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A qualitative study about the implementation of tablet computers in secondary education: the teachers' role in this process

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Abstract

In the context of the digital age, this paper reports the perceptions of stakeholders about an integrated implementation of tablet computers in a secondary school in Flanders. The main focus is on the central role that teachers play in this implementation process. Focus group interviews show that teachers can be distinguished into two categories, namely the innovative and the instrumental teachers, which has consequences on the manner of giving courses and the needs concerning professional development. These results indicate that the role of innovative teachers has to be promoted and attention has to be given to digital didactics.

1. Introduction

In the digital age the potential of educational technologies in schools cannot be ignored considering the new possibilities it provides for the learning environment (Alvarez, Brown, & Nussbaum, 2011; Melhuish & Falloon, 2010). This article focuses on the perceptions of stakeholders about the implementation of innovative technology, and in particular, on tablet computers in secondary education. Existing literature about the implementation of technology states that such implementations are not evident but challenging (Klein & Knight, 2005; Kotter, 2007; Pynoo, Devolder, Tondeur, van Braak, Duyck, & Duyck, 2011; Tondeur, Kershaw, Vanderlinde, & van Braak, accepted). Moreover, implementation of tablet technologies in schools requires careful and long-term planning

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before, during and after the implementation process. This implementation has to involve a technical network, stakeholder preparation, ongoing engagement of all stakeholders, and plans for monitoring the implementation process and evaluation (Burden, Hopkins, Male, Martin, & Trala, 2012; Heinrich, 2012).

1.1. Educational innovation and the role of teachers

Nowadays, the use of technology is becoming increasingly popular in many schools, but the element determining the success or failure of the implementation, namely the teachers, is often underexposed. According to Chen, Looi, & Chen (2009), the teachers and their central role in the integration of technology in the classroom are the most important elements. Teachers' attitudes, viewpoints and philosophies towards technology play a central role in the perceptions of their students towards technology (Hu, Clark, & Ma, 2003; Sang, Valcke, van Braak, Tondeur, & Zhu, 2011; Wallace, 1991). Moreover, the use of technology in education is related to the perceptions of teachers; a more traditional or constructivist belief about education influences the didactical practices and use of technology (Becker & Ravitz, 1999). In addition, implementation of such technology demands a lot from teachers (Barnes, 2005; Pynoo et al., 2011; Vanderlinde & van Braak, 2011; Wheeler, 2001). Using ICT requires a modification of the role of teachers, who will need other skills and responsibilities as well as teaching skills (Wheeler, 2001) such as technological skills and the skill of integrating the given technology into their daily courses (Sinko & Lehtinen, 1999). However, teachers feel inexperienced in the use of educational technology and ask for additional feedback and support (West, 2012). Research of Oakley, Pegrum, Faulkner, and Striepe (2012) confirmed these findings and stated that teachers felt both technically and pedagogically uncertain in this new territory. The findings implicate that implementing technology into the classroom requires teacher development (Heinrich, 2012; Henderson & Yeow, 2012).

1.2. Focus on implementation of tablet computers in education and the didactic consequences

Implementing educational technology in schools can support the changing nature of teaching and learning (Clark & Luckin, 2013; Henderson & Yeow, 2012). The acquisition of knowledge and skills through technology means we may need different didactics, and more specifically, digital didactics. Simons (2002) defined digital didactics as 'knowledge and expertise regarding the use of ICT to facilitate learning'. In line with this changing nature of teaching and learning, Mishra & Koehler (2006) TPACK framework, indicate that the introduction of mobile technologies such as tablet computers allows educators to think about how technological knowledge can complement teachers' pedagogical and content knowledge because it can foster innovative classroom practices.

In the little existing research, teachers reported that using tablet computers transformed their teaching practices, and made them rethink their professional role (Burden et al., 2012; Clark & Luckin, 2013). This transformation included not only instrumental advantages, but it also enabled the teachers to provide a wider range of learning activities, to promote independent learning and to differentiate more easily (Burden et al., 2012; Heinrich, 2012). Moreover, the use of mobile technology encouraged teachers to explore alternative activities, which were not possible previously (Burden et al., 2012). As mentioned in heading 1.1, the use of tablet computers has implications for the training and development of teachers, this modified training is a necessary component for the effective integration of tablet devices into classrooms (Heinrich, 2012; Henderson & Yeow, 2012). In contrast with these findings, Burden et al. (2012) stated that formal training for teachers should be minimal and teachers should learn through experimental learning. Besides professional development, a minimal familiarization with the device was important to get teachers started.

Still, the use of technology in an effective way is not evident. Above all, not much is known about the perception of the most important stakeholders, the teachers and students. Because the first school-based implementation of such devices has been conducted in Flanders, Belgium, it is the ultimate opportunity to

investigate the perceptions of both students and teachers about the role of teachers and the didactical consequences of tablet computers.

The following research questions are central in this article: *What are the students' and teachers' perceptions about the teachers' role in the implementation process of tablets computers? What are the consequences of these perceptions on teachers' didactical practices? And, finally, what are the implications for teachers' professional development activities?*

2. Method

2.1. Participants and setting

A qualitative focus group study has been organized in one of the first secondary schools in Flanders - the Dutch speaking region of Belgium - that has implemented tablet computers, namely iPads, into the whole school and classroom organization. Using Rogers' (1995) innovation diffusion theory, which describes five stages of the life cycle of an innovation, this school can be considered as an 'early adopter' of tablet computers. The school-wide decision to use tablet computers in all grades and courses is a unique case in Belgium, which makes this school a pioneer or 'early adopter'. This school is the first, and presently the only school, which has implemented the tablet computers in all grades and courses. More specifically, this means that all teachers and all students have a tablet computer available for usage at school and at home. The school's main vision behind this implementation project is to motivate and stimulate students to learn by providing rich and relevant content according to the digital age in which they all life. Due to its unique character, the research project is defined as a single case study. Within the context of this single case study design, different focus group interviews were organized with students (n=36) and teachers (n=20). All participants were randomly selected, and treated anonymously, resulting in respondents of different gender and grade. The use of focus group interviews is a common method for gathering information in qualitative educational research (Puchta & Potter, 2004; Vaughn, Schumm, & Sinagub, 1996), especially for those research designs where no solid information is yet available in research literature. To put it differently, setting up a focus group study was relevant in this context to gather explorative information about the perceptions of the most important stakeholders using tablet computers in this pioneer school.

2.2. Procedure

The study reported in this paper is embedded in a broader longitudinal study of a PhD research, consisting of collecting and analyzing quantitative and qualitative data. In this paper, results of the focus group interviews are reported with a specific focus on the teachers' and students' perceptions of the changing role of teachers, and the didactical consequences related to the implementation of tablet computers in classrooms. Six focus groups with teachers (n=20) and students (n=36) were organized. Each focus group contained homogenous groups between nine and ten participants, and was set up in a quiet environment, following the guidelines of Krueger & Casey (1988) and Morgan & Krueger (1998). Additionally, the conversations of students were guided through the use of the application *Socrative* on the tablet computers of the students. The tablet computer has become one of the studied instruments. *Socrative* is a student response system developed for mobile technologies, and empowers students to be engaged to answer questions on their device. In this study, the *Socrative* app is being used to present statements to students with a five-point Likert-scale (ranging from *strongly disagree* to *strongly agree)*, and open-ended questions to encourage conversation. The focus groups were filmed and their conversations were transcribed.

Data was analyzed using a two-step procedure (Miles & Huberman, 1994). In the first step of the data analysis, a vertical analysis was applied leading towards results for each individual focus group. A coding

scheme was used with a special focus on the teacher's role. In the second data analytic step – the horizontal analysis –, a systematical comparison of the results of the vertical analysis was conducted by looking for similarities and differences.

Methodological decisions were taken to safeguard the quality of the interpretative data in both the vertical and horizontal analysis procedure. These decisions include presentations of the interpretative results in a meeting with the involved teachers so they were able to give feedback on the research results. Next, all analyses and interpretations were discussed among the researchers involved in the study.

3. Results

Based on the horizontal analysis, we distinguished two types of teachers. The first group is labeled 'instrumental teachers'; teachers who perceive the tablet computer as a device with instrumental advantages; the second group is labeled the 'innovative teachers'. This group of teachers transformed their lessons to suit the medium of the tablet computer. Moreover, we also found differences between these two groups of teachers when it comes to the view on their role as teacher. The distinction between these two types of teachers further reflects the manner of giving courses and has consequences on the opportunities and needs that they experience for their own professional development. In the next section we explain these two types of teachers, and present how these two types of teachers influence teaching practices and professional development.

3.1. Perceptions about the role of teachers

As mentioned above, both students and teachers describe two kinds of teaching styles that occur during the implementation process of tablet computers: the 'instrumental teachers' versus the 'innovative teachers' (see table 1). The instrumental teachers are defined as those who have not taken another role after the implementation of the tablet technology in their classroom. They perceive the tablet computer as a device with a mainly instrumental value and indicate the usefulness of such devices. For instance, they do not have to reserve the computer lab or copy additional work sheets. These teachers continue to perform their role in the same way with the main difference that the textbook has been simply replaced by the tablet computer (book behind glass). Some of these teachers are even disillusioned by the lack of material for the tablet in combination with the high workload, and therefore, go back to the traditional textbooks. By contrast, the second types of teachers, the 'innovative teachers', are teachers who take on the role of coach and indicate that they have transformed their lessons according to the possibilities that tablet computers offer. They indicate that their horizon as a teacher has been broadened, and that they have changed their teaching style.

Table 1. Example statements about the role of teachers

Topic: Role of teachers	Example statements	
	'Instrumental teachers'	' Innovative teachers'
Teachers	" My role is just the same as before " " I would also state that my role as a teacher remains the same: I am a teacher who provides content, and helps pupils to understand the content"	" As a teacher, I am closer to the pupils. You really need to be a coach " " We teachers have to take an active, coaching role which needs much more preparation "
Students	" We have teachers who are super modern, others are not so 'iPaddy' and are old fashioned " (first grade) " There are some Apple freaks, others don't get it, for them I think it is a big adaptation " (second grade) " The teachers stayed pretty much the same " (third grade)	

3.2. The implications on didactical practices

The distinction between these two types of teachers is further reflected in the way they give their courses. In other words, it has consequences for teachers' didactical practices. Results from the focus group interviews indicate that teachers' didactical practices have changed in the way that they use more multimedia (see table 2). Moreover, teachers who take an instrumental role replace the traditional textbooks by tablet computers. Consequently, students from all ages state that most of these teachers have not changed their teaching style: "*They are standing in front of the classroom with their iPad instead of with their textbooks" (student first grade)*. In addition, this group of teachers confirms they have not changed their didactical practices drastically: *"The difference between previous years is the fact last year students received copies, and this year's students can follow the text on their tablet screens" (teacher)*. The reason why they have not changed their didactics draws upon the high workforce and lacking availability of digital material. Students from second and third grade state that, besides using text-processing applications, little attention has been paid to the didactical applications of tablet computers. Furthermore, both students and teachers claim that teachers have taken a more controlling function over their classroom. Teachers seem to have the fear of losing their class management by the introduction of tablet computers, as they think students are seduced to surf social network sites. In other words and surprisingly, implementing innovative technology strengthened those teachers with an instrumental role to become more conservative. The innovative teachers, the teachers who tried to integrate the tablet computer into their daily courses, stated that the use of tablet computers opened many doors, and that contextual and realistic lessons can be offered where students have to learn in an active and independent manner. These teachers use more didactical applications beside the text-processing ones. They emphasize that teachers need to reflect about the link between the purpose of the lesson and the specific application. Teachers of this type claim that the use of tablet computers stimulates higher order thinking and reasoning. Furthermore, they underline the need to rethink didactical practices. They argue that their changing role makes teaching exhausting on the one hand, yet more interesting on the other hand. The place of teachers remains among students as a coach instead of assuming an authoritative role. Moreover, the preparations of courses are more intensive, which causes a high work pressure but the teachers argue it remains an investment for the future.

Table 2. Example statements about the didactical practices

Topic: Didactical practices	Example statements	
	'Instrumental teachers'	'Innovative teachers'
Teachers	" I give many courses the way I gave them last year " " Despite the potential of using tablet computers, because of the high workload I have no intention to be very innovative " " I used to have more control, now I have to interrupt my class to tell them to pay attention instead of surfing Facebook "	" Many realistic examples, visualization, more active education " " Using tablet computers increased the educational opportunities " " iPads offer possibilities to promote active learning and activate higher-order thinking among students "
Students	" We have teachers who are super modern and adjust their courses to the iPad, others are not so open towards iPads" (first grade) " They trust us less, they say more often that we are busy with something else " (first grade) " They do not teach differently, they still write on the blackboard " (first grade) " They pay more attention to what we are doing but they make the courses more fun " (second grade) " I think it is almost the same as last school year " (second grade) " Most teachers have no other way of teaching " (third grade) " The teachers continue to teach in the same manner, but only with more multimedia " (third grade)	

3.3. The need for professional development

Based on the horizontal analysis, it can be concluded that there are different opinions about the need of professional development (see table 3). While students from the first degree state that some teachers need professional development, they give rather neutral scores on the questions asked with the application *Socrative* (see figure 1). When being asked for explanations, some students think their teachers are adequately prepared to give courses with tablet computers. Other students state their teachers need additional development to use tablet computers more effectively. However, these results should be nuanced, not all students were able to make a comparison with earlier lessons because it is their first year in secondary education. Older students (those from second and third grade) are more skeptical about the competences of their teachers and advice them to take more professional training courses. These training courses should involve information about techniques and apps to promote interactive learning. Besides these training courses, students of second and third grade think teachers need more time to master these devices. This means that time and support are needed for the teachers.
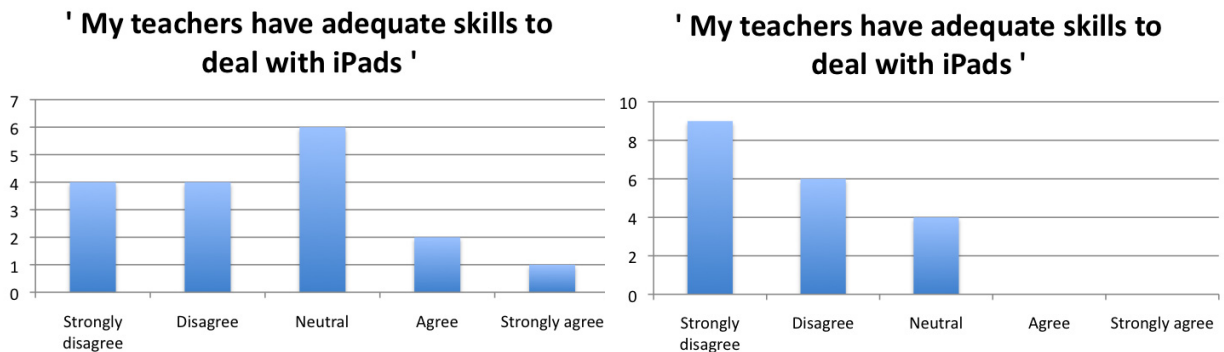

Fig. 1. (a) Results with *Socrative* of students from the first grade; (b) Results with *Socrative* of students from the second and third grade

A mixed picture about the need of professional development can be found among teachers during the focus group interviews. Some teachers feel the need for additional explanation about the didactic use of tablet computers and state that the mutual exchange of expertise is an opportunity to exchange new ideas and applications. Some teachers have no energy left for additional training while others indicate the lack of adequate training. According to their opinion, it is up to them to provide training and share expertise with other schools. Both students and teachers finally indicate that a strong and competent IT-team is a critical factor that contributes to the success of this innovative decision.

Table 3. Example statements about professional development

Topic: Professional development	Example statements
Teachers	" My digital skills have improved but I still have a long way to go "
	" Before this project, we lived each on a island, now we share expertise "
	" If I hadn't had any help from the IT support team, I wouldn't have given any classes with the iPad "
	" There is no adequate training available, we train others "
Students	" I still think they are well trained " (first degree)
	" We have Apple freaks who can cope well with it while others are completely unskilled " (first degree)
	" I think teachers should be instructing us about using iPads instead of us instructing them " (second degree)
	" There is a need for training on how to find and to use educational apps in classes " (third degree)

4. Conclusion and discussion

This study confirms existing research which states that the implementation of technology in organizations and schools is not evident (Klein & Knight, 2005; Kotter, 2007; Pynoo et al., 2011; Tondeur et al., accepted). According to Rogers' (1995) innovation diffusion theory, this school can be assumed as an 'early adopter' of tablet computers and has already taken the first steps to introducing mobile technology into the classroom. This research confirms that teachers are the determining key component for the success or failure of the implementation of technology (Chen et al., 2009). In line with research of Becker et al. (1999), results show that teachers can be distinguished into two categories, namely the 'instrumental' and 'innovative' teachers. Introducing innovative technology seems to provoke conservative practices among some teachers with an instrumental view, by taking up a stringent role and giving classical courses with a tablet computer. As a conclusion, the role of innovative teachers has to be promoted and attention has to be given to digital didactics. Like the research of Burden et al. (2012) and Clark & Luckin (2013), rethinking the professional role about teaching is needed. Furthermore, confirming research of Heinrich (2012) and Henderson & Yeow (2012), more attention has to be paid to the professional development of teachers, both formal and informal. These findings are confirmed by older students in this study who advise teachers to improve didactical skills to master tablet computers. We can conclude that a policy in which attention is given to an adequate preparation before and during the implementation remains necessary. Also, more attention has to be paid to the preconditions by providing technical and pedagogical support to stimulate stakeholders' appreciation of tablet computers potential in education.

Practical implications of the results of this study can be formulated. First, there is the necessity for well-trained and experienced teachers, with a clear and practical vision on using innovative technology in the classrooms. Secondly, what we have learned from this early study should be taken in account when trying to implement tablet computers in other schools. Thirdly, the satisfying results should be an encouragement for other schools to follow the innovation of this particular school. Finally a remarkable aspect of this study is that the study object itself, namely the tablet computer, has become one of the measurement instruments. Data collection can be taken using the tablets themselves. In next research, we will focus on the further analysis of the focus group interviews, and link them with the results of the longitudinal study.

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