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Appropriation of Digital Competence in Teacher Education

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ABSTRACT

The aim of the article is to explore opportunities for appropriation of digital competence in teacher education. Digital competence is knowledge, skills and attitudes required in order to use technology critically and reflectively in the process of building new knowledge. According to Wertsch learning to use a cultural artefact is characterized by two processes: mastery and appropriation. The article reports from a case study of two teacher education institutions. Findings indicate that the same challenges are found in both institutions: the conflict between mastery and appropriation, and between personal and educational use of technology, and the resistance towards technology among some teacher educators. The results signify that in order to create opportunities for appropriation of digital competence and encourage use of technology as part of pre-service teachers' professional didactic competence, technology should be better integrated as pedagogical tools for teaching and learning in all subjects in the teacher education programmes.

Keywords

teacher education, technology, digital competence, appropriation

INTRODUCTION

Over the last two decades, considerable time and money have been invested in integration and use of technology at all levels of education, and a number of large reforms have swept through the Norwegian education system (Lund & Hauge, 2011). However, in spite of the investments and the ever increasing availability of technology in schools (Egeberg, Guðmundsdóttir, Hatlevik, Ottestad, Skaug, & Tømte, 2012), there still appears to be a gap between the technology available in classrooms and teachers' use of this technology for educational purposes (Kopcha, 2012; ten Brummelhuis & Kuiper, 2008; Petko, 2012; Zhao, Pugh, Sheldon, & Byers, 2002). Studies have revealed that many teachers do not integrate technology effectively into their classroom activities (Ertmer, Ottenbreit-Leftwich, Sadik, Sendurur, & Sendurur, 2012; Harris,



Mishra, & Koehler, 2009) and that minimal pedagogical change can be identified (Somekh, 2008).

Research has also indicated that pre-service teachers' experience with technology from teacher education programmes influences how they later choose to use technology in their teaching (Drent & Meelissen, 2008; Agyei & Voogt, 2011). Nevertheless, providing pre-service teachers with the necessary competence in order to integrate technology in their future classrooms remains a challenge for teacher education programmes worldwide. Teacher education programmes are commonly criticized for their failure to provide pre-service teachers with the necessary experiences of how to utilize educational technologies in a teaching practice (Chien, Chang, Yeh, & Chang, 2012) and for not focusing sufficiently on developing pre-service teachers' digital competence (Wilhelmsen, Ørnes, Kristiansen, & Breivik, 2009). This is confirmed in a recent report from the Nordic Institute for Studies in Innovation, Research and Education, indicating that development of professional digital competence is consistently weakly rooted in the management of teacher education programmes, and that most programmes lack a coherent approach to the development of such skills (Tømte, Kårstein, & Olsen, 2013). An analysis of the curriculum for teacher education in Norway indicates that digital competence is integrated to a limited extent in the curriculum documents and that there are variations between the different institutions in terms of technology integration (Instefjord & Munthe, 2014). Thus, there is a need to investigate further how teacher education programmes prepare pre-service teachers for using technology in their future classrooms. Against this backdrop we ask: *What opportunities for appropriation of digital competence does teacher education offer?* In short, digital competence is knowledge, skills and attitudes required in order to use technology critically and reflectively in the process of building new knowledge. The focus of this article is directed towards teacher educators' and pre-service teachers' perceptions and descriptions of digital competence and how technology is being used and appropriated by teacher educators and pre-service teachers.

THEORETICAL PERSPECTIVE

In the Knowledge Promotion Reform, a curriculum reform for primary- and secondary education that was introduced in Norway in 2006, the ability to use digital tools was emphasized as one of five basic skills. This was recently followed up by a framework for basic skills, developed by the Norwegian Directorate for Education and Training in 2012, which highlights that developing digital skills means "learning to use digital tools, media and resources and learn to make use of them to acquire subject-related knowledge and express one's own competence" (Norwegian Directorate for Education and Training, 2012, p. 12). Being able to use digital tools is now seen as a central competence at all levels of society, and a number of attempts have been made towards developing a common understanding of the notion *digital competence*. In a

report from the European Commission, Ferrari (Ferrari, 2012) proposes the following definition:

Digital competence is the set of knowledge, skills, attitudes (thus including abilities, strategies, values and awareness) that are required when using ICT and digital media to perform tasks; solve problems; communicate; manage information; collaborate; create and share content; and build knowledge effectively, efficiently, appropriately, critically, creatively, autonomously, flexibly, ethically, reflectively for work, leisure, participation, learning, socialising, consuming, and empowerment (Ferrari, 2012, pp. 3–4)

The definition illustrates the complexity of the concept by indicating that being digitally competent involves far more than having technical skills. Technical skills and the ability to use specific tools are only two of many aspects of digital competence. In this article digital competence refers to the wide range of competencies associated with the use of digital technologies. These technologies include hardware and software used for educational as well as social and entertainment purposes, both in school and at home. The competence needed to make use of these technologies embraces technical, cognitive and social-emotional perspectives of learning with digital technologies (Ng, 2012). Preparing pre-service teachers for their future classrooms requires teacher education programmes that help students develop an understanding of this complexity, both in terms of technologies and competencies. However, digital competence for teachers is also about being able to use technology to promote student learning and contribute to building knowledge in all the ways the definition calls for. This requires a special expertise that differs from digital competence of other professional groups (Krumsvik, 2011). The specific focus in this article is therefore directed towards the development of digital competence as a tool for teaching and learning.

Learning is seen in light of Somekh's (2008) understanding of learning as a situated process being mediated by the context of the classroom, school and larger society. The concept of mediation implies that individual's interaction with objects in the world is mediated by cultural artefacts: signs, symbols and tools. By using various physical and intellectual tools, we are able to solve problems and master social situations in ways that would not have been possible without the support of cultural artefacts. Artefacts carry with them a history of use and are altered, shaped and transformed when employed in activities (Säljö, 2000). In the process of learning how to use artefacts, Wertsch distinguishes between the *mastery* of a cultural artefact and the *appropriation* of a cultural artefact. The first refers to knowing *how to* use an artefact, while the latter refers to "the process of taking something that belongs to others and make it one's own" (Wertsch, 1998, p. 53). If we see learning and development as mastery and appropriation of cultural artefacts, these processes stand out as a sophisticated process of coordination between humans and cultural artefacts (Säljö, 2006). Learning begins with an initial contact with something that is not familiar to us. At this stage of the learning process we begin to try out a new

artefact and start to investigate the different aspects of how the artefact mediates, and we may require help from others who are more familiar with the artefact. In this way we meet cultural artefacts in specific contexts and may begin to see them as resources for particular types of activities. As we spend more time getting to know the artefact, we learn new ways to use it and we discover new functions that we did not recognize in the beginning. Through these processes we learn to master the artefact in different contexts and it becomes so natural for us to use it that it will eventually be a part of our identity; it becomes appropriated and we will no longer need help from others.

Nevertheless, cultural artefacts are not always easily appropriated, and often a cultural artefact is mastered but not appropriated by the learner. Seen in light of Ferrari's (2012) definition this may mean that aspects of digital competence, such as being able to use technology to communicate, could be mastered in a particular context such as for socializing with family and friends, but not appropriated by the learner to such an extent that he or she would choose to use it in an educational context to create and share content and build knowledge creatively. There may also be situations of appropriation without mastery, where both interest and motivation are strong, but understanding of how to use the cultural artefact is still lacking or unsophisticated (Polman, 2006). Thus, appropriation without mastery refers to "coming to value a practice, but not yet having the competency to carry it off" (Laffey, 2004, p. 377).

According to Wertsch, an important aspect of appropriation is that it always involves some sort of resistance: "In such instances of mediated action, the agent may use a cultural tool but does so with a feeling of conflict or resistance" (Wertsch, 1998, p. 56). In operation, the cultural tool is not part of their identity and they may therefore choose to use it only in situations that demand compliance.

DESIGN AND METHODS

Selection

The study was designed as a multiple-case study (Yin, 2009) with two cases. The cases were selected on the basis of an analysis of programme descriptions for primary and lower secondary teacher education programmes for years 1–7 and 5–10, respectively, from all teacher education institutions in Norway. In the programme description from the first institution no examples of technology integration were identified, while the second demonstrated multiple examples of technology integration. Thus, the cases illustrate potentially contrasting situations in terms of emphasis on use of technology. The purpose of the study was to explore further the differences found at the curriculum level in order to gain a deeper understanding of how the use of technology in teacher education contributes to pre-service teachers' appropriation of digital competence.

Recruitment of teacher educators took place in three steps. First, written information about the project was sent to the Dean of each of the institutions in November 2011, inviting teachers to take part in the study. The Deans then forwarded the information to a selection of teachers. Thirdly, the researcher contacted these teachers and made arrangements directly with those who were willing to participate. A total of nine teacher educators agreed to participate in the study. Four teacher educators were female and five male. They taught a variety of subjects: Norwegian (2); mathematics (1); Pedagogy and Pupil-related Skills (4); Educational technology (1); and Physical Education (1).

In order to get in touch with pre-service teachers and simultaneously gain some informal indications of how technology was used, the researcher participated in lectures at both institutions. Two full days of lectures were attended in each of the institutions together with pre-service teachers in their first and second year of teacher training during April 2012. In line with ethical standards for research, all pre-service teachers who attended these lectures received oral and written information about the purpose of the visit, and they were asked to indicate their willingness to participate in focus group interviews. A total of 14 students volunteered to participate.

Data collection

Data was collected in April 2012 through individual interviews with teacher educators and focus group interviews with pre-service teachers. Both types of interviews were conducted as semi-structured interviews (Kvale & Brinkmann, 2009) and were fully recorded. Teacher educators were asked about their perception of what constitutes the notion of *digital competence* and what they believed a teacher in their subject needed to know in order to be digitally competent. They were also asked about how and how much they used technology in their own teaching and how they would rate their own level of digital competence. The interviews lasted between 32 and 91 minutes. All interviews were conducted on the basis of the same semi-structured interview guide and thus the time spent on each interview was controlled by the interviewees.

Focus group interviews were used to collect data from pre-service teachers. While group interviews are ideal for gathering many opinions from individuals within a group, focus group interviews are interactive and are particularly useful for understanding the collective perspective (Gibbs, 2012). Two focus group interviews were conducted in each of the cases. Two groups (one in each case) consisted of only two students, while the remaining two groups consisted of respectively six and four students. Nearly the same interview guide that was used in the individual interviews with teacher educators was used for the focus group interviews. However, in line with recommendations for moderation of focus group discussions (Gibbs, 2012), not all questions were covered and new areas of discussion were included as they arose from the group interaction. The focus group interviews lasted between 35 and 72 minutes.

Data analysis and presentation

Interviews were fully transcribed in HyperTranscribe and analysed in HyperResearch. Each interview was analysed by closely reading the transcripts several times. During the first reading, an overview of the data was achieved and broad categories focusing on initial patterns in the interviews were identified (Miles & Huberman, 1994). In the second reading, specific words and paragraphs that captured specific themes from the interview guide were highlighted. As a result, three main categories were identified: *self-perceived digital competence level*, *use of technology for educational purposes*, and *reflection on digital competence for teachers*. Each interview was then recoded in light of these categories. In the next step of the analysis data from each case was assembled as a set and a descriptive case report was written for each case. These case reports are included in the findings section. While examples of comments from the individual interviews are shown in the presentation, the data from the focus group interviews are presented without quotations from individuals. This is done to underline the collective perspective as the unit of analysis (Gibbs, 2012).

In order to facilitate a cross-case analysis, an analytic approach based on the theoretical perspective presented earlier was developed. Wertsch (1998) argues that learning to use a cultural artefact is characterized by two processes: *mastery* and *appropriation*. These aspects of the learning process have been used to frame the discussion in this article with the purpose of understanding how digital competence and teacher identity develop in interaction with one another.

RESULTS

Results from each case are presented separately. Teacher educators have been given fictitious names, while pre-service teachers are primarily referred to as students. All quotations have been translated from Norwegian by the researcher.

Case 1

Teacher educators Sarah, Chris, Ben and Karen work at a university college located in the eastern part of the country. Substantial investments and efforts have been made towards integration of technology, including providing laptops for all students in the teacher education programmes for primary and lower secondary education. The institution also provides a support system for students and faculty. The four teacher educators interviewed in this case represent three different subjects (Pedagogy and Pupil-related Skills (Sarah and Ben), Educational technology (Chris), and Mathematics (Karen)).

Chris and Ben rated their own level of digital competence and their interest in technology as being above average. They both had experience from different

professions before they joined the university college. Ben did not have any formal technology training, but had previously run his own ICT-company and had worked as an ICT coordinator in an elementary school. Chris, a teacher in Educational technology, was trained as a computer technician. He was the main teacher in an introductory course on educational technology and had strong opinions concerning the importance of integrating technology in teacher education. The two other teacher educators in case one, Sarah and Karen, both rated their digital competence as about average. Neither of them had any formal training in the use of technology, but they both felt quite confident about using technology. Karen, a Mathematics teacher, said:

Some of my colleagues are a lot better than me, I am, it's not the area that I know most about, but I do what I need to master it with my students" (Case1: Karen).

Karen used technology regularly in lessons and had a clear educational rationale for her use of technology. When required to reflect on the technology she used in class, she commented:

We use Excel, in several different areas, and then students learn to use Excel while they also see what this can be used for in school, and we also discuss what is good and what is not good about using spreadsheets. And we use GeoGebra, a programme that is very good for solving equations and working with functions, and for showing things in geometry. And then we have a discussion about why it is ok to use it in teaching and which benefits it provides pupils (Case1: Karen).

Sarah was very enthusiastic about technology. She had recently introduced iPads as a new tool in Pedagogy- and pupil related skills, and she was utterly excited about all the new possibilities this tool could provide. Although her institution did not encourage it, she had also chosen to use Facebook both for communicating with her students and for educational purposes. According to her, all but one of her students were already on Facebook, and she therefore found Facebook to be a more efficient platform for communication. However, when being asked about what criteria guided her selection of apps or other learning resources, Sarah acknowledged that she did not always have an educational rationale for her choices.

All teacher educators reported that they used digital tools both for preparations, in the office, at home, and in the classroom. They all used PowerPoint presentations regularly and most of them said they used PowerPoint in all lectures. Ben, however, believed that his students did not learn enough from looking at PowerPoint presentations and had therefore chosen to use other methods of delivery:

I use digital tools, this is kind of a dilemma, because I use them a lot. But I use them a little differently than others. We try to provide exemplary teach-

ing, we hope we get there, but we cannot, because students have a certain expectation that we will have slides and have prints and have things they should write down, the way it has always been. And in a way I understand that, but we know that they forget the pictures very quickly. So I thought, what do we do about that, how do we give them experience with other methods than highlighted sentences on a screen? So, I thought I would do something different. And I chose to use illustrations instead. So I present an awful lot of pictures, animations, movies, stuff like that, and besides from that I am analogue, so I draw, I use my own drawings and scanner, and I simply draw on the blackboard (Case1: Ben).

When being asked about what a teacher needed to be able to do or know in order to be digitally competent, a number of the teacher educators mentioned being able to use PowerPoint and social media. One teacher educator noted:

They should at least be able to use PowerPoint or Prezi, and then they should master the use of e-mail. I think social media are also important. I don't master Twitter, I don't know why, but I think they should at least master one of them, either Facebook or Twitter (Case1: Sarah).

The interviews also revealed that all the teacher educators saw use of interactive whiteboards as an important aspect of teachers' digital competence. However, Chris, the educational technology teacher, was the only one who knew how to use an interactive whiteboard, while Ben, Karen and Sarah all expressed concerns about their own lack of competence in this area. In Karen's words:

I haven't learned to use a SMART Board well enough to use it in my teaching. I have taken a course, so I do know what it is about, and I'm planning to attend a course here on the 15th of May, but I have had so little time I haven't had time to learn it properly (Case1: Karen).

This comment aligns with the feedback students provided in the focus group discussions. The six students in the first group were second year students on the 1–7 programme, ranging between 20 and 35 years of age. On the whole, they rated their own level of digital competence as being fairly high. However, the students were clearly split on their views about how much they had learned about use of digital tools during the programme. Most of the students in the group were of the opinion that their digital competence had been acquired before they started the programme. One student was more positive than the rest. She had a particular interest in technology and rated her own digital competence level as being very high. This student said that the programme had contributed to increasing her competence level. The discussion revealed that the institution offered a compulsory, introductory course in educational technology during the first year of the programme. However, a number of practical problems were pointed out about the introductory course. Students felt that the course was too detached from the rest of the subjects and that even though they

had worked with the mandatory requirements during the first year, the competence acquired during the course was already lost. The activities did not enable them to build connections between what they learned in the course and what they needed in their future teaching. Comments also suggested that they were critical as to how the technology course was organized. The course was taught in a large lecture theatre with many students present, and the lecturer was either the educational technology teacher or presenters representing external companies such as SMART Technologies. According to the students there were too many students and too little time, a situation that made it difficult for them to receive necessary support if they encountered any technical problems. Instead of explaining how to solve technical problems, assistants would do the tasks for them. Due to the way this course was organized they did not have any practical experience with, for instance, the use of interactive whiteboards, and they were therefore critical to the overall learning outcome of the course.

The two students who took part in the second focus group discussion were generally more positive about the introductory course. They were first year students on the 5–10 programme and the interview was conducted immediately after they had attended a full day's course in the use of a SMART Board. They said they found the course interesting and that they had gained new competence through attending the course. However, they noted that they would have learned more if the course provided an opportunity to experiment with the board instead of only watching the presenter. Although they both perceived their own level of digital competence to be more or less average, none of them had any previous experience with using an interactive whiteboard.

Case 2

Teacher educators Tom, Peter, Lisa, David and Anna teach in the second teacher education institution located in the western part of the country. The five teacher educators represent three different subjects (Norwegian (Tom and Peter), Pedagogy and Pupil-related Skills (David and Anna), and Physical Education (Lisa)).

Tom and Lisa both rated their own digital competence level as average, while David, a Pedagogy and Pupil-related Skills teacher, and Peter, a Norwegian teacher, rated their own digital competence as fairly high. They had both used technology for many years, both in personal situations and with their students, and one of them had participated in national projects related to the use of technology in education. In the words of Peter:

I'm not a technician myself, but I've always been interested in how to use it in a rational and meaningful way, but also in teacher training, including for example related to, uh, everything from digital portfolios [...] to the use of digital whiteboards (Case2: Peter).

However, the last teacher educator in case two, Anna, a Pedagogy and Pupil-related Skills teacher, expressed serious concerns about both her own level of competence and the general level of digital competence at her university college:

No, but the [digital] competence is in general too low, I think, but I think I'm among the very worst, most of the others are better than me (Case2: Anna).

Comments also suggested that several of the teacher educators had attended theoretical introductory courses in how to use an interactive whiteboard but had no practical experience with the board. For this reason they did not feel confident using this technology in the classroom. One teacher educator said: "I have taken a course, but I have never used it. I don't know how to use it" (Case2: Tom).

Teacher educators were asked to explain how they understood the notion *digital competence* and what they thought a teacher needed to know in order to be digitally competent in their subject. Several of the teacher educators indicated that this was a difficult question. One of them said:

If you want me to define it that could be a little bit difficult because I haven't even read the course book about digital competence. But I believe it means that you should be able to use technology and manage information and communicate through it. [...] No, but all these new pages with Twitter, and all these places where children can go in and create their own pages, and how dangerous that is, that is something the teacher should talk about. And the ethical perspective and how girls can be offended through Facebook and all these new things. That is something I would have spent time on if I were a young teacher today. And that is what I tell my students (Case2: Anna)

Tom argued that he did not see any big difference between the digital competence needed in his subject, Norwegian, and other subjects:

Yes, no, but I doubt that the subject Norwegian is so special in this regard. Digital competence in Norwegian, is that any different from digital competence in religion or social science? But perhaps it's a little different in mathematics and physics where they need models and figures and those sorts of things (Case2: Tom).

Peter, on the other hand, had a clear opinion of what teachers needed to know in order to be digitally competent. According to him, teachers needed basic competence in standard software, social media, learning platform and internet, as well as a strong didactic competence:

[...] they should have a minimum of awareness, and I believe they do, although they do not always manage to use it, but awareness of what is

good ICT didactics, that is how you can use ICT in a didactic manner. When they use PowerPoint, as most teachers do, what is a good PowerPoint, how can you use it properly? It can be used in many ways, depending on what the purpose of the PowerPoint is (Case2: Peter).

As was found in the interviews in case one, all teacher educators in the second case reported that they used technology for preparations and in the classroom. Except for Lisa, the Physical Education teacher, they all reported that they used PowerPoint in nearly every lecture. Tom was concerned that the way PowerPoint was used in the teacher education programmes did not serve as a good example of how their students should use technology in the classroom. He was worried about what he expressed as lack of connection between the instructional strategies used by the teacher educators, and the relationship between the practices for which the students are prepared:

It feels like I sit by that machine nearly all day. And that leads to, when I finish work and go home at night, I do not really want to turn on my computer in the evening. I simply think I use it so much, but I use it less in teaching, but maybe, yes, no, I will not say I use it too much, but too badly I'd rather say. [...] You know, I think that when our students get out in the classroom during practical training they will soon understand that they cannot follow our example and give only one way lessons like we do here (Case 2: Tom).

He followed up this comment by saying that he wished the students would acquire more practical skills for use in school. Comments in the focus groups indicated that this concern was also shared by the students. The students in the first focus group were first year students at the 1–7 programme, between 20 and 25 years old (two male, two female). They rated their own level of digital competence as being average for their age group. They mastered standard software, were able to search for information on the Internet, and used social media for personal purposes. The discussion revealed that students felt attending lectures at the teacher education programme had not given them ideas for future teaching. In the preceding lecture they presented a multimodal text they had created by themselves. Nevertheless, when asked about what kind of digital tools they had encountered in the teacher training programme, they said that they had not learned anything new about digital tools, and that digital tools were not used in the programme *at all*. The interviewer found this information surprising and the students were therefore asked to elaborate. The students then explained that they had “only” used PowerPoint, YouTube, Internet and Word. According to them, they did not see these tools as technology worth mentioning; these tools were simply tools that they used more or less every day as learners. The discussion also revealed that they were tired of PowerPoint being used in all lectures, and that, although they had enjoyed working with the assignment they had just presented, they did not see much value in accomplishing it.

The two students (one male, one female) in the second group were students on the 5–10 programme and they were both 22 years old. These students shared the teacher educators' view on interactive whiteboards. Comments indicated that the students had been introduced to interactive whiteboards during practical training and they were clear that being able to use an interactive whiteboard to enhance student learning was an important aspect of teachers' digital competence. However, they had little or no experience with interactive whiteboards from the teacher training, and were critical about the lack of training in this area.

DISCUSSION

This study investigated opportunities for appropriation of digital competence in two different teacher education institutions. Before we discuss the opportunities for learning in terms of Wertsch's distinction between mastery and appropriation we should once again direct our attention towards Ferrari's (Ferrari, 2012) definition of digital competence. In short, digital competence is the knowledge, skills and attitudes required to be able to use technology reflectively for a number of different activities in a number of different contexts in life. For a teacher, digital competence is also about having the competence needed in order to help others develop a digital competence in line with all the aspects included in Ferrari's definition. Such a competence demands awareness around the use of technology that goes far beyond technical skills. According to Haugerud (2011), what has to be appropriated in order for pre-service teachers to use technology effectively as teachers, is far more than use of technology in isolation or in personal situations.

However, when asked about their level of digital competence, several of the teacher educators in both cases focus primarily on the technical aspects of their competence when they describe their own competence level. Although the two cases were initially chosen because of their potentially contrasting situation in terms of technology integration, the results do not unveil any major differences in terms of teacher educators rating their digital competence. In both cases most of the teacher educators rate their own level of competence and extent of technology use as being around average – some a little higher, some a little lower, but in general nearly similar to everyone else's. Moreover, they use their technical skills as a measure of their own digital competence. Seen in light of Wertsch's (1998) perspective on learning as mastery and appropriation of cultural artefacts, teacher educator's descriptions of their own digital competence may be seen as indicators of mastery without appropriation. This can, for instance, be seen in Tom's description of his own use of PowerPoint. He masters the technical aspects of the software itself, but he is not happy with neither his own use of it in the classroom, nor does he see any potential educational benefits. In case one, Ben's description of how he uses technology in the classroom may serve as another example of mastery without appropriation. Ben uses the cultural artefact with a strong feeling of conflict or resistance and does

not view the artefact as something that belongs to him or his teaching practice. When the level of resistance grows sufficiently strong he may refuse to use the cultural artefact all together (Wertsch, 1998). In Ben's example this is nearly the case, – he still uses technology, but he admits that he prefers to write and draw on the board instead.

If we rate our own competence as very high, there is little need for competence enhancement. Ben's resistance towards the use of technology can be seen as an example in this regard. Although Ben has not appropriated the use of technology as seen from a teaching perspective, he masters the technology and therefore he is not interested in learning more about how to use the technology in a teaching context. An important aspect of appropriation of a technology as a cultural artefact is therefore to find ways to overcome this resistance (Säljö, 2006).

Karen can be seen as an example of a teacher educator who has appropriated digital competence. Although she is relatively humble when she talks about her own digital competence level, her answers in the interview indicate that, with the exception of interactive whiteboards, she masters the necessary artefacts both on a personal and didactic level. She demonstrates a high level of pedagogical reflection concerning uses of technology for educational purposes and makes it clear that she only uses technology when she finds this to be the tool best suited in order to accomplish the desired learning outcome. A similar example is found in case two where Peter reflects on what digital competence is for a teacher. He knows how to use the technology and can make use of it in a number of different contexts.

The interviews also revealed examples of what seems to be appropriation without mastery, for instance when Anna reflects on what a teacher should know in order to be digitally competent. She evidently sees the value of social media in education without being able to use them herself. Anna knows that her own digital competence is lower than most of her colleagues and students, and, although her understanding is lacking, she is interested and motivated, and spends time discussing the issues with her students. This appropriation of an activity may serve as motivation for trying to develop the necessary competence required for the activity (Haugerud, 2011). Another example of appropriation without mastery is related to the use of interactive whiteboards. In both cases teacher educators and pre-service students see the use of whiteboards as an important aspect of teachers' digital competence, but they do not master the artefact. Although these teacher educators lack the competency to use the relevant technologies, it can be positive that they have come to value the technologies. However, unless they also actively seek to develop the necessary mastery, there is no guarantee that this may serve as what Polman (2006) refers to as preparation for future learning.

For pre-service teachers' opportunities for appropriation of digital competence, the examples of mastery without appropriation and appropriation without mastery are discouraging. The example from case two, where pre-service

teachers initially claim not to have used any digital tools in the teacher education programme, and later mention a number of examples of digital technologies they have used, indicates that pre-service teachers and teacher educators have different opinions on what it means to use digital tools in the classroom. While students seem to have appropriated use of technology to such an extent that it has become part of their identity as learners (Wertsch, 1998), teacher educators still tend to see technology as an add-on that does not necessarily blend with their teaching strategies. They use PowerPoint to structure their lectures, but there are few pedagogical justifications for their use. The differing opinions found, underlines the need for a common language that enables teachers to reflect on the use of technology to enhance learning. In order to encourage use of technology as part of pre-service teachers' professional didactic competence, teacher educators must acknowledge the complex relationship between mastery and appropriation on the one hand and personal and professional use of technology on the other hand. Such a competence cannot be developed through independent introductory courses in the use of technology as that discussed in case one, but should be intertwined with the context of the classroom, school and larger society.

Mastery without appropriation is also found among pre-service teachers. An example of this can be found in case two, where students talk about the multimodal texts they presented earlier the same day, or in case one, where the students talk about the introductory course they have attended. They have used technology to complete the task, but they do not see the technological accomplishment as personally valuable (Laffey, 2004). On the other hand, seen in light of Säljö's (2006) perspective on appropriation as a process of coordination between learner and artefact, the initial contact with new technology that such courses can offer should not be underestimated as a starting point for the learning process. In this way the introductory course may serve as a toolbox for the pre-service teachers, with a variety of tools that can be pulled out in different situations. However, all cultural artefacts carry with them a history of use and are themselves altered, shaped and transformed by the activity, in which they are used (Säljö, 2000). If pre-service teachers continue to use the artefacts after the initial encounter, they may learn to use them in other contexts than the one in which the artefact was originally introduced. But this process requires time and assistance from someone who is more familiar with the artefact in order for pre-service teachers to appropriate the artefact sufficiently to transfer what they have learned in a teacher education context to their future job as a teacher.

In this connection, the fact that most of the teacher educators and pre-service teachers in both cases rate their own digital competence as similar to everyone else's may weaken the opportunities for appropriation of digital competence among pre-service teachers. If we see learning as a process of coordination and collaboration between learners and cultural artefacts, students must interact with someone who has a higher level of competence in order for learning to take place (Säljö, 2000).

Limitations

As a final point it is important to acknowledge the limitations of the study. One of these limitations is related to the nature of the data collected. Focus group interviews are useful for exploring ideas and interpretive validity (Johnson & Turner, 2003). Furthermore, focus group interviews are particularly useful for studying social interaction as a means of producing a more complete understanding of the issues discussed (Halkier, 2010; Gibbs, 2012). On the other hand, the possibility of the discussion being dominated by one or two students must be taken into consideration. Although the task of the moderator in a focus group discussion is to present the issues in question and create an open atmosphere where the participants are comfortable expressing their attitudes, students may be influenced by the more dominant participants in the group and thus be less inclined to present their personal opinions (Kvale & Brinkmann, 2009; Johnson & Turner, 2003; Gibbs, 2012). Moreover, both pre-service teachers participating in the focus groups and teacher educators were volunteers and thus their views on the issues discussed may not represent the full range of views.

A second limitation that should be addressed is the relatively small number of participants in the study. It is difficult to determine whether the same results could be identified across a larger group of teachers or in different institutions. However, the purpose of a case study is not to generalize across populations but to contribute to expand on or generalise theories by studying individual, group or organizational phenomena in the context of which they occur (Yin, 2009). This is what Yin refers to as *analytic generalisation* (Yin, 2009, s. 15). A second kind of generalization within case study research is *naturalistic generalisation* (Melrose, 2009; Stake, 1995). The purpose of naturalistic generalisation is not for researchers to present conclusions that can be transferred to a large population, but to invite readers to reflect on how ideas from the depictions presented may be applicable to their own situations (Melrose, 2009). In the current study, teacher educators are invited to translate the cases into their own day-to-day experiences with integration of technology in their classroom.

Finally, the question of reliability should be mentioned. While reliability in quantitative research depends on instrument construction, reliability or credibility, qualitative research relies largely on the skills of the researcher (Miles & Huberman, 1994). All analyses in this study have been done by the same person, something that may influence the reliability of the results. However, in order to improve reliability and reduce the potential bias of one person doing all the analyses, excerpts from the interviews were discussed with a second researcher.

CONCLUSION

Together the two cases highlight some important challenges regarding the appropriation of digital competence in teacher education. The stories presented

in this article suggest that the same challenges are found in both cases; the conflict between mastery and appropriation and between personal and educational use of technology, and the resistance towards technology among some teacher educators. This resistance may to some degree explain the gap between pre-service teachers' and teacher educators' personal use of technology and their competence in how to make use of technology in a learning context. In order to create opportunities for digital competence and teacher identity to develop in interaction with one another, it is therefore necessary to find ways to overcome this resistance. This can only be done by integrating technology even more as a pedagogical tool for teaching and learning in all subjects in the teacher education programmes.

Pre-service teachers who start their first year of teacher training autumn 2014 will not graduate until 2018. By the time they enter the classroom as teachers, the technical aspects of their digital competence in terms of mastery of digital tools may already be out-dated. Focus should therefore be directed away from mastery of tools themselves and towards appropriation of a digital competence that embraces awareness of how technology can be used critically and reflectively in the process of building new knowledge.

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