(WHAT PRODUCES THE) BEST EFFECTS ON TEACHERS' ICT USE IN CLASSROOM: FORMAL TRAINING, INFORMAL TRAINING, OR NEITHER?

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Abstract

This paper presents a study developed with 103 secondary school teachers, which assumed the purpose of analysing the efficiency of two different approaches in teachers' ICT training, specifically formal and informal courses. This analysis was conducted considering teachers' perceived impact of formal and informal teachers' training courses as well as the number of courses attended into two different psychological constructs: (a) teachers' perception of ICT use in professional activities and (b) computer self-efficacy. Significant differences were possible to identify in these two different formats of training initiatives.

Technologies, Training and Teacher Professional Practices

The current society is frequently described as immersed in a digital age, in which technologies have a leading role in personal, societal and professional interactions. The Internet, PC´S, mobile phones, tablets and other gadgets have profoundly transformed the way people live, work and occupy their leisure time.

This digital revolution brought major challenges to education and educators. Todays' schools cannot stay aside from the development of society and the challenges that this development entails. A digital society needs a new school, an innovative one with a new vision and new teaching methods where Information and Communications Technologies (ICT) are an asset.

But school transformation can only happen with a robust and strategic investment in its professionals. Unfortunately, Mckenzie (2002) observed that few countries have really cared about the quality of their teachers. Their teaching styles, aspirations, potential, needs and fears are poorly considered. ICT is frequently referred as a territory where teachers do not feel comfortable to step in. For many teachers, technologies really scare them. ICT uses a language that is not their own (Prensky, 2001), and it requires them too much effort, time and investment (Cerezo, 2006) to proficiently manipulate them. It is not surprising that regarding the discomfort and all the difficulties in dealing

with its unknown tools, many teachers, in a predatory movement of fighting what is feared, tend to avoid such technologies.

In the last years, many authors identified and studied the effects of the major barriers regarding ICT integration. In Portugal, as in many other countries, different authors (Costa, 2008; Fernandes, 2006; Moreira, Loureiro, & Marques, 2005; Paiva, 2002; Pedro, Soares, Matos, & Santos, 2009; Silva, 2003) have developed research project in which obstacles for ICT-adoption in schools were listed. In the relevant part of those, teacher training is referred to as a critical barrier.

Schoepp (2005) has noted that even when all contextual factors with restrictive impact are eliminated from schools (such as the lack of access to technologies, shortage of time, limitations on institutional and technical support), teachers' investment and adoption of technology was not yet guaranteed. The author advocates that it was the remaining barriers, especially those associated with teachers' technological skills and competences, the ones that effectively determine the schools' level of technology integration.

Lack of training makes teachers feel inhibited in using ICT for teaching purposes. In fact, the lack of specific preparation for using technology tends to be repeatedly reported in literature, and over several decades, as one of the most serious obstacles to full integration of technology in the classrooms (Bravo & Fernández, 2009; Culp, Honey, & Mandinach, 2003; Harvey & Purnell, 1995; Hasselbring, Barron, & Risko, 2000; Means, Olson, & Ruskus, 1995; NCREL, 2000; Norris, Soloway, & Sullivan, 2002).

Lawless and Pellegrino (2007) indicate that if teachers don't receive the required training to feel comfortable in using ICT, this equipment will be hardly seen as a teaching resource, and even less, as a strategic tool that can be productively use to support students' learning.

Costa (2008) states that one of those with the major responsibility for a reduced adoption of ICT in teacher's practices is, indeed, higher education institutions, specifically the preparation provided to teachers in their pre-service training. Even when ICT is present in teachers' education courses, they are often reduced to a technical approach without regarding its curriculum-integration; mastery of tools and application is the only thing which seeks to be achieved.

Based on a literature review, Balanksat, Blamire, and Kefala (2006) tried to organize the main obstacles of the ICT-integration into three levels: (i) macro (educational-system level), meso (institutional level) and micro (individual's level). At the highest levels, the authors consider as inhibiting factors: the fragile stability of teachers' careers, the inadequacy of the curricula, the lack of funding for equipment maintenance, obsolete hardware and software, logistic and labour conditions (physical spaces, number of students per teachers, stuffed schedules) and lack of a school strategic vision and shared ambitions regarding ICT adoption. In the micro level, the authors focus on two distinct agents, students and teachers. Students' differences in access to

technology at home is the most critical factor. Regarding teachers the author referred to lack of training and competence in managing ICT, the difficulties in fulfilling all the content of schools' curricula and beliefs and attitudes towards technology.

Several authors confirm the importance of teachers' competence, confidence and motivation as decisive factors in the implementation of innovative educational practices using ICT (BECTA, 2004; Becker & Riel, 2000; Marcinkiewicz, 1996; Pelgrum, 2001). In fact, the research conducted by Lumpe and Chambers (2001) and Pratt (2002) shows that teachers' attitudes are one of the elements that most influence the position taken by teachers in what refers to the process of ICT integration in classrooms activities. Among these, teachers' sense of confidence and self-efficacy has been was distinguished. Some authors attest that teachers' sense of self-efficacy has a significant impact on their level of technology use (Wang & Ertmer, 2003).

Presented under the Social Cognitive Theory, the concept of self-efficacy refers to the belief held by an individual on their ability to perform all actions required to achieve a certain goal (Bandura, 1997). It presents to be a strong predictor of human behaviour because it determines personal aspirations, choices and effort and also dictates the level of involvement on a given task. Teachers' self-efficacy beliefs tend to be associated to their level of professional investment and involvement in innovative projects (Drubay, 2001; Tschanner, Moran, & Woolfolk Hoy, 2002).

Research Aims

This paper is based on a wider research project (Piedade, 2010) where, among other goals, the authors aimed to explore the existence of differences regarding the format of ICT-training initiatives, formal and informal, in (a) teachers computer self-efficacy and (b) technology-use in professional practices. The following research questions were assumed:

- Is it possible to identify any effects in teachers' computer self-efficacy and level of technology use in professional practices that can be link to their enrollment in-service ICT training initiatives?
- Is it possible to identify differences regarding the format of the in-service ICT training initiatives, particular formal and informal approaches?

As formal training initiatives the authors considered all the courses conducted by certified trainers and accredited by the council of the Ministry of Education officially responsible for teachers' continuous education. These courses range normally, from 15 to 50 hours long and require teachers' assessment and approval on the course for this training to be recognized as valid for professional accreditation. As informal training initiatives, the authors considered *on-demand* designed workshops, self-organized by schools, teachers or directors, which do not have any official recognition or

accreditation. These courses were to be planned/ developed for 3 to 10 hours; no formal process of evaluation of teachers learning is conducted.

Methodology

Data was collected from 103 teachers of a secondary public school evolving 85% of the total number of the schoolteachers. The participants were predominantly female (71,84%), who had been teaching for more than 20 years (67%) and for more than 10 years in this particular school (54,4%). This study assumes a descriptive and exploratory nature and fits into a pragmatic research paradigm (Creswell, 2007).

A quantitative based approach was undertaken for data collection and analysis. Data was collected through two self-report scales, organized in an online questionnaire: Computer Self-Efficacy Scale (Cassidy & Eachus, 2002) and Measure Teacher´s Technology Use Scale (Bebel, Russel, & O´Dwyer, 2004). The Computer Self-Efficacy Scale was developed by Cassidy and Eachus (2002) applying the general postulated of Bandura's Social cognitive theory. The authors present the instrument as "domain-specific.*"* The instrument is originally composed by 30 items with 5-points response options in a Likert format scale (ranging from 1"totally disagree" to 5 "totally agree").

The Measure Teacher's Technology Use Scale is proposed by the authors as a multidimensional instrument that considers that the use of technology by teachers does not happen in the same way and with equal intensity in different professional tasks. The scale is organized into seven dimensions: (i) preparation, (ii) professional email, (iii) delivering instruction, (iv) accommodation, (v) student use, (vi) student products and (vii) grading.

The items are presented in a Likert format scale and teachers are requested to select the answer choice according to the shown scale between "rarely" to "very often," listed with values ranging between 1 and 5, respectively. For this specific article, the total scale score and not the respective dimensions will be only considered.

In the process of translation and adaptation of instruments, it was necessary to analyze their psychometric quality, thus seeking to eliminate any less discriminative items. Therefore, in order to validate the instruments, a pilot-study was conducted with 56 secondary schools teachers.

Through internal consistency analysis procedures the Computer self-efficacy scale items were reduced to 27 and a Cronbach's alpha coefficient of 0.94 was found, revealing a high internal consistency of the scale. The same level of internal consistency was found in the Measure Teacher's Technology Use Scale, registering a Cronbach's alpha coefficient of 0.93 and all the items were maintained.

Other questions related to teachers previous experiences regarding in-service ICT-training courses the attended ICT-training programs were also added to the questionnaire. They were specifically related to: (i) the number of attended ICT-training courses in the previous school years and (ii) the perceived impact

of the ICT-training courses attended in own professional practices. This last item took the form of a Likert-format response scale (five points), where the highest value (5) appeared associated with a high impact and a lower value (1) was associated with a reduced impact.

To ensure the required procedures regarding data collection, a formal request for permission to develop the study was firstly submitted to the school director. After receiving formal authorization, the study was conducted between February and April 2010. The questionnaire was created online, using the Googledocs-form web tool and the URL was sent to the participants email. The possibility of answering to it in a paper-format was also available.

Results

Considering the constructs under analysis (teachers' computer self-efficacy and teachers' perception of technology-use in own professional activities), the following data were organized in order to distinguish the effects arising from the impact of different formats of in-service ICT-training courses.

In order to discriminate the effects of formal ICT-training courses and informal ICT-training workshops, three groups of teachers were formed considering the level of perceived impact of the training initiatives undertaken: (i) high impact group, including teachers whose answers range between four to five points, (ii) moderate impact group, considering teachers who selected the 3 points option, and (iii) reduced impact group, including teachers who attributed one or two point. In this procedure, equal sample sizes per group was possible to guarantee (the number of elements of the larger group didn't exceed 1.4 times the smallest group).

By analysis of the means presented for each of the groups presented in Table I, it is possible to see that differences emerge. In regards to formal ICT-training, the results evidence that teachers who classified its impact on their professional practices as high, were also those who presented the highest levels of computer' sense of efficacy (M = 4.05) and technology use (M = 3.71). Indeed, it was possible to identify a growing tendency in the results, both in the scores of computers self-efficacy and technology-use.

The same linearity in the results was not evident regarding informal ICT-training workshops undertaken by teachers. The highest levels of computers self-efficacy (M = 3.55) and technology use (M = 3.94) were presented by the group of teachers who scored at the highest level the informal ICT-training initiatives impact. However, the other constituent groups do not seem to reflect any pattern in the results. In both the constructs under analysis, the group of teachers who attributed a moderate impact to the informal ICT-training undertaken revealed lower scores than the groups of teachers who classified as reduced its impact.

Table 1

Mean and Standard Deviation of Teachers, Computer Self-Efficacy and Technology-Use Given Perceived Impact of Formal and Informal Training

Formal ICT-Training Perceived Impact		M	SD
Computer self-efficacy	high	4.05	0.58
	moderate	3.61	0.52
	reduced	3.46	0.74
Teachers technology-use	high	3.71	0.75
	moderate	3.12	0.57
	reduced	2.59	0.99
Informal ICT-Training Perceived Impact		**M**	**SD**
Computer self-efficacy	high	3.94	0.65
	moderate	3.64	0.57
	reduced	3.86	0.70
Teachers technology-use	high	3.55	0.73
	moderate	2.98	0.71
	reduced	3.22	0.99

In order to analyse the statistical significance of the differences found in these groups, both in computer self-efficacy scores and in the technology use scores, a multiple analysis of variance (ANOVA) test was conducted. All its requirements were previously satisfied: independence of variables, normal distribution and homogeneity of variances (Newby, 2010). The application of the Levene' test confirmed the homogeneity of the variances, both for technology use and for computer' self-efficacy, as regard to formal and informal ICT-training perceived impact. Simultaneously, the Kolmogorov-Smirnov test revealed a normal distribution.

For formal ICT-training perceived impact, the ANOVA test confirmed that the differences found between the three groups were statistically significant for both computer self-efficacy variable (F (2,50) = 1,609, p= .001) and for teachers' technology-use (F (2,50) = 4.482, p= .015). In contrast, the differences found in informal ICT-training perceived impact didn't revealed to be statistically significant, nor in computer self-efficacy (F (2, 77) = 1.603, p= .207) and neither in the teachers technology-use (F (2,77) = 1.731, p= .208).

Because three groups were constituted, additional exploration of the differences among means is needed to provide specific information on which groups the means are significantly different from each other. A post-hoc test was calculated for the formal ICT-training groups (Tukey's test).

Table 2

Tukey's Test of Teachers' Computer Self-Efficacy and Technology-Use for Formal ICT-Training Groups

Formal Training Perceived Impact		*p*
Computer self-efficacy	reduced - moderate	.854
	reduced - high	.047
	moderate - reduced	.854

	moderate - high	.063
Teachers technology-use	reduced - moderate	.247
	reduced - high	.002
	moderate - reduced	.247
	moderate - high	.048

In computer self-efficacy it appear that significant differences were found between teachers who classified as 'reduced' the level of impact of the formal training workshops in which they had been enrolled and the teachers who classified it as high. In teachers' technology-use, it was possible to identify significant differences between the following groups: 'reduced'-impact' group and 'high'-impact group ($p = 0.002$) and 'moderate' -impact group and 'high'-impact group ($p = 0.048$).

This study aimed to explore the existence of differences regarding the format of ICT-training initiatives, formal and informal, in teachers' computer self-efficacy and technology-use in professional practices and these results evidences that differences can be found regarding informal training but more specifically when focusing in the group of teachers to whom this in-service training courses did revealed a high impact in their professional practices.

Conclusions

Although based on the evidence collected from a reduced number of teachers and with self-report scales, the results show that teacher ICT-training perceived impact can be seen as a relevant indicator to consider when analysing the effects of in-service (and possibly also pre-service) ICT-training courses in teachers' adoption of ICT in their teaching practices. This variable may have a discriminate power considering the differences found in this study and also other studies, previously developed by the same authors (Piedade & Pedro, 2011), where perceived impact presented to be must more evidential of teachers' level of technology used than, for instants, the number of ICT-training attended.

The results also indicated that the two different formats of teachers' in-service ICT-training, formal and informal initiatives, do evidence to produce distinct effects in teachers' computer self-efficacy and in teachers' technology use. Although mean values revealed that teachers who classified the ICT-training initiatives, regarding both formal and informal ones, as having a high impact in their professional practices were also the ones who scored highest in the Computer self-efficacy scale and in the Measure teacher´s technology use scale, not all these differences revealed to be significant. Only formal ICT-training initiatives presented significant variations in teachers' beliefs regarding their levels of ICT proficiency and their perception of ICT- adoption in own professional activities. No significant effects were found associated to informal workshops.

Some recent studies have shown totally different results. Polly, Mims, Sheperd and Inan (2010) as well as Avalos (2011) postulate that very positive effects arise from informal training initiatives undertaken in schools.

The differences in the way these two types of teacher training have been developed in the Portuguese context may explain these results. Informal training workshops are mostly constituted by self-organized school initiatives. Even though, they present to be highly contextualized, more adjusted to teachers' daily practices and more easily to follow-up through the support of colleagues, they also tend to be (i) episodic, (ii) poorly systematized, (iii) with no clear objectives, (iv) mostly never evaluated and therefore improved, (v) too short and limited in time and thus too intensive, (v) biased by workplace interpersonal relations, and mainly, (iv) not taken seriously by teachers. The weaknesses of the way this kind of teachers' training format has been implemented in the Portuguese context may have overtaken its potential benefits.

Nevertheless, the authors state that teachers' in-service ICT-training, the efficiency of its effects on teachers' attitudes, beliefs and practices needs to be more accurately addressed. A mediation effect exerted by the 'quality' factor appear to be underling these results. The differences between teachers' formal and informal training can be explained by differences in the quality of the training initiatives and therefore in their perceived impact on teachers' practices. The quality of the courses design, training activities, methodologies and, of course, the trainer is critical and in it relies the answer to the question that entitles this work. Good quality ICT-training, developed to directly impact teachers' own sense of competency and professional practices produces the best effects on integrating ICT in classroom teaching and learning activities.

Many criticisms emerge in the literature related to the way which ICT-training programs have been designed and implemented in schools. In such documents teachers' training in ICT are generically referred to as: streamlined and implemented by professionals without real knowledge about the needs, interests and current characteristics of teachers and students, disconnected from the curriculum content and the actual activities that take place in today's classrooms (Goole, Kautz, & Knuth, 2000); insensitive to teachers' different levels of knowledge (Christensen, Knezek, & Griffin, 2001; Liu & Huang, 2005); asymmetric and depersonalized (Schoepp, 2005); excessively focused on technical mastery of tools and applications (Daly, Pachl, & Pelletier, 2009; White & Myers, 2001) and clueless regarding how to apply it in classes (Anderson, 2006).

This study (although not methodologically flawless) presents relevant results that need to be taken further. These results need to be confirmed and substantialized by other and wider studies, preferably by national and international research projects that utterly take into analysis teachers' professional development and its relevancy regarding ICT-integration in schools activities.

The adoption of technology requires teachers' ownership of technical and pedagogical skills, as well as a strong sense of professional commitment and interest in innovation and for that purpose, high-standards training programs for promoting teachers competences regarding ICT-use need to be developed. Yet, the guidelines by which these programs need to be designed are still

narrowly known, not at all organized and even less consensual. so further empirical studies and systematic review research needs to be conducted.

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