administration of questionnaires to headmasters, teachers and students, in order to analyse resources, strategies, practices and expectations of ICT use. The sample wasdefinedto ensure a high level of diversity by geographical location and socioeconomic contexts, including schools from the five Portuguese administrative regions according to population numbers (see table 1). Schools that are considered exceptionally innovative and which are part of technology pilot projects were not included. Since a national program for building and equipment modernisation

included schools in four stages, it was vital to include in oursample schools involved in each stage.

Table 1. Organizational profile and academic scores

School	Att.	SSMP **Stage**	Vocational Orientation	Poverty rate	Parents H.Educ.	Staff stability	Exams Performance 2007	Exams Performance 2010	Exams Rank 2007	Exams Rank 2010
A	1047	1	12.4	5.8	20	97	10.2	11.2	222	126
B	1260	3	32.2	7.0	n/a	80	9.8	10.7	302	195
C	1300	2	18.2	22.1	13	73	9.8	9.7	313	404
D	1733	3	17.2	10.6	n/a	79	10.9	11.5	92	87
E	1740	3	15.4	13.6	23	82	10.9	11.4	103	100
F	1200	2	2.5	5.8	n/a	86	11.6	11.8	45	64
G	1612	1	77.9	20.0	19	83	10.9	10.3	99	287
H	1800	2	4.9	11.0	30	78	10.9	11.3	102	106
I	1185	2	n/a	10.5	24	84	10.9	11.3	101	111
J	1004	1	5.0	10.1	28	84	11.9	12.2	31	40
K	916	3	13.2	16.0	11	81	10.8	11.2	111	125
L	1222	0	4.6	12.0	19	89	9.3	9.0	406	504

A total of 2674 students, 324 teachers and 12 directors participated in the survey. Their responses were codified and analysed using *SPSS Statistics 18.0 for Windows*. This quantitative approach was complemented by interviews with teachers and students in each school in order to corroborate the explanatory hypothesis and understand the meaning of some of the patterns observed in the survey.

Since this article adopts an organizational approach and the aim is to generate a broad picture of ICT strategies and uses, the results of the survey were also crossed with educational projects (elaborated locally by school boards) and external evaluation reports (conducted by the Portuguese General-Inspectorate for Education).

Main results

Although far from the target ratio oftwo students*per* computer, according to headmasters' responses, the technological equipment in the 12 secondary schools is considerable: an average of 209 computers (174 of which connected to the Internet), 13 printers, four scanners, 14 interactive whiteboards, and 38 projectors. Nonetheless, ICT resources vary remarkably between schools, from a ratio of four to 19 students *per* computer (see Table 2).It is noteworthy that two contrasting realities emerge in terms of 'computers connected to the Internet': there are schoolswith less than eight students *per* computer (A, B, F, G, J, K, L) and there are others with

more than 12 students *per* computer (C, D, E, H, I). This suggests uneven ICT-related educational opportunities.It is useful to note that some schools have many interactive whiteboards and projectors and few computers (e.g., cases H & I), while the opposite is true in other schools (e.g., case B).

Table 2. ICT resources by school

School	Computers		Internet Connections		Printers		Scanners		Interactive boards		Projectors	
	N	R	N	R	N	R	N	R	N	R	N	R
A	238	4.4	238	4.4	26	40	6	175	15	70	45	23
B	220	5.7	220	5.7	10	126	5	252	1	1260	7	180
C	223	5.8	75	17.3	6	217	2	650	17	76	23	57
D	151	11.5	123	14.1	28	62	3	578	2	867	13	133
E	93	18.7	90	19.3	2	870	1	1740	11	158	22	79
F	160	7.5	160	7.5	10	120	6	200	13	92	50	24
G	400	4.0	380	4.2	20	81	5	322	25	64	60	27
H	238	7.6	116	15.5	10	180	4	450	26	69	45	40
I	187	6.3	96	12.3	8	148	1	1185	17	70	60	20
J	206	4.9	201	5.0	19	53	3	335	21	48	46	22
K	121	7.6	121	7.6	5	183	1	916	3	305	38	24
L	270	4.5	270	4.5	9	136	5	244	18	68	45	27
Av	209	6.3	174	7.6	13	101	4	330	14	94	38	35

Most of these computers were less than three years old (71 per cent), although there is also a significant inequality in "technological age": in some schools (B, D & E) the rate is lower than 50 per cent. Furthermore, in some schools (e.g., F & K) more than 20 per cent of computers are laptops, whichallowmore diversified and flexible usage, although the rate for most schoolsremains below 10 per cent. All schools offer Wireless connection (except school C), most have all their computers connected to a local network, and work simultaneously with cable and optical fibre connections. All schools use Microsoft operating systems and basic applications, but seven out of 12 also use Open Source solutions (A, B, F, H, I, J, K). All of them use specific educational software, except schools C, F & I.

According to the survey, computers are often placed in ICT labs (35 per cent) and classrooms (18 per cent), while others are located in administrative offices (11 per cent), teachers' rooms (11 per cent) and libraries (8 per cent), and the laptops are usually assigned to teachers for class work, by prior reservation. However, ICT management strategies are highly diversified. While some schools emphasize flexible use of computers by different actors (D, H, L), others earmark most computers for student use (C, G, K) and yet others for the work of teachers (A, B, F, J). In most schools (eight out of 12), teachers are in charge of ICT coordination and maintenance,usually on a part-time basis, although one school has a full-time ICT coordinator (J), and three have no formal ICT coordinator (B, C, I).

Concerning online school services, all schools have a website, use a Moodle platform (except case F) and have an email account to communicate with staff (except case L). However, only seven out of 12 use the Internet to communicate with parents (A, B, C, D, F, H, K) and only four to interchange information with students (B, F, G, K).

The responses to the survey by headmastersmake it possible to explore their personal attitudes regarding the use of ICT in secondary education. Most headmasters support the reinforcement of ICT in education, but those of at least four of the 12 schools indicated they werescepticalabout the policy (B, C, D, H) for varying reasons. Except for school E, all schools elaborated a specific plan for ICT implementation and regulation. The schools can be distinguished according to three distinct stages in the implementation of their ICT strategic plan: those focused on enlarging ICT resources and staff training (B, C, D, I); those oriented toward the internal production and management of educational services and applications (A, F, H, L); and those in an intermediary position between the two poles above (G, I, K).

The student survey responses enable us to confirm the differential use of ICT in classrooms (ANOVA test of variances significance: 0.000; F [11, 2599=19,493]; $p< .001$). In schools A, J & L, the average response of students was that ICT are moderately used in classes (at least once in a week). However, the average response of students in eight schools was that ICT are irregularly used in classes (once in a while), particularly for schools D& I, in which ICT are apparently hardly everusedwithin the classroom (see Table 3).It isworth noting that the survey responses of teachers confirmsthis pattern (emphasizing the scarce use of ICT in school D), although teacher responses appear to be more influenced by the "social desirability effect" (Schwartz et al., 1997) than those of students (ANOVA test of variances significance: 0.000; F [11, 311=4,977]; $p< .001$; Variance homogeneity:0.296).

Table 3. Students' perception of the intensity of ICT use in classrooms by school

School	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
A	217	3.23	1.578	.1071	3.0147	3.4370	1,00	6,00
B	215	4.17	1.398	.0953	3.9796	4.3553	1,00	6,00
C	256	3.91	1.584	.0990	3.7113	4.1012	1,00	6,00
D	230	4.57	1.371	.0904	4.3915	4.7477	1,00	6,00
E	273	4.05	1.544	.0934	3.8710	4.2389	1,00	6,00
F	242	4.10	1.742	.1120	3.8785	4.3198	1,00	6,00
G	179	3.97	1.599	.1195	3.7363	4.2079	1,00	6,00
H	225	3.99	1.400	.0933	3.8028	4.1706	1,00	6,00
I	196	4.58	1.435	.1025	4.3794	4.7838	1,00	6,00
J	197	3.32	1.754	.1250	3.0784	3.5714	1,00	6,00
K	179	3.69	1.519	.1135	3.4632	3.9111	1,00	6,00
L	202	3.14	1.660	.1168	2.9083	3.3690	1,00	6,00
Total	2611	3.91	1.613	.0316	3.8451	3.9688	1,00	6,00

Scale: (1) Every day or almost; (2) A few times a week; (3) Once a week; (4) A few times each month; (5) A few times per semester; (6) Never.

Concerning the use of computers and Internet outside the classroom (see Table 4), student survey responsesalso document significant variation among schools: it is more common in schools A & K, and particularly rare in schools C, E & I (ANOVA test: 0.000; F [11, 2654=14,961]; $p< .001$).

Table 4. Students' perception of the intensity of ICT use at school outside classrooms

School	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
A	216	2.70	.967	.066	2.57	2.83	1	4
B	216	3.00	.918	.062	2.88	3.13	1	4
C	282	3.40	.896	.053	3.30	3.51	1	4
D	235	3.10	1.008	.066	2.97	3.23	1	4
E	276	3.48	.978	.059	3.37	3.60	1	4
F	247	3.13	1.080	.069	2.99	3.26	1	4
G	180	3.01	.963	.072	2.87	3.15	1	4
H	232	3.02	1.077	.071	2.88	3.16	1	4
I	198	3.63	.856	.061	3.51	3.75	1	4
J	202	3.06	.988	.070	2.93	3.20	1	4
K	180	2.92	1.005	.075	2.77	3.07	1	4
L	202	3.10	1.072	.075	2.96	3.25	1	4
Total	2666	3.15	1.014	.020	3.11	3.18	1	4

Scale: (1) Every day; (2) A few times a week; (3) A few times each month; (4) Never.

The intensity of ICT use also varies significantly (ANOVA test: 0.000) according to the stage of implementation of the nationalsecondary school modernisation program (for a complete outline of this program and its different stages of implementation, see: http://www.parque-escolar.pt/en/program/international-programme-assessment.aspx). This is particularly pronouncedamong the schools involved in stages 0 and 1 (there is no variation among the schools engaged in stages 2 and 3). There is also a significant – albeit not very strong – correlation between the *ratio* of students per computer and the intensity of ICT use in classrooms ($r=-0.159$, $p<.001$).

When we crossed our findings about ICT resources, strategies and effective use (Tables 1 to 4), we were able to distinguish between three types of schools:

a) *Innovative schools* (A, J, K, L) – these allocate considerable ICT resources (a *ratio* of less than six students *per* computer connected to Internet), use open source applications, educational software and develop local solutions to support regular teaching-learning activities, and theirheadmastersand most staffare most supportive of ICT implementation.
b) *Traditional schools* (C, D, E, I) – these lack ICT resources (there are more than 12 students per computer connected to Internet), use only basic Microsoft and Moodle applications, seldom to support teaching-learning activities, their headmastersand most teachers are resistant to or sceptical about ICT, theirICT coordination is not dynamic, and their strategy is limited to resource reinforcement.
c) *Ambivalent schools* (B, F, G, H) – these are characterized by haphazard or inconsistent patterns of ICT use, probably due to a division among teachers (and headmasters) enthusiastic and supportive of ICT, which generates some interesting local dynamics, but prevents the development of an organizational strategy and overcome the resistance of the conservative segment.

Discussion

At a superficial level, the implementation of ICT in Portuguese secondary schools is supported by a large majority of school actors. According to the neo-institucional approach (Rowan, 1982), one may sustain ICT are actually generating through isomorphic mechanisms new formal institutions in the educational field, oriented towards the legitimation of the school work, rather than its efficiency.

Using the typology presented by Wong et al. (2008), ICT implementation in Portugal appears to be more "technologically driven" than "pedagogically driven", and does not go much beyond a "teacher-centred approach". However,the secondaryschools included in our research reveal a highly diversified pattern of ICT use, reflecting different stages of "e-maturity" and generating unequal opportunities for its students. The condition of generalized deprivation that was typical of the Portuguese educational system until some years ago, is gradually being

overcome mostly as a result of public programs such as the Technological Plan, among others, but the emerging reality is highly uneven and complex, characterized by a persistent absence of resources in some contexts, and byinvestments that are not effectively converted into educational gains in others.

A cumulative pattern was observed for the amount and quality of ICT resources to be associated often with the rate ICT-skilled teachers and the intensity of ICT use in regular pedagogical practice. If such cumulative pattern is sociologically predictable, it becomes an obstacle to achieving the equal opportunities principle within the schooling network, and raises serious issues about the redistributive ability of the state.

We established a three-category typology from the diversity of organizational appropriations, whichdifferentiates between *innovative*, *traditional* and *ambivalent* schools. Interestingly, other recent research on the organization of Portuguese schools that focuses on other variables, uses different methodologies and explores a much larger samplehas generated a similar typology (Veloso, Abrantes &Craveiro, 2011). In that study, the relation between school and community was found to be the key element differentiating school organization.

The organizational factor should not be overestimated, since our findings corroborate the international trend for faster appropriation of ICT for communicative and administrative purposes than for pedagogical work (Barron *et al.*, 2003; Palak& Walls, 2009).Moreover, our study found thatthere are some teachers using ICT on a regular basis in each of the 12 schools, and others who hardly use it at all, confirming the importance of teachers' cultures (Demetriadis*et al.*, 2003; Bauer & Kenton, 2005). Significant differences were also observed concerning teachers' conceptions, teaching areas and age. Such prevalence of ICT for administrative and communicative purposed as well as teachers' differences according to some social and educational variables are analysed in Project's Final Report (Alves et al, 2012) and in forthcoming papers. In the present paper, our team decided to focus strictly on organizational factors, quantifying and analysingthe differences between schools.

As Balanskat, Blamire&Kefala (2006) claim, there are schoolsthat seldom use ICT to support educational processes, some because they lack the material and human resources, but others because of the absence of an organizational strategy to manage resources and link them with curricular development and pedagogical practice.In some schools, however, ICT use has become more intense and diversified over the last few years, and has been increasingly incorporated into school culture and identity. Thus, the technological leadership of headmasters (Wong et al., 2008; Chang, 2012) aswell as the existence of an ICT coordinator and a school strategic planarise as key factorsshaping ICT resource allocation, management and pedagogical use.

Although external evaluation reports on schools elaborated by the Portuguese General-Inspectorate for Education barely focus ICT resources, strategies or effects, the content analysis of reports on these 12 schools suggests a relevant pattern: schools classified above as *innovative* (A, J, K, L) are all described in these reports as having efficient leadership, high levels of articulation and cooperation among teachers, and several partnerships with local and national institutions; by contrast,the *traditional schools* (C, D, E, I) are characterized in the reports as suffering from structural weaknesses in the coordination within and especially between departments, so that interdisciplinary practices are almost absent. Such findings corroborate the abovementioned international literature on effective schools (Fernández, 2004; Warren, 2005;

Santizo& Martin 2009; OECD, 2010), "isomorphic change" (Rowan, 1982; Tyler, 1988; Gewirtz, Ball & Bowe 1995; Perrenoud, 2001) and particularly on the impact of school culture and teachers' social capital on ICT development (Zhao & Frank, 2003; Frank, Zhao &Borman, 2004).

While strong leadership and strategic action appear to be a prerequisite for effective ICT implementation at schools, they are not sufficient in themselves. In some contexts, ICT areconceived as a core element of school culture and development prospects; in other contexts, ICT use isoften viewed as an unwanted distraction from schoolwork, and from the transmission of classic knowledge and virtues.These differing views are associated with systemswhere decision-making processes involve complex negotiations between many actors (so-called "multi-regulated systems"), and local responsibility for the management of enduring social conflicts is significant (Archer, 1978; Gewirtz, Ball & Bowe 1995).

It is important to stress that our data does not support any clear conclusions on the relation between "e-maturity" and academic achievements. It is true that none of the four*conservative* schools present high academic scores in national tests, a performance higher than expected considering students' backgrounds or a positive evolution from 2007 to 2010 (see Table 5). By contrast, the only school from this sample presenting an academic achievement considerably higher than expected in light of its social context is an*innovative* one.Despite such encouraging results, a higher level of variance was found within each school-type than between them.For instance, the higher level of academic performance was found for a school included in the *ambiguous* profile, while the lower average scores were observed in an *innovative* school. This weak correlation is associated with the fact that national assessments areexclusively based on written exams, and references to ICT use are strictly forbidden. Nevertheless, our findings refute the idea that ICT development undermines the strategy of increasing student scores in national exams (the *negative correlation thesis*). By the same token, to enhance ICT educational use in schools it would be necessary to revise assessmentmethodologies and tools, both at the local and national levels, valuing technological skills.

Table 5. ICT profile of each school (synthesis)

School	TPfE Stage	Students' background	ICT resources	ICT services	ICT strategy	ICT use	Academic scores	Academic scores evolution
A	1	High	High	High	Advanced	High	Average	↗
B	3	Average	Average	High	Basic	Average	Low	↗
C	2	Low	Average	Low	Basic	Low	Low	↘
D	3	Average	Low	Average	Basic	Low	Average	↔
E	3	Average	Low	High	Medium	Low	Average	↔
F	2	High	Average	Low	Advanced	Average	High	↘
G	1	Low	High	High	Medium	Average	Low	↘
H	2	High	Low	High	Advanced	Average	Average	↔
I	2	High	Low	Low	Basic	Low	Average	↔
J	1	High	High	High	Medium	High	High	↔
K	3	Low	Average	High	Medium	High	Average	↔
L	0	Average	High	Average	Advanced	High	Low	↘

Not surprisingly, the stage of implementation of the secondary schools modernisation programmehas also been identified as an important factor for ICT development in schools. On average, schools included instages 0 and 1 (for which most resources were transferred in 2007 and 2008) have shown more intense, advanced and diversified use of ICT in pedagogical activities, although there were some exceptions: for instance, ICT use is more common in school K (stage 3) than in school G (stage 1). It would be reasonable to expect that schools engaged in stage 2 would register higher frequencyof ICT use than those more recently involved, but no differences were observed between schools engaged in stages 2 and 3. We cannot therefore exclude an alternative hypothesis: that most schools engaged in stages 0 and 1 were already the most "e-mature", since they were those most interested in receiving ICT support, while the public program focused primarily on attaining fast results, actually reinforcing a pre-existing inequality. This may be the case due to the complex relations between public policies and local institutions (Ball & Bowe, 1992), especially in Mediterranean educational systems where a high level of formal centralism coexists with enduring local disparities (Archer, 1978; Fernández Enguita, 2001; Barroso, 2006).

Finally, as in other studies (Wong et al., 2008), factors as the geographical location and the social environment of each school appeared to have little impact on ICT use. *Innovative* as well as *traditional* schools were found both in middleclass andworkingclass environments.The humble social background of students may not be an issue because of previous governmental programmes (e-Escolas) dedicated to the distribution of laptops at reduced prices (or even free of charge) to secondary students, dramatically reducing the digital divide in this way; but equally,

headmasters and teachers working in some privileged contexts claimed that because students have easy access to many technologies, the role of the school should be to promote classic knowledge and values. Indeed, schools located in the Lisbon area (C, D, E, F), which is the richest and most technologically advanced region of the country, are among the most *traditional* ones. The fact that this is not a priority area for EU funding may explain the lower level of ICT resources at schools, but further research is necessary to explain most traditional views among teachers and headmastersin Lisbon (and the Centre of the country), using a larger sample and other methodological procedures.

Final remarks

There are huge ICT resources, policy and practice differences amongstate secondary schools in the Portuguese education system, even though the system is seen as being highly centralized in administrative terms. In this context, and in conditions of democracy, greater school autonomy tends to emerge beyond the framework of the formal systemic structure, in peripheral curricular areas.

Based on a cross-analysis of several indicators, we were able to categorize this diverse universe into three models of ICT use in schools: *innovative*, *conservative* and *ambiguous* schools. This orientation is associated with factors such as leadership and strategic action, partnerships, interdisciplinary cooperation and informal ties within schools, as well as with the stage at which schools are in the modernisation program.

Further research is necessary to broaden our knowledge in this domain. On one hand, although our typology matchesthat of a recent large-scalestudyof Portuguese school organizations (Veloso, Abrantes &Craveiro, 2011), it is important to investigate the specific issue of ICT using larger samples to corroborate observed patterns and to clarify others. With a nationally representative sample of schools it would be relevant to analyse the correlation between multiple factors, such as the profile of headmasters, ICT use, geographical location and academic scores, among other issues. On the other hand, our research raises new questions that could fruitfully be addressed by upcoming projects:how decisivefor ICT resource allocation is the relationship between school and administration (at the local, regional and national levels), and with Technological Plan in particular? And how are these resourcesaffected by schools' ability to find other public and private partners? What is the impact ofICT coordinatorson ICT implementation at schools? How can one quantify informal ties (social capital) among school staff and correlate it with ICT use?

Our findings have some implications in terms of the efficiency and equity of public policies. The distribution of ICT resources is necessary but insufficient to promote the systematic use of technologies in pedagogical activities. School organizations, national curricula, teacher training and assessment systems must also evolveto promote the harmonious integration of ICT and prevent it from becomingan undesirable and alien presence in school, while turns to be omnipresent in all the other fields of life.

Strategic programs such as the Technological Plan for Education appear to be successful in *innovative schools*, but its impact in *traditional* and *ambiguous* schools is hardly satisfactory, since it

focuses in technological development and distribution, relyingmostly on local planning and dynamics to incorporate them in pedagogical practices. The persistent lack of (human and technological) resources – or scarce use of existing ones – often limits the use of ICT in schools, challenging the principle of equal opportunities in the Portuguese educational system. *Ambiguous* schools require support to develop a local strategy for ICT appropriation, involving coordinators, staff and partnerships; ICT adoption in *traditional* schools will likely require more prescriptive policies, and an ICT expert working closely with headmasters and teachers. A typology of schools established by research can help public policy-makers to design sensible policies that target real existing school types and not a single ideal model of school.

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