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Social cognitive predictors of pre-service teachers' technology integration performance

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Abstract The main objective of the study was to examine interrelationships among social cognitive variables (self-efficacy, outcome expectations, and performance goals) and their role in predicting pre-service teachers' technology integration performance. Although researchers have examined the role of these variables in the teacher-education context, the present study was an examination of the manner in which variables may jointly function to predict technology integration performance. The Social Cognitive Career Theory (SCCT) served as the theoretic framework. Participants were 111 pre-service teachers enrolled in an introductory instructional technology course. Findings revealed that SCCT predictions were largely supported when the freshman students were excluded from the analyses. Self-efficacy and outcome expectations were related to each other and both contributed to the prediction of performance.

Keywords Social cognitive career theory · Self-efficacy · Outcome expectations · Technology integration performance

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Introduction

Investment in information technologies in US schools has increased dramatically in the last two decades (President's Committee of Advisors on Science and Technology 1997). Although 99% of public schools had Internet access and the ratio of students to instructional computers with Internet access was 4.8:1, 70% of teachers reported that they did not feel prepared to use computers and the Internet in their teaching (NCES 2000).

Studies have examined this issue from different perspectives in a variety of contexts and discussed a number of factors that support or hinder teachers' effective technology use. Among those factors, the role of pre-service teacher education programs has been noted as critical for the success of technology integration (Wilson 2003). Therefore, many consider improving pre-service teacher education programs the primary strategic step needed to address the question of how teachers can be prepared to use technology more effectively for instruction (OTA 1995; Stevens and Lonberger 1998; Thompson et al. 2003; Wetzel and Williams 2004).

To prepare prospective teachers, many efforts (i.e., development of educational technology standards, Preparing Tomorrow's Teachers to Use Technology, Apple Classrooms of Tomorrow History) have been made to ensure that pre-service and in-service teachers will be adequately prepared for integrating technology into their future classroom. These efforts in teacher education programs, as discussed in the literature, are expected to increase pre-service teachers' ability to integrate technology into teaching in order to prepare them for tomorrow's classrooms. As the early step of these efforts taken at the institutional level, many teacher education institutions in the nation have added an introductory instructional technology course to their curriculum to increase pre-service teachers' ability for technology integration. These courses are designed to introduce pre-service teachers to several computer programs (e.g., word processing, spreadsheet, and presentation programs) and to teach how to integrate these programs into teaching (Yildirim 2000). However, several research studies have suggested that such courses failed to help pre-service teachers develop necessary technology integration abilities (Brown and Warschauer 2006; Willis and Montes 2002).

Researchers have also examined why pre-service teachers were not equipped with necessary instructional technology skills in such courses and reported that both external factors (i.e., course structure, technical facilities, technology background) and internal factors (i.e., self-efficacy, outcome expectations) were influential on pre-service teachers' technology-related performance. Among those internal factors, self-efficacy (Karsten and Roth 1998), outcome expectations (Liu and Johnson 1998; Liu et al. 2004), and goal setting (Volet and Styles 1992) play an important role in pre-service teachers' technology-related performance in instructional technology courses. Therefore, it is useful to examine those internal factors that influence pre-service teachers' technology integration ability (as measured by performance) in such courses.

Although researchers have examined the role of internal factors on technology-related ability, they focused on these factors in isolation and rarely grounded their research in a theoretic framework. Examining the interactions among these factors within a meaningful theoretic framework may help us develop a better understanding of how these factors affect pre-service teachers' technology integration performance.

The main purpose of this research, thus, was to investigate factors (self-efficacy, outcome expectations, and goal setting) that influence pre-service teachers' technology integration performance. Social Cognitive Career Theory (SCCT) was used as the theoretic framework to help meet the goals of this research.

Theoretic framework

Principally rooted in Social Cognitive Theory (Bandura 1986), Lent et al. (1994) developed Social Cognitive Career Theory (SCCT) to explain and predict academic- and career-related behavior. This theory consists of three models: (1) Interest Development Model; (2) Career Choice Model; and (3) Performance Model. The Interest Development Model examines how career interests develop over time, while the Career Choice Model explores how personal, contextual, and experiential factors affect career-related choice behavior. The Performance Model explores the role of ability, self-efficacy, outcome expectations, and performance goals on academic or career-related behavior. Performance is defined as the level of achievements (e.g. course grades) as well as indices of behavioral persistence (e.g. stability of academic major) in the SCCT performance model (Lent et al. 2002).

According to SCCT Performance Model, past performance/ability, self-efficacy (SE), outcome expectations (OE), and performance goal (PG) are interrelated and each play an important and complex role in individuals' academic or career performance. For example, past performance influences people's SE and OE beliefs. These beliefs, in turn, influence PG and performance level.

Figure 1 shows the SCCT Performance Model (Lent et al. 1994). This model hypothesizes that past performance affects current performance directly and indirectly through its effects on SE and OE. Moreover, both SE and OE influence performance goals, which, in turn, lead to changes in performance. In other words, past performance affects SE expectations along with the expectations people have about imagined consequences of their actions (OE). These expectations influence the PG that people set for themselves, which, in turn, influences performance level. Once this process is complete, the resulting level of performance becomes past performance, which individuals use as a basis for their future SE and OE. These steps continue as the process iteratively repeats itself.

SE beliefs come from four main sources: (1) mastery experiences, (2) vicarious experiences, (3) verbal persuasion, and (4) physiologic indexes (Bandura 1986). Among these sources, mastery experiences were claimed to be the most important self-efficacy source, since "they provide the most authentic evidence of whether one can muster whatever it takes to succeed" (Bandura 1997, p. 80). Successful experiences increase SE while unsuccessful ones decrease it. Observation of similar peers performing a task successfully helps observers to gain the confidence that they can achieve the same task. In contrast, observing similar others fail may cause people to believe that they also lack the skills to succeed, preventing them from

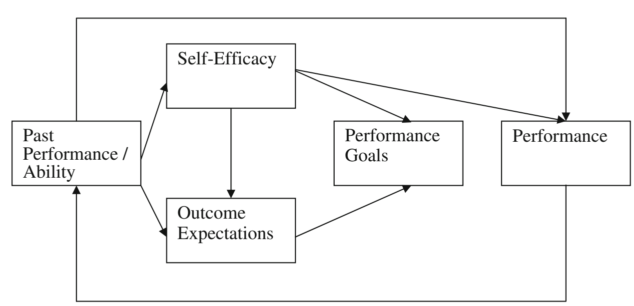

Fig. 1 SCCT performance model

performing the behavior (Schunk 2001). Verbal persuasion comes into play when individuals are encouraged to believe that they have enough capabilities to accomplish a task (e.g. being told "you can do this"). Finally, individuals might interpret bodily symptoms such as increased heart rate or sweating as a signal for anxiety or fear, resulting in an indication of their own lack of skills. It is important to note that information received from these sources do not automatically increase SE. Rather, it is cognitively appraised. In gauging SE, people combine and consider several factors such as difficulty level of the task, external help received, effort spent, perceived similarity to the model, persuader credibility, and number and pattern of success and failures (Bandura 1997).

In the context of teacher education, *self-efficacy* refers to pre-service teachers' perception of their capabilities to use instructional technology effectively in the classroom, while *outcome expectations* refer to their anticipated outcomes of using instructional technology in the classroom. *Performance goals* reflect the level of performance a pre-service teacher aims for in a given technology integration task, and *technology integration performance* refers to pre-service teachers' ability to create and design learning environments supported by technology.

The cyclical nature of SCCT can be examined in the context of pre-service teachers' performance in an instructional technology course. For example, a pre-service teacher who did well in previous instructional technology courses may have confidence in his or her ability to receive good grades (SE) and expect positive outcomes (e.g., improving instructional technology skills) in the next instructional technology class. As a result of these expectations, the student enrolls in this course and sets a challenging PG (e.g., receiving an A). Based on high SE, OE, and a challenging PG, the SCCT Performance Model would predict that this student would likely show high academic performance in the new class. If the student demonstrates high performance in this class, that state would become past performance and would serve as the basis for SE, OE, and PG in future instructional technology courses. Based on this theoretic framework, the present study aimed to investigate the relationships among factors (SE,OE, PG) that affect performance of pre-service teachers enrolled in an instructional technology course.

Literature

Self-efficacy, outcome expectations, and goal setting are the main predictors of academic and career-related behaviors as described in SCCT. Therefore, based on the SCCT framework, those factors are used in this study to predict pre-service teachers' technology integration behavior. This section, thus, is organized in a way that provides details on each of these factors: SE, OE, and PG. Within each section below, a definition of the construct, its importance in human behavior, and its role in academic and technology-related performance are given.

Self-efficacy (SE)

Self-efficacy is considered as the key factor in predicting and explaining academic and career-related behavior in Social Cognitive Career Theory. SE refers to "… people's judgments of their capabilities to organize and execute courses of action required to attain designated types of performances. It is concerned not with the skills one has but with judgments of what one can do with whatever skills one possesses" (Bandura 1986, p. 391). In other words, SE is the belief that one can successfully produce a desired outcome (Bell-Gredler 1986). For example, a teacher who has high computer SE may believe he or she can help his or her students learn subject matter better through the use of computers in the classroom.

Hackett and Betz (1981) were the first to apply the construct of SE in career domain. They made an effort to explain women's career choices and suggested that low SE may account for the limited range of women's career options. Their study resulted in investigations of the role of SE on behavior (e.g. performance, career choice) in several domains such as mathematics (Lent et al. 1993), reading (Shell et al. 1989), and information technology (Smith 2002). In a meta-analysis that examined 36 studies conducted between 1977 and 1988 on the relationship between SE and academic performance or persistence, Multon et al. (1991) found that SE was related to academic performance ($r = .38$, $p < .01$) and accounted for 14% variation in academic performance. SE also was found to make a significant contribution in predicting academic performance when the influence of ability was controlled (e.g., Lent et al. 1993; Rangel et al. 1990).

Moreover, the construct of SE has received remarkable attention in the literature on technology use. Researchers typically have concentrated on the construct "Computer Self-Efficacy (CSE)" in this area to examine its influence on computer-related behavior. Computer Self-Efficacy refers to "… a judgment of one's capability to use a computer" (Compeau and Higgins 1995, p. 192) and was claimed to be an important mechanism affecting computer-related behavior. Researchers found that CSE influences students' intentions to use computers in an introductory psychology course (Hill et al. 1987), the level of computer use (Compeau and Higgins 1995), and performance in a computer literacy course (Karsten and Roth 1998).

In addition to CSE, researchers in this area have also devoted remarkable attention to the "Technology

Integration Self-Efficacy" construct in recent years (e.g., Abbitt and Klett 2007; Wang et al. 2004). Our definition of technology integration in the current study is grounded in ISTE's National Educational Technology Standards for Teachers (Standard No: 2):

> Teachers plan and design effective learning environments and experiences supported by technology. Teachers (a) design developmentally appropriate learning opportunities that apply technology-enhanced instructional strategies to support the diverse needs of learners, (b) apply current research on teaching and learning with technology when planning learning environments and experiences, (c) identify and locate technology resources and evaluate them for accuracy and suitability, (d) plan for the management of technology resources within the context of learning activities, (e) plan strategies to manage student learning in a technology-enhanced environment. (ISTE 2000, p. 198)

From this definition, it is clear that technology itself is not what is being taught or learned; instead, technology is a tool that helps students to learn content in different and effective ways. In other words, technology integration does not focus on the technology itself; rather, it concentrates on the learning that takes place through the use of technology.

The technology integration SE beliefs deal with teachers' perception of their capabilities to use technology in the classroom effectively. These beliefs depend on a variety of factors such as knowledge of various types of technology, experience with using various technologies, readily available resources and support. Research involving this construct has primarily concentrated on whether pre-service teachers increase their technology integration SE as a result of their enrollment in an introductory instructional technology course. Although researchers have devoted some attention to this construct, we were unable to identify a study investigating the role of technology integration SE on pre-service teachers' technology integration performance.

In sum, research on technology use has primarily concentrated on the CSE construct and its influence on computer-related behavior. Findings reveal that CSE is an important mechanism influencing different types of computer-related behavior. The Technology Integration SE construct has also received remarkable attention in recent years, and researchers found that introductory instructional courses involving issues regarding technology integration exert significant influence on pre-service teachers' SE for technology integration. This influence becomes more powerful if pre-service teachers are also exposed to exemplary technology using teachers and encouraged to set learning goals.

Outcome expectations (OE)

Outcome expectations (OE) are other important mechanisms in Social Cognitive Career Theory that explain and predict academic and career-related behavior. Outcome expectations are defined as the anticipated outcomes of an action, and can be expressed as "If I do X, Y might happen?" (Lent et al. 2002). In the context of technology integration, outcome expectations may take a form such as "If I integrate technology into my classroom activities, I will increase my effectiveness as a teacher and/or my students will learn subject matter better."

Outcome expectations are important because they allow individuals to create cognitive maps or internal plans in their mind to analyze possible actions to reach the desired goal (Schunk 2001). For example, a student desiring to attain instructional technology skills (desired goal) may internally conceptualize action plans such as receiving external support or dedicating additional time to reach his or desired goal. Outcome expectations also play an important role in human motivation because they may drive individuals to sustain behaviors over long periods of time if they believe that their actions will eventually generate the desired outcome (Schunk 2001). For example, a classroom teacher might start integrating instructional technology in the classroom to increase his or her students' learning (desired outcome for the teacher). This teacher is very likely to continue to integrate instructional technology as long as he or she believes that using instructional technology will eventually increase his or her students learning. In contrast, this teacher might stop integrating technology if he or she decides that technology integration will not help increase his or her students' learning.

Researchers have examined OE's effects on academic performance. Findings revealed that OE had a low correlation with academic performance (Shell et al. 1989) and accounted for unique variance in performance when examined in isolation without controlling for SE beliefs. However, when OE is studied in conjunction with SE, OE made little or no contribution to predicting performance (Lent et al. 1993; Shell et al. 1989, 1995; Siegel et al. 1985). For example, in two studies that presented hierarchical regressions in which OE followed by SE was entered as the predictors of academic performance, OE accounted for a small portion of variance in performance above and beyond the effects of SE. The additional variance accounted for was 1.3% (Siegel et al. 1985) in mathematics and 5% for reading (Shell et al. 1989). Other studies that investigated the predictive ability of OE on performance above and beyond SE beliefs revealed that OE was a redundant predictor of academic performance (Lent et al. 1993; Shell et al. 1995).

Outcome expectations have sparked considerable attention in the literature on the use of technology. Several researchers have included OE in computer attitude scales as "perceived usefulness" and have employed OE to predict computer-related behavior. For instance, Albion stated that perceived usefulness "… could be considered as a measure of outcome expectancy because someone who believes that computers are useful evidently expects that their application will produce worthwhile effects" (2001, p. 324). Outcome expectations for technology use is important because those expectations play an important role in technology usage (Compeau and Higgins 1995), decision to use advanced technologies (Hill et al. 1987), enrollment in computer courses (Campbell 1992), and desirability of learning computing skills (Zhang and Espinoza 1998). Although outcome expectations seemed to be a good predictor and determinant of different types of computer-related behavior, there appears to be no empirical evidence that they predict and influence computer-related performance (Liu and Johnson 1998; Smith 2002).

Goal

Goal is another central mechanism in SCCT to explain and predict academic and career-related behavior. Having a goal reflects one's determination to strive toward a particular outcome or perform a particular activity (Lent et al. 1994), gives a framework within which individuals interpret and react to events, and results in different types of cognition, affect, and behavior (Dweck and Leggett 1988). By setting goals, "people help to organize and guide behavior, to sustain it over long periods of time in the absence of external reinforcement, and to increase the likelihood that the desired outcomes will be attained" (Lent et al. 1994, p. 84).

According to Dweck and Leggett (1988), students' tendency to adopt learning or performance goals depend partly on their personal theories about the nature of intelligence. Some students "hold an **entity view of intelligence,** *which is the belief that ability is stable and out of an individual's control;* others hold an **incremental view of intelligence**, which is *the belief that ability can be improved with effort"* (Eggen and Kauchak 2004, p. 364). Individuals with an entity view are more likely to adopt performance goals. On the other hand, those with an incremental view are more likely to adopt learning goals. If people are confident with their intelligence (holding an entity view), they tend to undertake challenging tasks and persist when they face difficulties. If confidence in their intelligence is low, they tend to avoid challenging tasks because they believe failure results from low ability. In contrast, people with an incremental view tend to undertake challenging tasks and persist even though they are not confident with their abilities, because failure suggests that more effort is necessary (Dweck and Leggett 1988).

The relationship of goals to academic performance has been examined by many researchers (e.g., Zimmerman et al. 1992). Zimmerman et al. (1992) found that among the variables of prior grades, efficacy for self-regulated learning, efficacy for academic achievement, parent grade goals, and student grade goals, grade goals were found to have the highest correlation with students' final grade ($r = .52$) in social studies. Other two studies examining the relationship between performance goals and grade revealed a low correlation between the two (.13 and .22, respectively).

Goals have also received attention in literature regarding technology use. For instance, the predictive power of goals on achievement in a computer course was demonstrated by Volet and Styles (1992). The role of students' goals and perceptions—along with other variables of age, gender, entering background in computing, program of study—on performance in an introductory computer course was examined in their study, and goals were found to have the highest correlation with performance ($r = .43$, $p < .001$). More importantly, the result of multiple regression analysis revealed that only goals, which accounted for 18% of explained variance, were retained in the equation predicting performance. Another study conducted in the information technology area revealed a similar result in that performance goals had the highest correlation with the final grade of students enrolled in an introductory computer course ($r = .34$) than other variables, including computer proficiency, self-efficacy, and outcome expectations (Smith 2002).

In sum, goals appeared to be an important mechanism that might influence individuals' technology-related performance. However, this variable has received little attention by researchers to examine its influence on technology integration performance. We believe that the present study will provide insight into the predictive ability of goals in pre-service teachers' technology integration performance.

Research questions and hypotheses

Two research questions helped address the purpose of the study. The first addressed interrelationships among SCCT variables and technology integration performance. The second addressed the predictive utility of SE and OE relative to technology integration performance.

Q1: To what extent are SCCT variables (SE, OE, and PG) related to each other and technology integration performance?

Two initial hypotheses arose from this question:

Hypothesis 1 SCCT Variables (SE, OE, and PG) are significantly correlated with each other and technology integration performance.

Hypothesis 2 SE has a higher correlation with technology integration performance than OE.

Q2: Do technology integration SE and OE make unique contributions to predicting technology integration performance above and beyond the effects of previous performance and academic ability (as measured by GPA and ACT scores)?

Two hypotheses arose from this research question.

Hypothesis 3 SE accounts for unique variance in technology integration performance above and beyond the effects of previous performance, academic ability, and PG.

Hypothesis 4 OE makes little or no contribution to predicting technology integration performance above and beyond the effects of previous performance, academic ability, SE, and PG.

These hypotheses address whether SE and OE account for unique variance in technology integration performance above and beyond the effects of previous performance and academic ability.

Methodology

Context

This study took place at a large Midwestern US university in an introductory instructional technology course for PK-6 pre-service teachers. The three-credit hour course was designed to help pre-service teachers understand how technology can be used to enhance learning and solve instructional problems in the classroom. The focus is on contemporary hardware, software, and pedagogical approaches that teachers and students employ in elementary and early childhood classrooms.

The course is taught in a lecture-lab format, in which students attend two 1-h lectures and a 2-h lab period each week. The course instructor introduces theoretic and pedagogical foundations of instructional technology to the pre-service teachers in the lectures, and in the lab periods students learn how several technology tools (e.g., Imovie, KidPix, Inspiration, and IPod) that can be integrated into teaching to enhance student learning.

Participants

Participants were drawn from 123 students who were enrolled in six sections of an introductory instructional technology course for pre-service teachers. One hundred seventeen students agreed to participate in the study (111 females, 6 males). Participants in the study were enrolled in elementary education (82.9%), early childhood education (15.3%), and other departments (1.8%). The majority of the participants were freshmen (52.3%); the rest were sophomores (27.3%), juniors (17.1%), and seniors (3.6%). Only data from participants who completed all materials and the self-report survey were analyzed.

Research instruments

Three research instruments were used in this study: the *Comprehensive Lesson Plan Assignment* (Schmidt 2007), the *Technology Integration Assessment Instrument* (Britten and Cassady 2005), and the *Intrapersonal Technology Integration Scale* (Niederhauser and Perkmen 2008; Wang et al. 2004).

Comprehensive lesson plan assignment

The course instructor developed the comprehensive lesson plan assignment as a course assessment tool. The assignment was designed to assess pre-service teachers' abilities in planning and designing technology-enhanced learning environments. In the assignment, each student was expected to create a lesson plan on the subject they choose that integrates technology into instructional objectives and assessment. The assignment consisted of four parts: (1) lesson plan; (2) assessment; (3) student product; and (4) reflection, but only the lesson plan and assessment component of the assignment were used in this study to assess pre-service teachers' performance in technology integration. Pre-service teachers were expected to create a comprehensive lesson plan allowing for the integration of a minimum of two different technologies (i.e. software programs, hardware, etc.) in the lesson plan as part of the assignment, and they were expected to come up with an assessment plan for measuring student outcomes and learning (i.e. rubrics, quiz/test, checklist, etc.)

Technology integration assessment instrument

The instrument used in the present study was adapted from Britton and Cassady's (2005) Technology Integration Assessment Instrument, and designed to measure teachers' skills in planning and creating technology-enhanced lesson plans and to enable teachers and administrators to explore the level and style of technology integration in a classroom. Participants' comprehensive lesson plan assignments were scored using this study's version of the instrument, which features a rubric for rating seven dimensions (planning, content standards, NETS-S standards, attention to student needs, implementation—use of technology in learning, implementation—use of technology in teaching, and assessment) of a technology-enhanced lesson plan, with four levels (technology not present, non-essential technology component, supportive technology component, and essential technology component) within each dimension. Due to the nature of lesson plan assignments, the planning dimension was not used in this study.

Intrapersonal technology integration scale

The Intrapersonal Technology Integration Scale is designed to measure pre-service teachers' perception of SE, OE, and PG with respect to technology integration. It consists of three sub-scales: (1) The SE for Technology Integration Sub-scale (16 items); (2) The Technology Integration OE Sub-scale (9 items); and the Technology Integration PG Sub-scale (1 item).

Self-efficacy for technology integration sub-scale The Self-Efficacy for Technology Integration Sub-scale (Wang et al. 2004) was used in this study to measure pre-service teachers' perceptions about their confidence that they would be able to integrate technology in the classroom. This sub-scale consists of 16 items. Examples of the items included in the instrument were "I feel confident that I have the skills necessary to use the computer for instruction," "I feel confident that I can consistently use educational technology in effective ways," and "I feel confident that I understand computer capabilities to maximize them in my classroom." Using a five-point likert-type scale, participants indicated their level of agreement with each statement (0 = strongly disagree and 4 = strongly agree). Item ratings were summed to form a total technology integration SE score, with higher scores indicating stronger technology integration SE beliefs. Possible scores on this sub-scale range from 0 to 64.

The technology integration OE sub-scale The Technology Integration OE Sub-scale (Niederhauser and Perkmen 2008) was used in this study to measure pre-service teachers' perceptions about the outcomes of integrating technology into their future classroom activities. The sub-scale consists of nine items. The stem for the scale items was "Integrating technology into my future classroom activities will likely allow me to…" Examples of the items included: "…increase my effectiveness as a teacher" and "…do work that I would find satisfying." Using a five-point likert-type scale, participants indicated their level of agreement with each statement (0 = strongly disagree and 4 = strongly agree). Item ratings were summed to form a total OE score, with higher scores reflecting higher OE. Possible scores on this sub-scale range from 0 to 36.

Technology integration PG sub-scale The Technology Integration PG Sub-scale was designed to measure the level of performance toward which a pre-service teacher aims for in a given technology integration task. Pre-service teachers were asked to indicate which grade they are aiming for in the comprehensive lesson plan assignment using an 11-point scale ranging from D-(0 points) to A (11 points).

Procedure

The course's teaching assistants introduced the lesson plan assignment to the pre-service teachers in the 7th week of the semester during their lab periods. The pre-service teachers were given 3 weeks to complete the assignment. The Intrapersonal Technology Integration Scale was administered during their lab periods in the 8th week of the semester. The researchers explained the purpose and significance of the study to the participants, and those who were willing to participate in the study read a consent form and filled out the Intrapersonal Technology Integration Scale. Participants then returned their lesson plan assignments in the 10th week of the semester. Of the 117 pre-service teachers who agreed to participate in the study, 111 of them submitted their lesson plans. Pre-service teachers who did not submit their lesson plan were excluded from the study, resulting in a final sample of 111 pre-service teachers. Participants' GPA and ACT scores were obtained from university record office with the participants' permission.

Data analysis

Data Analysis for the current study consisted of three major steps. In the first step, inter-rater reliability for the Technology Integration Assessment was established. Procedures for developing a scoring protocol for the Technology Integration Assessment Instrument included establishing inter-rater reliability among three separate scorers and understanding its utility in measuring pre-service teachers' performance in technology integration. The course instructor provided the researchers with nine technology-enhanced lesson plans created by pre-service teachers enrolled in the same course during a previous semester.

Regarding raters' backgrounds, one rater had served as the teaching assistant for the course for approximately 3 years, was a primary instructor during a summer session, and holds a Ph.D. in instructional technology. The second rater (one of researchers) also holds a Ph.D. in instructional technology and served as a computer teacher in a private computer course for 2 years. The third rater (the other researcher) was a Ph.D. candidate in instructional technology during the study. In the first phase, three different scorers used the rubric to evaluate three technology-enhanced lesson plans independently. Once inter-rater agreement was calculated and found to be 82%, the researchers and the other rater met to discuss cases where raters did not agree. The researchers then created decision rules for those cases and made some modifications in the rubric to reduce ambiguity. In the second phase, each of the three raters scored three new lesson plans. In this round, inter-rater agreement was established at 91%. The raters met again to discuss cases where they disagreed, and the researchers made additional modifications to the rubric based on the discussion. In the third phase, the raters scored the final three technology-enhanced lesson plans using the modified version of the rubric. The final inter-rater agreement was established at 93%.

In the second step of the data analysis, factorial validity and reliability of the Intrapersonal Technology Integration was examined. Principal component analysis was conducted to examine whether SE and OE are different constructs. Psychometric properties of the instrument were also examined to shed more light into the reliability of the instrument items.

In the third step, correlation and regression analysis was conducted to answer the research questions and test its associated hypotheses. To test the first two hypotheses, Pearson correlation analysis was conducted. To test the last two hypotheses, hierarchical regression analysis was conducted. Variables were entered into the equation based on the theoretic framework.

Results

Results are presented in three sections. First, key variables in the study are examined. Properties of the Technology Integration Assessment Instrument (TIAI) are then addressed, followed by an analysis of the validity and psychometric properties of the Intrapersonal Technology Integration Scale. The third section consists of hypothesis testing for the SCCT Performance Model predictions.

Technology integration assessment instrument

Based on the developed protocol among three different raters, 10% of the lesson plans ($N = 11$) were randomly selected and double-scored independently by the researchers. The inter-rater agreement estimate was established at 88% in the current study. This reflects a fairly high level of agreement between researchers, suggesting that the construct was measured in a reliable manner.

Descriptive data were then calculated to examine the nature of students' efforts to integrate technology into their lesson planning. Table 1 presents the mean, standard deviation, minimum scores, and maximum scores for the dependent variable and its dimensions. Participants' overall score on the dependent variable ranged from 4 to 17 with a mean of 12.85 (SD = 2.98) and were normally distributed. This range and standard deviation indicates that the instrument was sensitive to differentiating student performance on this task.

To further examine students' performance, descriptive analyses were conducted on the six dimensions that constitute the dependent variable. Findings suggested that participants scored high in meeting content and NETS standards ($M = 2.58$ and SD = .78, $M = 2.48$ and SD = .73, respectively) and making technology an integral part of their teaching activities ($M = 2.42$, SD = .75). In contrast, participants' lesson plans tended not to address ways to use technology to meet the needs of students from diverse backgrounds ($M = 1.06$, SD = .24).

Validity and psychometric properties of research instruments

A 25-item survey (Intrapersonal Technology Integration Scale) was used to examine participants' SE and OE beliefs. Principal factor analysis with varimax rotation was used to examine factorial validity. This analysis resulted in two factors, which accounted for 50% of the variance among the SE and OE items.

As expected, all SE items loaded on one factor and all OE items loaded on the second factor. Loadings for the SE items ranged from .50 to .75 on factor 1, and OE items ranged from .62 to .83 on the factor 2. Conversely, SE items loadings were very low for factor 2 (−.02–.28) and OE item loadings were very low for factor 1 (.07–.31). These results provided evidence that SE and OE form two distinct constructs in this context and with this population. Thus, it was appropriate to treat the two constructs as distinct scales. Since all of the items loaded on their respective factor, no item was excluded as a result of the analysis.

Table 1 Descriptive statistics for the dependent variable

Variable	*M*	SD	Range		
			Min	Max	Possible
Overall Performance	12.85	2.98	4	17	0–18
1. Content standards	2.58	.78	0	3	0–3
2. NETS	2.48	.73	0	3	0–3
3. Attention to students' needs	1.06	.24	1	2	0–3
4. Technology in learning	2.14	.68	1	3	0–3
5. Technology in teaching	2.42	.75	1	3	0–3
6. Assessment	2.15	.75	0	3	0–3

Internal consistency analyses were then performed on (1) the Self-Efficacy for Technology Integration Sub-scale and (2) the Technology Integration Outcome Expectations Sub-scale. Cronbach's alpha, corrected-item correlations, and squared multiple correlations were used to measure the internal consistency of the scales. Adequate alpha values should be higher than .70 and values higher than .80 are considered as excellent, while adequate levels of corrected-item correlations range from .3 to .9. Squared multiple correlations values of higher than .40 are considered to be adequate (Stevens 1986).

Cronbach's alpha was .92 for the Self-Efficacy for Technology Integration Sub-scale. Corrected-item correlations ranged from .44 to .70 and squared multiple correlations from .45 to .71. Cronbach's alpha was .91 for the Technology Integration OE Sub-scale. Corrected item correlations ranged from .58 to .77 and SMC from .48 to .73. The cronbach's alpha for the Intrapersonal Technology Integration Scale was .93. Together, these findings indicated homogeneity among the scale items and provided empirical evidence for the internal consistency of both the SE and OE dimensions of the scale. After establishing validity and internal consistency of the SE and OE measures, descriptive data were calculated for all the SCCT variables.

Table 2 presents the mean, standard deviation, minimum scores, and maximum scores for the SCCT variables. Participants had a fairly high sense of SE *($M = 44.26$, $M = 47$,* SD = *7.41)* and positive OE *($M = 27.30$, $M = 29$,* SD = *4.24).* They also aimed for high scores in the lesson plan assignment as indicated by their performance goals ($M = 10.14$, SD = 1.18). While SE and OE scores were normally distributed, PG scores were not. An examination of frequency of participants' responses revealed that 53% of the students aimed to receive an A in the assignment, resulting in a negatively skewed distribution for the PG variable. To manage this difficulty, we used a logarithmic transformation to adjust each score on the PG variable, which yielded a more normal distribution.

Testing the predictions of the SCCT performance model

Pearson correlations were calculated to test the first two hypotheses. Results revealed that all of the variables in the present study had a significant correlation with technology integration performance. GPA had the highest correlation, followed by OE (see Table 3). A moderate positive correlation ($r = .38$, $p < .05$) between SE and OE was also found; however, neither SE nor OE correlated with PG. In light of these findings, the first hypothesis (*SCCT Variables (SE, OE, and PG) are significantly correlated with each other and technology integration performance)* was partially supported. Further, the second hypothesis was rejected, since OE had a higher correlation with performance than did SE. ($r = .33$, $p < .01$ vs $r = .19$, $p < .05$).

To understand these unexpected results, we tested grade level as a potential moderating variable of the relationships. Because of the small number of participants within the junior and senior levels, the grade level variable was collapsed into two categories: freshman and upper level (sophomore, junior, and senior). We entered grade level as a dummy variable in the first step, followed by SE and OE. We then analyzed the two- and three-way interactions among these variables (SE*Grade, OE*Grade, SE*OE*-Grade). As Table 4 indicates, one of the two interactions (SE*Grade) was significant, leading to the conclusion that grade level moderated the relationship between SE and performance. Further analysis revealed that self-efficacy/performance correlation was found to be stronger in the upper-grade-level group ($r = .44$, $p < .01$) than in the freshman group ($r = .03$, $p > .05$).

Table 2 Description of the SCCT variables

Variable	Interpretation of higher score	*M*	SD	Range		
				Min	Max	Possible
SE	Stronger sense of SE	44.26	7.41	24	64	0–64
OE	More positive OE	27.30	4.24	15	36	0–36
PG	More challenging PG	10.14	1.18	4	11	0–11

Table 3 Correlations among variables

Variable	1	2	3	4	5	6
1. GPA	–	.54**	−.14	.08	.38**	.43**
2. ACT		–	.01	.00	.27**	.28**
3. SE			–	.38**	.05	.19*
4. OE				–	.12	.33**
5. PG					–	.27**
6. Performance						–

* $p < .05$, ** $p < .01$

Table 4 Hierarchical regression analyses predicting performance

Variable	*F*	*P*
Grade	.92	.34
SE	2.24	.13
OE	9.85	.00**
Grade*SE	4.94	.03*
Grade*OE	.68	.41
Grade*SE*OE	.47	.49

* $p < .05$, ** $p < .01$

Based on these findings, two separate correlation matrices were created: one for freshman and another for upper-level students (see Table 5). A moderate relationship between SE and OE existed for both groups; however, for the freshman group, SE was correlated with performance and PG. Thus, the first hypothesis was partially supported for the freshman group. Since OE had a higher correlation with performance than did SE, the second hypothesis was rejected for these students.

Results for the upper-level group revealed a pattern that was much more consistent with the SCCT Performance Model. With respect to hypothesis 1 *(SCCT variables are significantly related to each other and technology performance)*, all SCCT variables were significantly correlated with performance. Self-efficacy was also correlated with other SCCT variables including PG ($r = .28$) as well as OE ($r = .42$); however, no significant relationship between OE and PG existed. Thus, except for the lack of relationship between OE and PG, hypothesis 1 was supported. Hypothesis 2 was also supported, since SE had a higher a higher correlation with performance than did OE ($r = .45$ vs $r = .38$). These findings for upper-level students were largely consistent with the SCCT Performance Model, while findings for the freshman group were not. While beyond the scope of the present study, additional research is needed to further understanding of why SCCT predictions did not hold for the freshman group. Since findings for the upper-level group was largely consistent with SCCT predictions, the freshman group was not included in testing the hypotheses associated with the second research question.

Forced-order hierarchical regression analysis was conducted to test the last two hypotheses. Using this analysis enabled removal of variance associated with previous academic performance and academic ability. Based on the SCCT theoretic framework, predictor variables were entered into the regression equation in the following order: GPA, ACT, PG, SE, and OE. Results presented in Table 6 revealed that SE accounted for 8% variation in performance above and beyond previous performance, academic ability, and PG, while OE accounted for 9% of the variation above and beyond the effects of previous performance, academic ability, and PG and SE. Thus, it appears that SE contributed to the prediction of performance and that OE made a surprisingly large contribution to the performance above and beyond the effects of SE and the other variables.

In order to understand if the assumptions of regression analysis were met in our analysis, error terms (residuals) were examined. Results revealed that the residuals were normally distributed (*Skewness* $= -.14$, *Kurtosis* $= .23$) with a mean of 0. Multicollinarity among the predictor variables was not a problem, since all of the variance inflation factors (VIF) for the individual β parameters were less than 10 (max: 1.90). No outliers were detected, since all of the Cook's D values were less than 1 (max: .40). Together, these findings provide evidence that assumptions of the regression analysis were met.

Since the sample size for the regression analysis was relatively low, we calculated effect sizes of the whole model, SE and OE variables. Hinkle et al. (2003) stated that "with all other factors held constant, a test is more powerful when the effect size is larger" (p. 311). R^2 for the whole model in our study with all of the predictor variables was .37. Using the Cohen' s formula (1988),

$$f^2 = \frac{R^2}{1 - R^2}$$

We found the effect size of the model (*Cohen's* f^2 value $= .59$) large. In order to examine the effect sizes of SE and OE in the model, we used the formula below:

$$f^2 = \frac{R^2_{AB} - R^2_A}{1 - R^2_{AB}}$$

Note: R^2_A is the variance accounted for by a set of one or more predictor variables A, and R^2_{AB} is the combined

Table 5 Correlations among variables by grade level

Variable	1	2	3	4	5	6
Freshman students ($n = 58$)						
1. GPA	–	.51**	−.21	.05	.32*	.50**
2. ACT		–	.00	.06	.21	.26*
3. SE			–	.38**	−.07	.03
4. OE				–	.11	.32*
5. PG					–	.17
6. Performance						–
Upper level students ($n = 53$)						
1. GPA	–	.62**	.00	.09	.52**	.32*
2. ACT			.03	−.04	.36*	.31*
3. SE			–	.42**	.28*	.45**
4. OE				–	.17	.38**
5. PG					–	.44**
6. Performance						–

* $p < .05$, ** $p < .01$

Table 6 Forced-order hierarchical regression predicting performance

Variable	*B*	*R*	R^2 change	*F* change
GPA	.28	.44	.19	9.24**
ACT	.19	.44	.00	.02
PG	.05	.45	.01	.51
SE	.16	.53	.08	4.15*
OE	.35	.62	.09	5.19*

* $p < .05$, ** $p < .01$

variance accounted for by A and another set of one or more predictor variables B. By convention, f_A^2 effect sizes of .02, .15, and .35 are termed *small*, *medium*, and *large*, respectively (Cohen 1988).

Results revealed that effect size *for the SE variable* ($f^2 = .27$) *was medium and it was large for the OE variable* ($f^2 = .44$). These results provide evidence that SE and OE are useful predictors of technology integration performance above and beyond the effects of other variables. Implications of these results will be discussed in the next section.

Discussion

The main objective of the study was to examine interrelationships among social cognitive career variables (SE, OE, and PG) and their role in predicting pre-service teachers' technology integration performance. Although other researchers have examined the role of these variables on pre-service teachers' performance in computer courses, they rarely grounded their studies in a theoretic framework (e.g., Karsten and Roth 1998). The present study was undertaken to address this missing component. The SCCT Performance Model served as the conceptual framework.

Findings revealed that the Technology Integration Assessment Instrument was useful in differentiating student performance, that SE and OE were, indeed, distinct constructs, and that the scales used in this study to measure these constructs possessed good psychometric properties. Technology integration SE and OE were related to each other and both offered useful and nonredudant information to predict technology integration performance. The predictions for the SCCT Performance Model were supported for higher ranking students.

It is important to note that although the Technology Integration Assessment Instrument used in this study was helpful in differentiating pre-service teachers' technology integration performance, it deals with only the first two dimensions of technology integration (planning and designing). Pre-service teachers might have the abilities to plan and design learning environments supported by technology. However, this does not necessarily mean that they will be able to effectively use technology in a real classroom environment to promote student learning when they become a teacher. Thus, it would be useful for future research to develop and test instruments that measure additional dimensions of technology integration (implementation and evaluation), perhaps allowing pre-service teachers' ability for technology integration to be assessed more thoroughly.

It is also important to note that the sample size of the current study was relatively low to test its complex hypotheses. Despite this limitation, we found effect sizes for the SE and OE variables medium and large, respectively. Thus, we believe that the current study increased our understanding of the role of SE and OE in pre-service teachers' technology integration performance.

Self-efficacy

Although the SCCT would predict that SE would be a stronger predictor of performance than OE, initial testing of the research hypotheses revealed that technology integration SE had a lower correlation with performance than did technology integration OE. This SCCT-based prediction was supported differentially based on grade level.

Findings revealed that SE had a higher correlation with pre-service teachers' technology integration performance than did their technology integration OE for the upper-level group. This finding supported previous research studies that also indicated SE was the more potent of the two belief constructs (Lopez et al. 1997). For example, Lopez et al. study (1997) revealed that SE was much stronger predictor of students' end-of-term mathematics grade than OE.

Hypotheses testing across grade levels revealed other interesting results. The SE/performance relationship was found to be stronger in the upper-level group than in the freshman group. This finding was consistent with the results of another research study (Shell et al. 1989), which suggested that the relationship between beliefs and performance become stronger as persons become more skilled. Shell et al. (1989) found that SE and OE beliefs accounted for more substantial variance in reading achievement for mature skilled readers (undergraduate students) than for second and fifth graders. Perhaps, not surprisingly, technology integration SE may be a stronger predictor of performance when students have sufficient experience (e.g. creating technology-based lesson plans, using a number of instructional technology tools) and maturity to judge their capabilities regarding technology integration more accurately. Further research on technology integration SE and performance should remain sensitive to possible constraints on predictive relationships because of other factors that may moderate self-efficacy/criterion relationships.

It is important to note that technology integration in education does not simply mean being able to use a number of technology tools in the classroom. Rather, it is a complex process that requires a person to use technology based on an appropriate pedagogical model to teach a specific content (Koehler et al. 2007). Considering freshman students' limited backgrounds not only in technology but also in pedagogy and content area, they probably did not have a good understanding of what technology integration means as defined in the literature. In addition, freshman students might also be limited in terms of judging their own capabilities on what they could and could not do with technology integration. Thus, we believe that a lack of correlation between SE and Performance for these students may have resulted from their lack of understanding and inexperience of technology integration in education.

The relationship between technology integration SE and OE also deserved attention. Self-efficacy and OE were moderately correlated with each other, suggesting that pre-service teachers' anticipated outcomes from technology integration depended partly on perceptions of their ability to use technology in the classroom (SE). Thus, if a student believed he or she could use integrate technology into his or her teaching, it was more likely that he or she anticipated positive outcomes from using technology in the classroom. This finding was consistent with theoretic predictions based on Bandura's work (1997) and previous research studies that found similar relationships among the two variables (Lent et al. 1991, 1993; Lopez et al. 1997). For example, Lopez et al. (1997) found a moderate correlation between university students' mathematics self-efficacy and their perception of usefulness of mathematics for their future career. It appears OE and SE are related in both mathematics and technology integration contexts. Thus, to the extent that OE depends on SE beliefs, interventions that increase pre-service teachers' technology integration SE may also enhance their OE.

Finally, results for some students highlight the unique contribution of SE on performance above and beyond the effects of previous academic performance and academic ability. Analysis for the upper level group revealed that SE accounted for 8% of the variation when the variance attributable to GPA and ACT was removed. This result indicated that technology integration SE offered useful, nonredundant information that helped predict technology integration performance and supported previous research findings in different contexts, such as engineering (Lent et al. 1984) and mathematics (Lent et al. 1993).

Outcome expectations

Results revealed that OE was positively related to performance of both freshman and upper-level students. More importantly, OE accounted for an impressive amount of variance in predicting technology integration performance even when the variance attributable to traditional predictors (GPA and ACT scores) and SE was removed. These findings contradicted theoretic predictions and previous research that found OE made little or no contribution to predicting performance above and beyond the effects of SE (Lent et al. 1991, 1993). However, findings from this study involving the OE should be interpreted with caution. Although OE correlated with SE, it did not correlate with indicators of past performance or ability (as measured by GPA and ACT scores). Thus, removal of the variance associated with GPA and ACT did not decrease the unique contribution of OE on performance as would be expected using the SCCT. Using other indicators of ability or performance (such as past technology integration performance or ability) that might correlate with technology integration OE may help us better examine the predictive ability of OE on performance in the technology integration context.

Implications

Teacher educators and teacher-education programs have made enormous efforts to better educate pre-service teachers for technology integration (i.e., offering new theoretic approaches like TPCK). Despite these efforts, pre-service teachers still face challenges in their ability to integrate technology into teaching and learning. Therefore, debate in the field about how to better educate pre-service teachers for technology integration remains an important issue. This study contributes to these debates in two ways.

First, results in the present study revealed that there was a discrepancy between freshman students' beliefs about their technology integration capabilities (SE) and how well they perform in a given technology integration task. According to the SCCT, a positive relationship should exist between students' SE and performance if they judged their capabilities accurately. Since freshman students may not yet be able to accurately assess their technology integration competencies, teacher educators need to reconsider when pre-service teachers should be expected to take instructional technology coursework in their teacher education programs.

Second, since technology integration SE is a strong predictor of performance, it would be helpful to look at the sources of SE. As indicated earlier, SE comes from four main sources: (1) mastery experiences, (2) vicarious experiences, (3) verbal persuasion, and (4) physiologic indexes (Bandura 1986). Successful mastery experiences increase SE, unsuccessful ones undermine it. Thus, it is important that the pre-service teachers be involved in technology integration tasks in which they are likely to demonstrate success. Questions such as "Do I have pre-requisite skills to complete this task?", "What do I already know about this task?", "Are there any resources available to help me when I have difficulty finishing the task?" provide pre-service teachers with information about the likelihood of demonstrating success in given tasks. If their self-efficacy is high after answering such questions, they should feel confident about starting the task. If self-efficacy is low, they should seek help, resources, or strategies to make it more likely that they will be able to succeed at the task. In order to increase the pre-service teachers' SE, it would also be helpful to create peer teaching situations in which an expert technology-using pre-service teacher works with one or more pre-service teachers in a given technology integration task. By observing the expert-technology using pre-service teacher (vicarious experiences), pre-service teachers with low SE might increase their SE (e.g. If the other pre-service teacher can do it, I can do it).

References

Abbitt, J., & Klett, M. (2007). Identifying influences on attitudes and self-efficacy beliefs towards technology integration among pre-service educators. *Electronic Journal for the Integration of Technology in Education, 6*, 38–44.

Albion, P. R. (2001). Some factors in the development of self-efficacy beliefs for computer use among teacher education students. *Journal of Technology and Teacher Education, 9*(3), 321–347.

Bandura, A. (1986). *Social foundations of thought and action: A social cognitive theory*. Englewood Cliffs, NJ: Prentice-Hall.

Bandura, A. (1997). *Self-efficacy: The exercise of control*. New York: Freeman.

Bell-Gredler, M. E. (1986). *Learning and instruction: Theory into practice*. New York: Macmillan Publishing.

Britten, J. S., & Cassady, J. C. (2005). The technology assessment instrument: Understanding planned use of technology by classroom teachers. *Computers in the Schools, 22*(3/4), 49–61.

Brown, D., & Warschauer, M. (2006). From the university to the elementary classroom: Students' experiences in learning to integrate technology in instruction. *Journal of Technology and Teacher Education, 14*(3), 599–621.

Campbell, N. J. (1992). Enrollment in computer courses by college students: Computer proficiency, attitudes, and attributions. *Journal of Research on Computing in Education, 25*(1), 60–73.

Cohen, J. (1988). *Statistical power analysis for the behavioral sciences* (2nd ed.). Hillsdale, NJ: Erlbaum.

Compeau, D. R., & Higgins, C. A. (1995). Computer self-efficacy: Development of a measure and initial test. *MIS Quarterly, 19*, 189–211.

Dweck, C. S., & Leggett, E. L. (1988). A social-cognitive approach to motivation and personality. *Psychological Review, 95*(2), 256–273.

Eggen, P., & Kauchak, D. (2004). *Educational psychology. Windows on classrooms (6th ed.)*. Upper Saddle River, NJ: Pearson:Merrill Prentice Hall.

Hackett, N. E., & Betz, N. (1981). A self-efficacy approach to career development of women. *Journal of Vocational Behavior, 18*, 326–339.

Hill, T., Smith, N. D., & Mann, M. F. (1987). Role of efficacy expectations in predicting the decision to use advanced technologies: The case of computers. *Journal of Applied Psychology, 72*, 307–313.

Hinkle, D. E., Wiersma, W., & Jurs, S. G. (2003). *Applied statistics for the behavioral sciences* (5th ed.). Boston: Houghton Mifflin.

International Society for Technology in Education (2000). *National educational technology standards for students: Connecting curriculum and technology*. USA: ISTE.

Karsten, R., & Roth, R. M. (1998). The relationship of computer experience and computer self efficacy to performance in introductory computer literacy courses. *Journal of Research on Computing in Education, 3*(1), 14–25.

Koehler, M. J., Mishra, P., & Yahya, K. (2007). Tracing the development of teacher knowledge in a design seminar: Integrating content, pedagogy, & technology. *Computers & Education, 49*(3), 740–762.

Lent, R. W., Brown, S. D., & Hackett, G. (1994). Toward a unifying social cognitive theory of career and academic interest, choice, and performance. *Journal of Vocational Behavior, 45*, 79–121.

Lent, R. W., Brown, S. D., & Hackett, G. (2002). Social cognitive career theory. In D. Brown (Ed.), *Career choice and development* (pp. 255–311). San Francisco, CA: Jossey Bass.

Lent, R. W., Brown, S. D., & Larkin, K. C. (1984). Relation of self-efficacy expectations to academic achievement and persistence. *Journal of Counseling Psychology, 31*, 356–362.

Lent, R. W., Lopez, F. G., & Bieschke, K. J. (1991). Mathematics self-efficacy: Sources and relation to science-based career choice. *Journal of Counseling Psychology, 38*, 424–430.

Lent, R. W., Lopez, F. G., & Bieschke, K. J. (1993). Predicting mathematics-related choice and success behaviors. Test of an expanded social cognitive model. *Journal of Vocational Behavior, 42*, 223–236.

Liu, L., & Johnson, D. L. (1998). A computer achievement model: Computer attitude and computer achievement. *Computers in the Schools, 14*(3/4), 33–54.

Liu, L., Maddux, C., & Johnson, L. (2004). Computer attitude and achievement: Is time an intermediate variable? *Journal of Technology and Teacher Education, 12*(4), 593–607.

Lopez, F. G., Lent, R. W., Brown, S. D., & Gore, P. A. (1997). Role of social-cognitive expectations in high school students' mathematics-related interest and performance. *Journal of Counseling Psychology, 44*, 44–52.

Multon, K. D., Brown, S. D., & Lent, R. W. (1991). Relation of self-efficacy beliefs to academic outcomes: A meta-analytic investigation. *Journal of Counseling Psychology, 38*, 30–38.

National Center for Education Statistics (NCES). (2000). "Teachers' Tools for the 21st Century." [Online] Available: http://nces.ed.gov/pubs2000/2000102A.pdf.

Niederhauser, D. S., & Perkmen, S. (2008). Validation of intrapersonal technology integration scale. *Computers in the Schools, 25*(1–2), 98–111.

Office of Technology Assessment, U.S. Congress. (1995). *Teachers and technology: Making the connection, (OTA-HER-616)*. Washington, DC: U.S. Government Printing Office.

President's Committee of Advisors on Science and Technology, Panel on Educational Technology. (1997). Report to the President on the Use of Technology to Strengthen K-12 Education in the United States.

Rangel, T., Church, D., Szendre, K., & Reeves, C. (1990). Self-efficacy in relation to occupational consideration and academic performance in high school equivalency students. *Journal of Counseling Psychology, 37*, 407–418.

Schmidt, D. (2007). Comprehensive lesson plan assignment. CI 202 introduction to instructional technology course at Iowa State University.

Schunk, D. H. (2001). *Learning theories: An educational perspective*. Upper Saddle River, NJ: Prentice-Hall/Merrill.

Shell, D. F., Colvin, C., & Burning, R. H. (1995). Self-efficacy, attributions and outcomes expectancy mechanism in reading and writing achievement: Grade level and achievement-level difference. *Journal of Educational Psychology, 87*, 386–398.

Shell, D. F., Murphy, C. C., & Bruning, R. H. (1989). Self-efficacy and outcome expectancy mechanisms in reading and writing achievement. *Journal of Educational Psychology, 8*(1), 91–100.

Siegel, R. G., Galassi, J. P., & Ware, W. B. (1985). A comparison of two models for predicting mathematics performance: Social learning versus math aptitude anxiety. *Journal of Counseling Psychology, 32*(4), 531–548.

Smith, S. M. (2002). The role of social cognitive career theory in information technology-based academic performance. *Information Technology, Learning and Performance Journal, 20*(2), 1–10.
Stevens, J. (1986). *Applied multivariate statistics for the social sciences*. Hillsdale, NJ: Lawrence Erlbaum Associates.
Stevens, C., & Lonberger, R. (1998). *Using technology in instruction: Supporting teacher education faculty development*. ERIC Document (ED4211311).
Thompson, A. D., Schmidt, D. A., & Davis, N. E. (2003). Technology collaboratives for simultaneous renewal in teacher education. *Educational Technology Research and Development (ETR&D), 51*(1), 73–89.
Volet, S. E., & Styles, I. M. (1992). Predictions of study management and performance on a first year computer course: the significance of students' study goals and perceptions. *Journal of Educational Computing Research, 15*(2), 423–449.
Wang, L., Ertmer, P. A., & Newby, T. J. (2004). Increasing preservice teachers' beliefs for technology integration. *Journal of Research on Computing in Education, 36*(3), 231–250.
Wetzel, K., & Williams, M. K. (2004). Changing teacher education faculty: Mission possible. *Journal of Computing in Teacher Education, 21*(2), 45–49.
Willis, E. M., & Montes, L. (2002). Does requiring a technology course in preservice teacher education affect student teacher's technology use in the classroom? *Journal of Computing in Teacher Education, 18*(3), 76–80.
Wilson, E. (2003). Pre-service secondary social studies teachers and technology integration: What do they think and do in their field experiences? *Journal of Computing in Teacher Education, 20*(1), 29–39.
Yildirim, I. S. (2000). Effects of an educational computing course on preservice and inservice teachers. *Journal of Research on Computing in Education, 32*, 479–495.
Zhang, Y., & Espinoza, S. (1998). Relationships among computer self-efficacy, attitudes toward computers, and desirability of learning computing skills. *Journal of Research on Computing in Education, 30*(4), 420–435.
Zimmerman, B. J., Bandura, A., & Martinez-Pons, M. (1992). Self-motivation for academic attainment: The role of self-efficacy beliefs and personal goal-setting. *American Educational Research Journal, 29*, 663–676.