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Multimedia case-based learning to enhance pre-service teachers' knowledge integration for teaching with technologies

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HIGHLIGHTS

- We investigated the effects of multimedia case-based learning in teacher education.
- Video cases helped pre-service teachers' individual knowledge acquisition.
- Video cases helped pre-service teachers integrate knowledge for TPACK.
- Teacher preparation programs need to be reconstructed to incorporate TPACK.

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ABSTRACT

This study investigates the effects of case-based learning on pre-service teachers' knowledge integration related to teaching with technologies. 78 pre-service teachers were provided with interventions that included either video cases or no cases. ANCOVAs were performed to compare two groups' TPACK scores representing technological, pedagogical and content knowledge, and their integration. The results showed that video cases improved pre-service teachers' perceived learning of technological and pedagogical knowledge, and knowledge integration of these knowledge areas. However, content-relevant knowledge for technology integration was not developed through case-based learning. The results were discussed in the context of current teacher preparation programs.

1. Introduction

Nowadays, new generations are immensely familiar with emerging technologies, and pre-service teacher education has even more strongly emphasized the use of such technologies in a meaningful way in education (Ertmer, 2005; Lawless & Pellegrino, 2007). With this increasing importance of using technologies in teaching, in the United States, one survey shows that, among 1439 institutions with teacher education programs, 85 percent provide an educational technology course (Kleiner, Thomas, & Lewis, 2007). However, doubts have been raised as to whether pre-service teachers are adequately educated to use these technologies in a way that goes beyond standard daily use that could be incorporated within instructional practice to enhance education. Researchers have criticized university teacher preparation courses for putting more emphasis on a mastery of basic computer skills, such as using a particular software program, rather than on teaching students to integrate technology into their classroom teaching (Lee, Shin, Yoo, & Lee, 2000; Llorens, Salanova, & Grau, 2002; Russell, Bebell, O'Dwyer, & O'Connor, 2003). This criticism seems universal and many studies conducted in various countries reported the needs for improvement of university teacher preparation programs. For example, in Singapore, pre-service teachers perceive that finding and integrating ICT tools and resources relevant for the target students and learning activities is particularly challenging (So & Kim, 2009). Also, the limitations of current teacher preparation programs have been reported in South Korea (Eom, Shin, & Han, 2011), in Turkey (Goktas, Yildirim, & Yildirim, 2009). By comparing the use of technologies between new teachers and more experienced teachers in the United States, one study also reported that pre-service teachers are not educated to use technologies when delivering instruction or having students engage in learning

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activities (Russell et al., 2003). Along with this criticism, pre-service teachers also perceive their teacher preparation programs do not adequately address their needs for technology integration, because educational technology courses are disconnected from methods courses (Friedman & Kajder, 2006; Kay, 2006) and lack content-area relevance (Sutton, 2011).

Recently, academic interest in these deficiencies in teacher preparation programs has increased and technological, pedagogical, content knowledge (TPACK) has been proposed as a framework to examine what knowledge teachers should have in order to effectively integrate technology in teaching (Koehler & Mishra, 2008, 2009; Koehler, Mishra, & Yahya, 2007; Mishra & Koehler, 2006). According to TPACK, content, pedagogy, and technology should be considered as a whole, not separately, with TPACK being explained as the outcome of interactions among the three parts of the model, which includes effective teaching and learning activities and strategies using technology. Also, given that there is no 'one-size-fits-all' teaching and learning strategy for using technology, these three parts of TPACK should be flexibly amalgamated in content-specific ways (Mishra & Koehler, 2006). Within this framework, many studies argue that teachers should be educated to integrate knowledge of technology, pedagogy, and content in teacher preparation programs (Niess, 2005; Polly, McGee, & Sullivan, 2010). However, we are not aware of any research that particularly focuses on how to educate pre-service teachers to construct integrative knowledge for technology integration. Prior studies have identified teachers' belief as a critical factor that influences teachers' use of technology (Ertmer, 2005; Hew & Brush, 2007; Kim, Kim, Lee, Spector, & DeMeester, 2013) and various strategies for changing teachers' belief have been suggested (Ertmer, 2005; Kim & Baylor, 2008). However, these studies do not provide a guideline of how to improve teachers' integrative knowledge that is a prerequisite for effective technology integration. Thus, in this study, we examine the effect of multimedia case-based learning as an instructional method for pre-service teachers' construction of TPACK that is necessary for using technology in future practice.

2. Relevant literature

2.1. Case-based learning for teacher education

The construction of integrative knowledge can be realized with case-based learning approaches, which provide pre-service teachers with contextual understanding of how complex teaching and learning can be, and when and how to apply instructional principles at critical decision points (Doyle, 1990; Sykes & Bird, 1992). This instructional method is theoretically based on situated cognition and cognitive flexibility, and also related to anchored instruction (Fang, Lee, & Yang, 2011; Schulman, 1992; Williams, 1992). According to a theory of situated cognition (Brown, Collins, & Duguid, 1989), learning can be meaningful and effective when instruction is based on specific situations rather than presented in decontextualized activities. Since classrooms are dynamic and changing environments, in order to successfully plan and implement lessons, teachers have to endeavor to integrate their knowledge in a way that reflects content-specific contexts. Thus, teaching and learning should not be addressed theoretically as distinct constructs, but occur simultaneously and in an integrative way, which is more difficult to achieve from a lecture and textbook model (Schulman, 1992).

Given that cases capture and provide dynamic interactions in teaching practice, case-based learning has been researched and reported as a possible method for enhancing teacher education by providing opportunities to combine content knowledge and pedagogical theories learned in different teacher preparation courses (Baker, 2009; Kim, 2011; Kim & Hannafin, 2008, 2009; Koc, Peker, & Osmanoglu, 2009). Specifically, case-based learning has proven effective in developing various thinking skills, such as critical thinking skills (Mayo, 2004), reasoning abilities and meta-cognitive skills (Lundeberg, 1999), and also in other aspects of teacher education, such multicultural education (Noordhoff & Kleinfeld, 1991), motivation (Richardson, 1994), and classroom management (Stoiber, 1991). Overall, cases in teacher education provide opportunities to pre-service teachers to apply theoretical knowledge to analyzing real classrooms (Lundeberg, 1999) and to prepare for realities of teaching (Butler, Lee, & Tippins, 2006; Masingila & Doerr, 2002).

2.2. Multimedia case-based learning for knowledge integration

Multimedia cases appear to better capture a classroom's complexity compared to print-based cases that often present a single viewpoint and present events in a linear format (Kinzer, Cammack, Labbo, Teale, & Sanny, 2006; Kinzer, Kapur, et al., 2006) and visualize dynamic processes, which present learners with a fuller picture of complexity (Goldman, Pea, Barron, & Derry, 2007). In a study comparing classroom exemplars in video, animation or text formats, Moreno and Ortegano-Layne (2008) found that the video and animation groups were better able to apply principles learned in the course than the text and no case groups. With this advantage of multimedia cases, multimedia case-based learning has shown to enhance pre-service teachers' understanding about real classroom environments (Han & Shin, 2011; Koc et al., 2009; Kurz & Batarelo, 2010; Zhang, Lundeberg, Koehler, & Eberhardt, 2011). For example, Baker (2005, 2009) examined teachers' perceptions of their growth as literacy teachers, and multimedia case-based instruction was perceived as a useful tool to advance this pedagogical development. Also, Case Technologies to Enhance Literacy Learning (CTELL) proved a potential vehicle to broaden pre-service teachers' understanding. This project showed that teachers became more aware of the centrality of concepts related to the principles of effective reading instruction than did a control group taught using traditional methods (Kinzer, Cammack, et al., 2006; Kinzer, Kapur, et al., 2006). Furthermore, teachers used what they learned from multimedia cases when they designed their own activities (Van den Berg, Jansen, & Blijleven, 2004).

Regarding knowledge integration for using technology in teaching, multimedia cases also have potential to improve pre-service teachers' technology uses by developing their situated understanding of theories as applied in real classroom situations (Kim, 2011). Moreover, multimedia case-based learning and discussions positively affected pre-service teachers' perceptions of the diffusion of information and communications technologies (Sahin, 2012) and their lesson planning for using technologies (Han & Shin, 2011). Despite these positive influences of multimedia cases on technology integration, these studies did not further examine whether multimedia cases affected knowledge integration of technology, pedagogy and content knowledge that was proposed as a framework for effective integration of technology in teaching.

3. Research questions

In order to successfully educate pre-service teachers to effectively use technologies in teaching, their knowledge acquisition in technological, pedagogical and content aspects is necessary. Further, how to integrate those three elements is critical for enabling the knowledge to be used to solve authentic problems in real teaching practice. Thus, this study examines how multimedia case-based learning affect pre-service teachers' perceived learning of individual knowledge acquisition regarding technology, pedagogy and content knowledge, and integration of these three for