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Factors Affecting School Teachers' Perceptions Of The Instructional Benefits Of Digital Technology

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Abstract

The potential benefits of digital technology for teaching and learning in schools have been extensively characterized in the academic literature. However, little is known about the factors that affect teachers' perceptions of these benefits. This state of affairs is problematic since we know that teachers' perceptions have an impact on their teaching practices. The ultimate aim of this study was to develop and test a model of the factors affecting primary and secondary school teachers' perceptions about the instructional benefits of digital technology in their teaching practices. Instructional benefits are defined here as the contribution of digital technology in several aspects of curriculum development such as the formulation of learning goals, the development of curriculum content and learning activities, the allocation of educational resources, and the adoption of new methods of assessment. This study used survey data gathered from 702 teachers from a 356 primary and secondary schools in Spain. The study aimed at exploring the relationship between teachers' perceptions of the benefits of using digital technology for curriculum development and individual and school-level conditions. Correlation analyses examined the relationship between overall variables and teachers' perceptions. Several significant relations were identified. Preliminary findings suggest that factors such as teaching area, digital literacy, educational ICT training, and Internet access are important predictors of teachers' perceptions of the instructional benefits of digital technology. The outcomes of the study will help schools and teachers to enhance the use of digital technology in their teaching and learning practices.

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1. Introduction

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In recent years, the factors that influence the integration of ICT in classrooms and the ways digital technologies are used in teaching and learning have become central topics in the field of educational technology (Tondeur, Valcke, & Van Braak, 2008; Wastiau, Blamire, Kearney, Quittre, Van de Gaer, & Monseur, 2013). Within this literature, the potential positive impact of digital technology on teaching and learning in schools has been widely acknowledged (Voogt, Knezek, Cox, Knezek, & Brummelhuis, 2013). According to Bilbao-Osorio & Pedró (2009) two types of positive impacts of digital technologies can be identified: (i) the enhancement of the student performance, which includes aspects such as the development of ICT competences and the academic performance in basic subjects, and (ii) the improvement and introduction of new processes of teaching and learning.

A substantial body of research shows that teachers' perceptions of instructional benefits are an influential factor that affects technology integration in classrooms (e.g., Inan & Lowther, 2010; Knezek, Christensen, & Fluke, 2003; Van Braak, Tondeur & Valcke, 2004). Current evidence shows that instructional benefits are defined as the perceived effectiveness of digital technology, which Petko (2012, p. 1355) describes as "the belief that student learning is improved with the help of digital media". According to Petko, the element of effectiveness should include items related to "whether the use of digital media could improve the quality of teaching, learning outcomes, interest, and creativity, collaborative work and learning strategies for the students" (p. 1355).

Several studies that based their rationale in the "will, skill, tool model" (e.g., Christensen & Knezek, 2001; Christensen & Knezek, 2008; Knezek, Christensen & Fluke, 2003; Morales Velázquez, 2006) used the explanatory variable "perceived effectiveness of digital technology" as one of the "will variables". In these studies, effectiveness is defined as teachers' personal beliefs regarding ICT. Two other variables used in these researches include technical ICT infrastructure (tool variables) and teachers' abilities to integrate ICT into teaching (skill variables). Altogether, these three variables explain much of the variance in the frequency of classroom ICT use. Recently, Petko (2012) has also demonstrated that the perceived effectiveness of ICT is one of the most important predictors of the frequency of classroom use of computers.

Van Braak, Tondeur & Valcke (2004) measured teachers' attitudes toward the effects of computer adoption in the classroom. Some items that these authors included in their measures were: "increases the level of creativity of pupils", "helps pupils to achieve better text writing", or "used as a learning tool, increases student motivation". The findings of the study showed that general computer attitudes -which included items such as computer liking, computer anxiety, and computer confidence- have a direct effect in the attitudes toward the use of computers in education. The study concluded that the attitudes toward computers in education have a considerable influence in teachers' technological innovativeness and teachers' classroom use of computers.

Inan & Lowther (2010) examined the effects of teachers' individual characteristics and perceptions of contextual factors that influence ICT integration in classrooms. One of the independent variables included in their study was teachers' beliefs about technology, which was defined as the teachers' perception of the influence of technology on teaching and learning practices. Findings showed that teachers' computer proficiency, teachers' overall support, teachers' technical support, and computer availability have a significant influence on teachers' beliefs about technology. Also, teachers' beliefs had a strong influence on the use and integration of ICT in classrooms.

To date, only Perrotta (2013) has explored the influence of individual, classroom, school and system-level issues on how teachers experience the educational benefits of digital technology. In this study, perceived benefits of using technology included aspects such as the access that it gives to wider learning content and resources, and the fact that it allows students to become more motivated, more active and independent, and more attentive in their learning process. The study concluded that broader contextual and cultural conditions might influence teachers' perceptions of the benefits of digital technology. However, this research had three main limitations. Firstly, it approached the topic of benefits solely from a learning standpoint (i.e., educational benefits for students). Furthermore, it did not analyse the potential role of digital technology in supporting the teaching practices. Secondly, while it included ICT training within the explanatory variables, it left out other important ICT related individual characteristics such as the digital literacy and the school and outside school internet access. Thirdly, while considering the effects of a range of school-level characteristics, it ignored the influence of key ICT related school conditions such as the ICT policy or the ICT infrastructure.

The present study aims to shed light on these issues by examining the teacher and structural factors that affect teachers' perceived effectiveness of digital technology. To do so, the study uses a wide range of variables concerning ICT related teacher and school conditions as well as specific items measuring teachers' perceptions of the instructional benefits of digital technology.

2. Method

2.1. Participants

A survey was conducted at the end of the 2006-2007 academic year (March - June 2007) in a sample of 356 educational centres offering compulsory primary and compulsory secondary education in Spain. Within each school, school principals and teaching staff teaching in a randomly selected classroom from the final grades (i.e., compulsory primary students aged 11-12 years, and compulsory secondary aged 15-16) completed an in-school, in-depth, self-administered questionnaire assisted by the research staff. The final sample of this study was composed of 356 school principals and 702 teachers.

2.2. Measures

Perceived effectiveness of digital technology. Teachers reported on a five-level ordinal rating scale (ranging from "strongly disagree" to "strongly agree") their level of agreement with five items presenting different perceptions about the benefits that digital technology plays in their teaching practices (i.e., ICT-based communication and collaboration with my students are useful for my teaching practices, educational resources available on the internet meet the needs of my teaching area, ICT improves the quality of my students' learning experience, ICT helps me to achieve the educational goals of my students, and ICT-based educational resources are suitable for my teaching practices). Exploratory factor analysis using principal components analysis (PCA) showed a one-component solution (KMO=0.857 and a significant Bartlett's test, p=0.000), with component loadings ranging from 0.770 to 0.847. This solution accounted for 64.50% of the total variance and showed a Cronbach's α of 0.861.

Socio-demographics and school-level information. Teachers were asked to provide basic socio-demographic information (i.e., age and gender) and their teaching area. School-level information regarding the education level offered (compulsory primary or compulsory secondary), the school's type of funding (public or private), and total population of the town or city where the school was located were also included in this research.

ICT related school conditions. School principals were asked to report key information about the school ICT policy, ICT infrastructure, ratio of computers to students in classrooms, and availability of ICT support. In order to assess school ICT policy, a list of six dichotomous items concerning teaching (i.e., policy measures to promote changes in the educational goals and curriculum, policy measures to encourage new teaching methods, and policy measures to improve assessment practices) and management (i.e., policy measures to promote out-of-school-time use of ICT by students and their families, policy measures to incentive and reward teachers' use of ICT in their teaching practices, and policy measures to promote teachers' competence in educational ICT use) issues was presented. Given their non-metric nature, PCA with polychoric correlation was used and showed a two-components structure (KMO=0.714 and a significant Barlett test, p=0.000) that accounted for 65.32% of the total variance in teaching (48.35%) and managing issues (16.97%). The rotated solution (Direct oblimin) provided components loadings ranging from 0.763 to 0.905, and from 0.726 to 0.745. Both components showed an acceptable reliability, with a Cronbach's α of 0.901 and 0.790 respectively.

With regard to ICT infrastructure, another list of four dichotomous items concerning common ICT infrastructure available in schools (i.e., maintaining a school's website, providing broadband internet access, providing a WIFI service, and having a school intranet) was presented. PCA showed a one-factor structure (KMO=0.688 and a significant Bartlett's test, p=0.000), with factor loadings ranging from 0.594 to 0.827. This solution accounted for 50.63% of the total variance and showed an acceptable reliability with a Cronbach's α of 0.675.

ICT related teacher conditions. Teachers were also asked to report their digital literacy, their attendance at a specific course addressing the educational uses of ICT, and their frequency of Internet access within and outside school. In order to assess teachers' digital proficiency, they were asked to report their competence in six Internet practices (i.e.,

browsing the Internet, downloading a file, sending an email, using instant messaging applications, publishing on the Internet, and developing websites). The scale covered four levels of mastering that range from "I don't know what this is or means" to "I can do it by myself". PCA showed an acceptable one-component solution (KMO=0.843 and a significant Bartlett's test, p=0.000), with component loadings ranging from 0.771 to 0.903. This solution accounted for 72.33% of the total variance and showed a Cronbach's α of 0.921.

With regard to educational ICT training, a three-level ordinal measure that included both quantity and perceived quality of educational ICT courses received by teachers over the last three years was constructed ranging from "did not receive any" to "received a very useful one". Finally, two four-level ordinal items ranging from "never or hardly ever" to "daily" were used to measure their frequency of Internet access within (i.e., in the staff room, school library, computer lab) and outside (i.e., at home, public library, Internet café) the school premises at any time other than their regular classes.

3. Results

Descriptive statistics and correlations

Table 1 shows descriptive statistics and correlations between all variables. Only some variables have a significant positive correlation with the perceived effectiveness of digital technology. The strongest relationships are with ICT related teacher variables such as digital literacy (r=0.28; p<0.001), educational ICT training (r=0.26; p<0.001), school internet access (r=0.25; p<0.001) and outside school internet access (r=0.20; p<0.001). Further variables that have a weaker relationship with the dependent variable are gender (r=0.11; p< 0.01), teaching area (r=0.09; p< 0.01), and ICT teaching policy (r=0.07; p<0.05). Finally, ICT infrastructure (r=0.06; p<0.10) shows a positive and significant correlation with the perceived effectiveness of digital technology.

Table 1. Means, standard deviations and correlations between the observed variables (N=702)

		M	SD	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	Perceived effectiveness [e]	2.49	0.64	-														
2	Digital literacy [f]	2.35	0.53	0.28[d]	-													
3	Educational ICT training [g]	1.12	0.88	0.26[d]	0.23[d]	-												
4	School internet access [h]	1.97	1.06	0.25[d]	0.33[d]	0.24[d]	-											
5	Outside school internet access [i]	2.13	1.08	0.20[d]	0.49[d]	0.14[d]	0.30[d]	-										
6	ICT teaching policy	0.33	0.35	0.07[b]	0.03	0.02	0.09[c]	0.13	-									
7	ICT management policy	0.48	0.29	0.05	0.02	0.06	0.04	0.00	0.36[d]	-								
8	ICT infrastructure	0.61	0.27	0.06[a]	0.02	0.11[c]	0.05	0.03	-	0.07[a]	0.22[d]	-						
9	Computers to student ratio	0.45	1.02	- 0.02	- 0.04	0.09[c]	0.13[d]	- 0.05	- 0.04	0.05	- 0.04	-						

10	Availability of ICT support [j]	0.63	0.48	-0.09	0.06[a]	0.10[c]	0.12[b]	0.02	0.08[b]	0.14[d]	0.11[c]	0.02	-						
11	Age	41.09	9.86	-0.03	0.33[d]	0.05	0.06[a]	0.20[d]	0.02	0.05	0.13[d]	0.00	0.03	-					
12	Gender [k]	0.41	0.49	0.11[c]	0.11[c]	0.05	0.11[c]	0.07[b]	-0.03	0.02	0.03	0.06[a]	-0.03	0.13[d]	-				
13	Teaching area [l]	2.94	2.01	0.09[c]	0.16[d]	0.00	0.13[d]	0.10[c]	0.04	0.01	0.02	0.03	0.01	0.04	0.11[c]	-			
14	Education level [m]	0.20	0.40	0.04	-0.01	0.08[b]	-0.04	-0.01	0.11[c]	0.00	0.13[d]	0.10[c]	-0.00	-0.05	0.12[d]	0.07[b]	-		
15	School's type of funding [n]	0.37	0.48	-0.01	-0.02	0.11[c]	0.13[d]	-0.00	0.10[c]	0.05	0.20[d]	0.15[d]	0.00	-0.04	0.14[d]	0.03	0.61[d]	-	
16	Town population [o]	1.82	1.37	-0.00	-0.02	0.02	0.12[d]	0.02	0.01	0.10[c]	0.11[c]	0.14[d]	0.07[b]	0.06[a]	0.08[b]	-0.01	0.19[d]	0.33[d]	

[a] p<0.10; [b] p<0.05; [c] p<0.01; [d] p<0.001.

[e] 0= "strongly disagree", 4= strongly agree; [f] 0=I don't know what this is or means", 3=I can do it by myself; [g] 0=Did not receive any, 1=Received a hardly useful one, 2=Received a very useful one; [h] 0=Never or hardly ever, 3=Daily; [i] 0=Never or hardly ever, 3=Daily; [j] 0=No, 1=Yes; [k] 0=Female, 1=Male; [l] 0=Spanish language, 1=Co-official Spanish languages, 2=English language, 3=Mathematics, 4=Humanities, 5=Science, 6=Arts, 7=Technology; [m] 0=Compulsory primary, 1=Compulsory secondary; [n] 0=Public, 1=Private; [o] 0=Less than 10,000, 4=500,001 or more.

4. Discussion and Conclusion

Our findings indicate that socio-demographics (i.e., gender and teaching area) and ICT related teacher conditions concerning digital skills (i.e., digital literacy level and educational ICT training) and frequency of Internet access (i.e., inside and outside school internet use) show the strongest correlations with teachers' perceived effectiveness of digital technology. School-characteristics, however, show no significant difference. Finally, ICT related school conditions such as ICT teaching policy and ICT infrastructure show a significant but more modest association with teachers' perceived effectiveness of digital technology.

These preliminary results contrast with the findings of previous studies. Conversely to Perrota's (2013) findings, we found little empirical evidence that school-level conditions mediate and significantly affect teachers' perceptions of the instructional benefits of digital technology. Additionally, in consonance with Inan & Lowther's (2010) findings, teachers' digital literacy is identified as one of most influential variables in our model. However, unlike these authors, we did not find a significant relationship of the ratio of computers to students in classrooms and the availability of ICT support with the perceived effectiveness of digital technology.

Furthermore, results from a preliminary multiple linear regression analysis conducted as part of work in progress confirm a significant effect of individual teacher variables (i.e., high digital literacy, very useful educational ICT training, teaching area) in the perceived effectiveness of digital technology. Further regression analyses will be conducted to confirm the relationships observed in the bivariate analysis. These analyses will also allow us to assess the independent contribution of socio-demographics, school-level information, ICT related school conditions and ICT related teacher conditions in the model.

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