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The impact of authentic learning experiences with ICT on pre-service teachers' intentions to use ICT for teaching and learning

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ABSTRACT

This research focuses on how experiences of learning with ICT in pedagogically meaningful ways can affect pre-service teachers' intentions to use ICT for teaching and learning. The research is based on the framework of the theory of planned behaviour (TPB). It is a quasi-experimental design study with pre- and post-testing. The effects that a 12-week course using collaborative, inquiry based learning practices and several ICT applications have on four areas of pre-service teachers' TPB are investigated. The research was conducted using repeated measures *t*-tests and structure equation modelling (SEM). The results indicate that there were no differences in pre-service teachers' attitudes and behavioural intentions towards the use of ICT for teaching and learning. Statistically significant changes were found in pre-service teachers' self-efficacy and subjective norms concerning the use of ICT for teaching and learning. Also, differences between pre- and post-testing were found in the relationship between subjective norms and self-efficacy and other areas of TPB.

1. Introduction

The importance of information and communication technology (ICT) for teaching and learning is widely recognised. In Finland it is exemplified in curricula where there is an expectation that ICT will be integrated at every school level from grammar school to higher education (c.f. Finnish National Board of Education, 2014). Also, the role of ICT is emphasised in national development strategies (c.f. Ministry of Education and Culture, 2010). At a more global level, the use of ICT for teaching and learning is associated with so called twenty-first century skills (c.f. Binkley et al., 2010; Ahonen & Kinnunen, 2014), skills that today's students are expected to acquire as they enter working life. These skills consist of abilities for creative and critical thinking, problem solving, communication and collaboration, learning and information and ICT literacy. ICT literacy is a vast area embodying the necessary skills to use ICT effectively and to use it for supporting other twenty-first century skills, that is, in support of collaborative and creative thinking and learning etc. The role of ICT in education is an issue for today's student generation i.e. the net generation (Tapscott, 2008). Even though there are conflicting views about the ICT skills and learning preferences of the net generation (c.f. Tapscott, 2008; Bennett, Maton, & Kervin, 2008), it cannot be denied that there are differences between the learning environments provided by schools and ICT environments that net generation students use in their day-to-day lives. Especially in Finland, the use of ICT in education has not developed as anticipated. According to ESSIE (2013), while the ICT resources in Finnish schools are good, the actual use of ICT applications is very low. More poignantly, many teachers have little belief in their skills to use ICT.

These expectations pose challenges for teachers as well as for teacher educators. It is important for teacher educators to find ways to provide new teachers with the abilities to use ICT and to enhance their intentions to use ICT for teaching and learning. Even though different ICT applications are part of today's pre-service teachers' everyday world, their use of them for teaching and learning appears to be problematic (Lei, 2009; Valtonen et al., 2011). According to Lei (2009), one reason for this is that pre-service teachers have limited personal

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experiences of learning with ICT. According to Sadaf, Newby, and Ertmer (2012) and Valtonen, Dillon, Hacklin, and Väisänen (2010), today's youth are familiar with ICT in general, especially with social software for networking. Also, Sadaf et al. (2012) suggest that today's pre-service teachers have rather positive attitudes concerning the potential of ICT applications for teaching and learning. However, when it comes to actually integrating ICT into their classroom practice attitudes and approaches are more reserved. Despite having positive attitudes and being active users of ICT, it seems that pre-service teachers have rather limited skills that enable them to see the potential and take advantage of different ICT applications for teaching and learning (Lei, 2009; Valtonen et al., 2011). According to Valtonen et al. (2011), pre-service teachers' conceptions of learning are fundamental in considerations of the added value that different ICT applications can bring to teaching and learning.

Teacher education holds an important position in considerations aimed at enhancing the use of ICT for teaching and learning. ICT needs to be integrated into different courses, and teacher educators have to serve as models of good practice in the use of technology for teaching and learning (Crowe, 2004; Teo & Tan, 2012). This research focuses on pre-service teachers' and their intentions to use ICT for teaching and learning. The concept of ICT is wide, containing various applications for various purposes. In this study the focus is on ICT applications easily available in normal classrooms i.e. laptop computers, cameras/smart phones and social software applications available online without charge (see more details in Table 1). The aim is to provide pre-service teachers with an example of a learning environment equipped with ICT that is easily available and suitable for learning purposes. Henceforth in the paper these applications are simply referred as ICT applications. The aim is to study how experiences of learning with ICT in pedagogically meaningful ways in the context of a Finnish teacher education course designed to promote collaborative inquiry (in the contexts of physics, chemistry and astronomy) can affect pre-service teachers' intentions to use ICT for teaching and learning. The course was designed to serve as an example to pre-service teachers and to provide them with inspiring learning experiences with ICT, experiences which, according to Lei (2009) and Valtonen et al. (2011), they lack. In order to study the effects that one course can have on pre-service teachers' intentions to use ICT, the theory of planned behaviour (TPB) (c.f. Ajzen, 1991; Ajzen, 2014) was used as a framework. The focus was on pre-service teachers' attitudes, self-efficacy, subjective norms and behavioural intentions towards ICT for teaching and learning. The research adopted a quasi-experimental, single group pre-test/post-test design (Shadish & Luellen, 2006) where the various ICT applications in the course served as the treatment.

2. Theoretical framework

This section has a dual focus. First, the theoretical groundings of the course design are outlined. The focus is on justifying the methods used in the design of the course concentrating especially on practices of collaborative learning, progressive inquiry and, from the perspective of ICT, the emphasis is especially on social software applications. Second, the theory of planned behaviour is outlined as a framework for research methods and data collection about pre-service teachers' intentions to use ICT for teaching and learning.

2.1. Collaborative and progressive inquiry learning

The aim of the course design was to provide pre-service teachers with experiences to enable them to take advantage of ICT, especially social software applications, in pedagogically meaningful ways. The pedagogical meaningfulness of using social software is grounded in collaborative learning practices. According to Koschmann (1996) there have been several paradigms in the use of ICT in education culminating in computer supported collaborative learning (CSCL) which remains a valid paradigm. According to Häkkinen and Hämäläinen (2012), learning tools have changed dramatically in recent years; however, basic learning mechanisms have remained the same. Häkkinen and Hämäläinen (2012) consequently emphasise the need for student collaboration, self-regulation and inquiry-based learning approaches. They explain that in collaborative learning situations, the role of students' earlier knowledge structures and divergent ideas is central. The core of collaborative learning is based on the co-ordination of these divergent ideas and perspectives and merging them into shared knowledge construction. Students are expected to negotiate different interpretations, seek additional information and design and undertake experiments etc. in order to build a shared understanding of a topic that goes beyond individual thinking (Dillenbourg, 1999; Häkkinen & Hämäläinen, 2012).

There are many ways to support collaborative learning. One such is to design so-called 'scripts' to scaffold collaborative learning situations and to provide students with more detailed tasks and instructions about how to collaborate in order to achieve expected learning outcomes (c.f. Hämäläinen & Arvaja, 2009; Dillenbourg, 2002; Noroozi, Weinberger, Biemans, Mulder, & Chizari, 2013). In order to support collaboration between pre-service teachers in this study, the course design was grounded in practices of collaborative inquiry (Järvelä, Veermans, & Leinonen, 2008) and progressive inquiry (Muukkonen, Hakkarainen, & Lakkala, 1999). In collaborative inquiry, students, in this case pre-service teachers, are actively encouraged to ask questions, formulate hypotheses and test them through experimentation (Järvelä et al., 2008). Progressive inquiry is a process of learning that starts from context creation and the setting of research questions and follows with defining and evaluating working theories, searching for additional information, generating new subordinate research questions and, eventually, forming new working theories (Muukkonen et al., 1999), Altogether, collaborative and progressive learning mechanisms

Table 1
ICTs in the learning environment.

Wiki environments	Wiki Confluence served as a platform where the pre-service teachers reported their findings and built learning materials (one wiki-environment for every class of 22 pre-service teachers).
YouTube	Materials in video format were uploaded to YouTube and, from there, were embedded to the wiki environment.
Facebook	A Facebook group was set up, and its aim was to support pre-service teachers' reflective thinking. In this group, the pre-service teachers were encouraged to collaboratively share their learning experiences.
Blog	The course teacher maintained his own blog where he submitted instructions, lecture materials, comments and his own course reflections.
Cameras/mobile phones	The pre-service teachers took photos and videos of their experiments in order to capture the essential elements of the phenomenon studied.