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Research paper

Educating digitally competent teachers: A study of integration of professional digital competence in teacher education

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HIGHLIGHTS

- Teacher educators' efficacy correlates positively with digital competence.
- 35% of teacher educators believe they are good role models for use of technology.
- Pre-service teachers are critical of the HEI's emphasis on digital competence.
- The influence of management on technology integration should be explored further.

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ABSTRACT

The present study focuses on the integration of professional digital competence in initial teacher education programmes. Data analysed are from three national questionnaire surveys conducted among teacher educators, mentor teachers and pre-service teachers in Norway. The study shows that there are weak positive correlations between positive management, management's development support, and teacher educators' digital competence, but stronger positive correlations between teacher educators' self-reported efficacy and digital competence. Results are discussed in relation to teacher education's role in qualifying for professional work in digital classrooms.

1. Introduction

As society has become more and more digitized, the demand for digitally competent teachers has evolved, imposing the need for new approaches when it comes to integration of technology in education. Teacher education is regarded as a natural place to start this integration (Kay, 2006), but recent research indicates that there is a mismatch between the digital demands that newly qualified teachers meet in their profession and the training in use of instructional technology provided during teacher education (Gudmundsdottir, Loftagarden, & Ottestad, 2014). Research indicates that in order for technology integration to take place, teachers need access to relevant equipment, workplace support and positive attitudes towards technology (Ertmer, 1999; Ertmer, Ottenbreit-Leftwich, Sadik, Sendurur, & Sendurur, 2012; Kopcha, 2012).

Being able to integrate and use technology for educational purposes involves having a set of generic skills suitable for all situations, both personal and professional, as well as specific teaching-profession skills. This is what is referred to as *professional digital competence* for teachers (Lund, Furberg, Bakken, & Engelien, 2014). Teacher educators have a dual responsibility in this regard; not only should they be able to use technology for their own teaching, they should also contribute to developing pre-service teachers' professional digital competence. In a complex education like teacher education, where preparation of teachers takes place both on campus and in field practice schools, the question of how technology is integrated on each of these arenas becomes particularly important.

This study is therefore concerned with the following question:

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How is professional digital competence integrated in initial teacher education? To investigate this question we will analyse results from three national questionnaire surveys conducted among pre-service teachers, teacher educators, and mentor teachers in Norway. Professional digital competence is studied from an organizational perspective and an individual perspective. The main contribution of this study is the design that includes respondents from three stakeholder groups, allowing the possibility to compare results from all three groups, and to discuss integration of professional digital competence in a more holistic way.

2. Theoretical and empirical background

There is an increasing demand for new kinds of teaching that support students' capacity building which includes the capacity to exploit technology to develop critical thinking, problem solving and communication skills (see e.g., Saavedra & Opfer, 2012). Many schools have good access to computers and necessary technology infrastructure, but despite access to such tools, the pedagogical use of instructional technology varies (European Commission, 2013). Results from the IEA International Computer and Information Literacy Study (ICILS), which examines the outcomes of student computer and information literacy, show that Norwegian students score well above the international average on computer and information literacy (Ottestad, Throndsen, Hatlevik, & Rohatgi, 2014). However, while 75% of the students report using a computer at home daily, only 8% report using computers at school on a daily basis. Thus, despite the considerable effort and expenditure by the Norwegian government to promote the use of instructional technology in education, there still appears to be a gap between the amount of technology available in classrooms and use of technology for educational purposes. Corresponding results are found by researchers worldwide, for instance in Switzerland (Petko, 2012), USA (Gray, Thomas, & Lewis, 2010; Kopcha, 2012; Zhao, Pugh, Sheldon, & Byers, 2002) and in the Netherlands (ten Brummelhuis & Kuiper, 2008).

The experience with use of technology that pre-service teachers acquire during teacher education, both through their own use and by observing teacher educators' use, is a crucial factor for their development of professional digital competence, and as Christensen and Knezek (2008) found, for their attitudes. The extent to which teacher educators choose to use technology in their teaching practice may thus directly influence their students' attitudes and dispositions towards integrating technology in their future classrooms. However, there is reason to believe that technology is less frequently used in teacher education than in primary education (Wilhelmsen, Ørnes, Kristiansen, & Breivik, 2009). Moreover, analyses of curriculum documents for teacher education in Norway confirm that digital competence and use of technology is not effectively integrated into the curriculum neither at a subject specific level nor at an overall programme level (Instefjord & Munthe, 2016).

Successful integration of technology in education has been an area of interest to researchers and educators for nearly as long as technology has been available for educational purposes, but most of the research has focused on primary and secondary education, not tertiary. This research has arrived at several explanations for why technology is still not integrated better in curriculum activities (Zhao et al., 2002) which can be relevant for tertiary education as well, and we will therefore briefly address some of these results.

First off, Harris, Mishra, and Koehler (2009) explain the lack of technology integration with the nature of how the use of technology has been conceptualized and supported. They argue that current methods for integration of technology are technocentric, focusing too strongly on technology skills and ignoring the complex relationship between technology, content, pedagogy and changing contextual realities. Others, like Ertmer (1999), suggest that lack of technology integration can be explained by barriers that have an impact on teachers' use of technology in the classroom. Ertmer distinguishes between first and second order barriers to change. First order barriers are defined as *external* to the teacher, embracing areas such as access to resources, training, and support, while second order barriers are *internal* to the teacher, including teachers' confidence, beliefs, and perceived value of technology (Ertmer et al., 2012). A similar labelling is found in Drent and Meeliisen's (2008) work where they distinguish between non-manipulative and manipulative school and teacher factors. Non-manipulative factors are factors that cannot be manipulated directly by the school, such as teachers' age, teaching experience or computer experience, or governmental policy and the availability of external support for schools. Manipulative factors on the other hand, are, for instance, teachers' attitudes towards technology, their skills in using instructional technology, or availability of technological support and commitment in relation to implementation of technology in school (Drent & Meelissen, 2008, p. 189). Similarly, Kopcha (2012) summarizes that five barriers to technology integration are commonly found in research literature; lack of *access* to technology, teachers' *vision* for technology, teachers' *beliefs* about usefulness of technology, required *time* and lack of *professional development* in relation to the use of technology in the classroom (Kopcha, 2012, p. 1109).

Likewise, the *will*, *skill*, *tool* (WST) model of technology integration (Christensen & Knezek, 2008), was developed specifically to explain the reality of technology integration in educational contexts. The model identifies three key elements for a high level of technology integration; teachers' *will* to use technology in the classroom (technology attitudes), his or her *skills* in using technology (digital competence) and having satisfactory access to technology as a *tool* (access to technology) (Christensen & Knezek, 2008). On the basis of previous research using the WST model, Knezek and Christensen (2008) maintain that 90% of the variance in level of technology integration in the classroom can be explained by these variables. The model also includes student achievement, assuming that teachers' computer attitudes, technology skills, and access to technology have an impact on technology integration, which in turn affects student achievement. Christensen and Knezek (2008) argue that a positive attitude towards computers can be associated with greater computer use. Factors associated with the concept of *will* are thus related to teachers' attitudes towards technology (Morales, 2006, p. 20) and to what Ertmer et al. (2012) refers to as beliefs or internal barriers. Pajares (1992) suggested that attitudes are formed by clusters of beliefs around a particular object or situation, which in turn guide a person's behaviour (Ajzen, 2001):

> When clusters of beliefs are organized around an object or situation and predisposed to action, this holistic organization becomes an attitude. Beliefs may also become values, which house the evaluative, comparative, and judgmental functions of beliefs and replace predisposition with an imperative to action. Beliefs, attitudes, and values form an individual's belief system (Pajares, 1992, p. 314, p. 314)

In this way, attitude can be seen as the sum of beliefs. A teacher can have many beliefs about using technology, about their self-efficacy as teacher educators, and about their students, both positive and negative. Ultimately, his or her attitude towards integrating technology in the classroom will be based on the overall evaluation of these beliefs. In an extensive review performed by Mumtaz (2000), attitude and self-efficacy were identified in several