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Computer skills instruction for pre-service teachers: A comparison of three instructional approaches

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ABSTRACT

The computer self-efficacy of teachers contributes positively to their technology integration self-efficacy. Many studies have examined instructional strategies that foster computer self-efficacy but not their corresponding impact on teachers' technology integration self-efficacy. This study investigated the instructional strategies used for pre-service teacher computer skills instruction and their corresponding impact on teacher computer self-efficacy and technology integration self-efficacy. Using a multiple case-study approach, video recordings were made of the class sessions of three participating instructors throughout a semester. Content analysis of these video recordings found the instructors using three approaches of computer skills instruction: Extensive behavioral modeling, targeted behavioral modeling, and independent problem-solving. Analysis of pre and post-study student survey responses also found that the three instructional approaches raised their perceived computer self-efficacy. However, the effect sizes were largest when the independent problem-solving approach was used. This approach was also found to have had better motivational effects on students than the extensive behavioral modeling approach. On the other hand, computer skills instruction increased students' technology integration self-efficacy only when instructors modeled teaching-related examples and provided students with multiple mastery experiences of technology integration practices. The applications of the three computer skills instructional approaches for teacher education are discussed.

1. Introduction

Instructional approaches such as behavioral modeling and hands-on practice have traditionally been effective for fostering learners' computer self-efficacy or their confidence with using computers (Compeau & Higgins, 1995b) during computer skills training. Computer self-efficacy has been found to raise learners' interest for information technology (Akbulut, 2009), reduce their computer anxiety (Mcilroy, Sadler, & Boojawon, 2007), enhance their outcome expectations (Bates & Khasawneh, 2007), and improve their performance of technology tasks (Johnson & Marakas, 2000; Kinzie, Delcourt, & Powers, 1994; Shapka & Ferrari, 2003).

Computer skills training is an important component of pre-service teacher education programs because 85% of 4-year degree-granting institutions in the USA offer stand-alone computer skills courses for pre-service teachers in their initial licensure programs where they learn to use word-processing, spreadsheet, slide presentation and Web development software (Kleiner, Thomas, & Lewis, 2007). There is evidence that such kinds of computer skills training raises teachers' computer self-efficacy (Abbitt & Klett, 2007; Albion, 2001; Milman & Molebash, 2008), which was found to have high positive correlation with teachers' outcome expectations from technology integration (Niederhauser & Perkman, 2010) and their intentions to use technology when teaching (Smarkola, 2008). Teachers need to be technically competent with using computers. They also need to integrate technology into teaching and learning activities. Nevertheless, there is recognition that teachers' perception of high computer self-efficacy did not imply that they felt similarly about their technology integration self-efficacy, that is, their confidence to integrate technology into teaching and learning activities (Abbitt & Klett, 2007; Brush et al., 2003; Moursund & Bielefeldt, 1999; Wetzel, Wilhelm, & Williams, 2004). It is therefore important for computer skills courses to address both the technical and pedagogical aspects of pre-service teachers' educational technology preparation (Niederhauser, Salem, & Fields, 1999). Yet, are the current instructional approaches used during pre-service teacher computer skills training adequate?

This is a question requiring further examination because there is currently a dearth of studies about the instructional approaches used during pre-service teacher computer skills training (Koh & Frick, 2009). Furthermore, the role of computer skills training in teacher education is becoming increasingly unclear. Some colleges of education have chosen to retain computer skills training as they strengthen their curriculum offerings with technology integration

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modules while others have proposed to remove computer skills training in favor of technology integration modules (Abbitt & Klett, 2007; Brinkerhoff, Ku, Glazewski, & Brush, 2001; Brush et al., 2003; Wetzel et al., 2004). The recent conception of technological pedagogical content knowledge (Mishra & Koehler, 2006) as a theoretical underpinning for teacher educational technology training has shed some light to this debate. This framework points out that teachers' expertise for technology integration is fostered through the integration of their technological knowledge, pedagogical knowledge, and content knowledge. Understanding the practice and impact of computer skills training approaches can help colleges of education better plan the development of pre-service teachers' technological knowledge. With this understanding, its curriculum role and synergies with technology integration modules can be better strategized.

This study therefore examined the instructional approaches used during a pre-service teacher computer skills course, and its effects on pre-service teachers' computer self-efficacy and technology integration self-efficacy. A naturalistic multiple case study approach was used to examine the different sections of a pre-service teacher computer skills classes throughout a semester. The instructional sequences taking place in each class section was videotaped and content analysis was then used to describe three main instructional approaches that emerged. Pre and post-study surveys were also administered to assess the changes of pre-service teachers' computer self-efficacy and technology integration self-efficacy, and to understand their perceptions about the impact of these instructional approaches. This study contributes to extant teacher education research by discussing the different instructional contexts whereby these instructional approaches could be effectively used to foster both the computer self-efficacy and technology integration self-efficacy of pre-service teachers.

2. Theoretical development and research questions

The theory underlying the constructs of computer self-efficacy and technology integration self-efficacy is social cognitive theory (Bandura, 1977). This theory posits that self-efficacy or the confidence that one perceives for performing a task influences the extent to which one attains a desired standard of task performance (Bandura, 1977). It also theorizes that self-efficacy can be developed in four ways, that is, through vicarious experiences (observing successful task performance), enactive mastery (actual success in task performance), verbal persuasion (teacher expressing confidence in pre-service teachers' successful task performance), and emotional arousal (reduction in feelings of tension or agitation during task performance). Compeau and Higgins (1995b) were the first to adapt Bandura's concept of self-efficacy for computer skills training and formulated the term "computer self-efficacy". Therefore, computer skills training methods have been shaped by Bandura's research. The use of vicarious experiences has even developed into the methodology of behavioral modeling which has been widely used during computer skills instruction in the 1990s (Gist, Schwoerer, & Rosen, 1989; Torkzadeh, Pflughoeft, & Hall, 1999).

During behavioral modeling, learners observe instructors as they demonstrate correct steps for using computer software (Johnson & Marakas, 2000). Many of the behavioral modeling studies are experimental studies conducted during the 1990s with undergraduates. These studies generally show that behavioral modeling is effective for raising undergraduates' computer self-efficacy (Bolt, Killough, & Koh, 2001; Compeau & Higgins, 1995b; Torkzadeh et al., 1999). Behavioral modeling is also more effective than lecture-based methods where the procedures for using computer software are verbalized but not demonstrated (Gist et al., 1989). While most of the evidence has pointed to the effectiveness of behavioral modeling, Johnson and Marakas (2000) asserted that enactive mastery experiences through hands-on practice could also be important for the development of computer self-efficacy. They replicated Compeau and Higgins (1995b) study and found that no significant relationships could be established between computer self-efficacy and actual task performance when enactive mastery experiences were missing. While these studies have established the relevance of behavioral modeling and enactive mastery, it is worthy to note that many were controlled experiments where the computer skills instructional segments were delivered through videotape to undergraduates who then worked on their tasks individually (Bolt et al., 2001; Compeau & Higgins, 1995b; Gist et al., 1989). This may not be typical of classroom-based computer skills instruction that involves face-to-face interaction between instructors and students. Therefore, the effects of these strategies on student computer self-efficacy in actual classroom situations have yet to be fully understood.

Research conducted at IBM Corporation showed the possibility of instructing computer skills through software manuals that support enactive mastery through independent learning. Their studies of computer user behavior showed that to be effective, these software manuals had to be modularized, support non-sequenced exploratory learning; and had to contain succinct prompts and hints for error recovery (Carroll, 1984; Van der Meij & Carroll, 1998). Nevertheless, the effects of such independent learning experiences on learners' computer self-efficacy have not been further examined in this line of research. Therefore, meaningful comparisons with behavioral modeling studies cannot be made.

Extant studies reviewed so far has shown the existence of three methods for computer skills instruction: behavioral modeling, enactive mastery, and independent learning with software manuals. The effects of these instructional methods when applied to the context of pre-service teachers' computer skills training have not yet been studied thoroughly. From available literature, there appears to be some emphasis on providing teachers with enactive mastery experiences through opportunities for hands-on contact with computer technology. The instructors' role in facilitating such kinds of hands-on experiences has not been described but there is evidence that when this occurs frequently across pre-service education, it raises teachers' computer self-efficacy (Albion, 2001; Milbrath & Kinzie, 2000). Experiences of enactive mastery could also occur when pre-service teachers work on design projects where they apply their computer skills to create teaching-related artifacts such as lesson plans and teaching presentations (Beyerbach, Walsh, & Vannatta, 2001; Pellegrino & Altman, 1997; Snider, 2002). Such kinds of experiences were conjectured to enhance pre-service teachers' technology integration self-efficacy because these allow pre-service teachers to experience the decision-making processes that teachers typically encounter during technology integration (Pellegrino & Altman, 1997). However, the impact of design projects on teachers' technology integration self-efficacy has also not been studied.

The use of behavioral modeling has rarely been mentioned in teacher education literature as there appears to be more emphasis on the need for faculty modeling, which is understood as the process whereby instructors model examples of technology-integrated lessons to pre-service teachers by using computers and technology tools to conduct their own lessons (Brush et al., 2003). Some studies reported that teachers who frequently observed their instructors using computers during their pre-service courses developed higher computer self-efficacy (Albion, 2001; Handler, 1993; Milbrath & Kinzie, 2000). Other studies provided anecdotal evidence of faculty modeling having positive influences on pre-service teachers' attitudes and perceptions towards technology integration (Beyerbach et al., 2001; Brush et al., 2003; Pope,