Factors that influence pre-service teachers' technology integration performance

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Factors that influence pre-service teachers’ technology integration performance

by

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# TABLE OF CONTENTS

LIST OF TABLES................................................................................................................................................ iv
LIST OF FIGURES .............................................................................................................................................. v
ABSTRACT ........................................................................................................................................................... vi
CHAPTER 1. INTRODUCTION ......................................................................................................................... 1
CHAPTER 2. LITERATURE REVIEW .............................................................................................................. 6
   Part I: Technology (Curriculum) Integration ................................................................................................... 6
       Definition of Technology (Curriculum) Integration ................................................................................... 7
       Technology Integration from Behaviorist Perspective ............................................................................... 9
       Technology Integration from Constructivist Perspective ........................................................................... 12
       Technology Integration Models .................................................................................................................. 15
       Technology Integration Assessment ........................................................................................................... 20
       Teacher Preparation and Technology Integration ....................................................................................... 22
   Part II: Theoretical Framework – Social Cognitive Career Theory .......................................................... 25
       Self-Efficacy ............................................................................................................................................... 27
       Research Studies on the Relationship between Self-efficacy and Performance ........................................ 28
       Self-efficacy in Technology Literature ...................................................................................................... 30
       Outcome Expectations .............................................................................................................................. 33
       Research Studies on the Relationship Between Outcome Expectations and Performance .................... 37
       Outcome Expectations in Technology Literature ..................................................................................... 38
       Goal ............................................................................................................................................................ 44
       Research Studies on the Relationship between Goal and Performance ................................................. 46
       Goal in Technology Literature ................................................................................................................. 47
CHAPTER 3. METHOD ...................................................................................................................................... 49
   Context ............................................................................................................................................................ 49
   Participants ...................................................................................................................................................... 49
   Research Instruments ....................................................................................................................................... 50
       Comprehensive Lesson Plan Assignment ................................................................................................... 50
       Technology Integration Assessment Instrument ........................................................................................... 51
       Intrapersonal Technology Integration Scale ............................................................................................... 55
       Self-efficacy for Technology Integration Scale ........................................................................................ 55
       Technology Integration Outcome Expectations Scale ............................................................................. 56
       Technology Integration Performance Goals Scale ................................................................................... 59
   Procedure ......................................................................................................................................................... 59
   Summary of the Analysis ............................................................................................................................... 60
CHAPTER 4. RESULTS ...................................................................................................................................... 62
   Technology Integration Performance Assessment ........................................................................................... 62
   Validity and Psychometric Properties of Questionnaire .............................................................................. 63
   Testing the Predictions of SCCT Performance Model .................................................................................. 65
CHAPTER 5. DISCUSSION ...................................................................................................................................... 73

Instruments .......................................................................................................................................................... 73
  Technology Integration Assessment Instrument .............................................................................................. 73
  Intrapersonal Technology Integration Scale ................................................................................................. 74
Hypotheses Testing ............................................................................................................................................... 75
Implications ......................................................................................................................................................... 77

REFERENCES ....................................................................................................................................................... 80

APPENDIX A: COMPREHENSIVE LESSON PLAN ASSIGNMENT ...................................................................... 92

APPENDIX B: ORIGINIAL VERSION OF THE TIAI ............................................................................................ 96

APPENDIX C: MODIFIED VERSION OF TIAI ...................................................................................................... 98

APPENDIX D: TECHNOLOGY INTEGRATION FOR SELF-EFFICACY SCALE ..................................................... 100

APPENDIX E: TECHNOLOGY INTEGRATION OUTCOME EXPECTATIONS SCALE ........................................... 102

APPENDIX F: TECHNOLOGY INTEGRATION PERFORMANCE GOALS SCALE .............................................. 102

APPENDIX G: FACTOR LOADINGS ................................................................................................................ 103
LIST OF TABLES

Table 2.1: Example from Instruments Measuring Perceived Usefulness ............................................................. 40
Table 4.1: Descriptive Statistics for the Dependent Variable ................................................................................ 63
Table 4.2: Description of the Predictor Variables ................................................................................................ 65
Table 4.3: Correlations among Variables ............................................................................................................. 66
Table 4.4: Grade Level as a Moderator Variable between Self-Efficacy and Performance ................................. 69
Table 4.5: Correlations among Variables by Grade Level .................................................................................... 70
Table 4.6: Forced-order Hierarchical Regression Predicting Performance .......................................................... 72
LIST OF FIGURES

Figure 1.1. Social Cognitive Career Theory Performance Model ................................................................. 4
Figure 2.1. Relationships among Content, Pedagogical and Technological Knowledge .............................. 16
Figure 2.2. Information Technology Integration Model .................................................................................. 17
Figure 2.3. The Three-Dimensional ITD Technology Integration System ................................................... 18
Figure 2.4. Social Cognitive Career Theory Performance Model ................................................................. 26
Figure 2.5. The Effects of Self-Efficacy and Outcome Expectations on Behavior ........................................ 37
Figure 3.1. SCCT Performance Model ......................................................................................................... 60
Figure 4.1. Relationship between Self-efficacy and Performance by Grade Level ........................................ 67
Figure 4.2. Relationship between Self-Efficacy and Performance for Freshman Group ............................ 68
Figure 4.3. Relationship between Self-Efficacy and Performance for Upper Level Group ....................... 68
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 they may jointly function to predict technology integration performance. Social Cognitive Career Theory (SCCT) served as the theoretical 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.
CHAPTER 1: INTRODUCTION

Investments on information technologies in US schools have increased dramatically in the last two decades (President’s Committee of Advisors on Science and Technology, 1997). A National Center for Educational Statistics (NCES) report (2003) indicated that 99% of public schools had Internet access and the ratio of students to instructional computers with Internet access was 4.8:1. However, seventy percent of teachers reported that they did not feel prepared to use computers and the Internet in their teaching (NCES, 2000). This finding has been also supported by more recent reports (Brown & Warscher, 2006; Willis & Montes, 2002).

Many efforts have been made to ensure that pre-service and in-service teachers will be adequately prepared for integrating technology into their future classroom. The International Society for Technology in Education (ISTE), in collaboration with the National Council for Accreditation of Teacher Education (NCATE), developed educational technology standards in support of pre-service teacher preparation programs. These standards define the essential concepts, knowledge, skills, and attitudes for using technology in educational settings. The Preparing Tomorrow’s Teachers to Use Technology (PT3) grant program was another example of efforts to improve technology integration among in-service and pre-service teachers. PT3 was an initiative of the U. S. Department of Education aimed at improving teacher preparation programs by concentrating on the preparation of pre-service teachers to more effectively integrate technology into their classroom practices.

Pre-service teacher preparation programs also play a critical role in preparing pre-service teachers for technology integration (Wilson, 2003). These programs should increase pre-service teachers’ ability to integrate technology into teaching in order to prepare them for
tomorrow’s classrooms. Many teacher education institutions offer an introductory instructional technology course 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 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 & Warscher, 2006; Willis & Montes, 2002). Therefore, it is useful to examine factors that influence pre-service teachers technology integration ability (or performance) in such courses.

There is substantial evidence that intrapersonal factors including self-efficacy (Karsten & Roth, 1998), outcome expectations (Liu & Johnson, 1998; Liu, Maddux, & Johnson, 2004) and goal setting (Volet & Styles, 1992) play an important role in pre-service teachers’ technology-related performance in instructional technology courses. However, to date, researchers have investigated these factors in isolation, concentrated on pre-service teachers’ basic computer abilities (not technology integration abilities), and rarely grounded their studies in a theoretical framework (e.g. Karsten & Roth, 1998). Examining the interactions among these factors within a meaningful theoretical framework may help us develop a better understanding of how these factors affect pre-service teachers’ technology integration performance.

Social Cognitive Career Theory (SCCT)

The Performance Model within Social Cognitive Career Theory (SCCT) (Lent, Brown & Hackett, 1994) provides a theoretical framework that can help teacher educators understand the role of these factors in pre-service teachers’ technology integration performance. The present
study was undertaken to uncover interrelationships among key factors associated with the SCCT, including self-efficacy (SE), outcome expectations (OE), and performance goal setting (PG) relative to pre-service teachers’ technology integration performance.

Principally rooted in Social Cognitive Theory (Bandura, 1986), Lent and his colleagues (1994) developed Social Cognitive Career Theory (SCCT) to explain and predict academic and career related behavior. The Performance Model is one of the three models in SCCT. It deals with two fundamental dimensions of performance: level of achieved success or ability and level of persistence in spite of difficulties. According to this theory, past performance, SE, OE, and PG are interrelated and each play an important and complex role in individual academic or career performance. For example, past performance influences people’s SE and OE beliefs. These beliefs, in turn, influence PG. These result in performance level.

Figure 1.1 shows the SCCT Performance Model (Lent et al., 1994). This model hypothesizes that past performance affects performance directly and indirectly through its effects on SE and OE. Moreover, both SE and OE influence performance goals, which then leads 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 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 iterately repeats itself.
In the context of this study, *self-efficacy* refers to pre-service teachers’ perception of their ability 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 student 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 person 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.

Research Questions

The purpose of this study is to explore interrelationships among factors that influence pre-service teachers’ technology integration performance. Based on the SCCT Performance Model, one would predict that SE, OE, PG are interrelated and influence technology integration performance and that SE and OE may make unique contributions to predicting performance above and beyond the effects of previous performance and academic ability. Two research questions helped address the purpose of the study. First, to determine the degree to which SCCT variables (SE, OE, and PG) and technology integration performance are interrelated, the question below was addressed:

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

Second, to examine the predictive utility of SE and OE on technology integration performance, the question below was addressed:

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)?
CHAPTER 2: LITERATURE REVIEW

This chapter is intended to provide insights about the key concepts, theoretical framework, and related literature on the technology integration (Part I) and Social Cognitive Career Theory (Part II). Therefore, the literature review, first of all, begins with a definition of the concept of technology integration in Part I and proceeds with technology integration from different perspectives, technology integration models, technology integration assessment, and teacher preparation and technology integration.

In Part II, details are provided about the principals of Social Cognitive Career Theory as the theoretical framework of this study and major constructs (i.e. Self-efficacy, outcome expectations) of the theory. The main emphasis in this part is a discussion of how self-efficacy, outcome expectations, and goals influence individuals’ academic and career related behaviors. In addition, the relationships between these concepts with performance are also discussed separately. Moreover, because of the context in which this study was intended to be carried out, the role of self-efficacy, outcome expectations, and goals in performance in technology related studies, specifically, are provided.

Part I: Technology (Curriculum) Integration

Although the use of technology in education has a considerably long history, confusion among educators about the role of technology has existed (Ertmer, 1999). To help students in their learning process, different technology uses within the various teaching and learning philosophies have been developed and implemented in schools (i.e., drill practice applications, integrated learning systems). However, as critics have pointed out, the expected changes in education have not taken place yet (Cuban, 2001) due to several internal (i.e. teachers’ attitude
toward computers) and external (i.e. lack of equipment) factors (Ertmer, 1999). Among those efforts to address some of these issues and find out how to utilize technology in education meaningfully and effectively, two main views on technology use have emerged as the main discussions in the technology related literature. Therefore, this section, as mentioned above, begins with the definition of the technology integration and proceeds with discussions on these two main views.

*Definition of Technology (Curriculum) Integration*

Over time, The International Society for Technology in Education (ISTE), among others, have provided a clear and comprehensive definition of technology integration. My definition of technology integration 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 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.

Technology has been integrated into teaching in U.S. schools using two approaches. Early approaches focused on using the technology as a *tutor* to teach students basic skills. Drill and practice was the most common use of computers from this approach. The computer would display a stimulus such as a math question, and the student would choose an answer. Then, the computer would provide some type of feedback, indicating the correctness of the answer. This approach was called *learning from technology* (Jonassen, Peck, & Wilson, 1999). Later approaches to integrating technology into teaching concentrated on using the technology as a *tool* to help students when they construct knowledge. This approach was called *learning with technology* (Jonassen, Peck, & Wilson, 1999). The technology in this approach is utilized as “engagers and facilitators of thinking and knowledge construction” (Jonassen, Howland, Moore, & Marra, 2003, p. 12).

Research has indicated that teachers’ pedagogical styles and beliefs about learning exert powerful influence on the way they use technology in the classroom (Judson, 2006; Niederhauser & Stoddart, 2001):

A teacher who firmly believes the best way for students to learn content is through informative teacher-delivered lectures will give little consideration to the idea of using technology as a means for student exploration. Likewise, it appears logical that a teacher who firmly believes in exploratory learning is not going to be an advocate for drill and practice software. (Judson, 2006, p. 582)
Niederhauser and Stoddart (2001) examined relationships between teachers’ instructional practices and their use of technology in instruction and found that teachers’ perspectives about effective computer-based pedagogy are associated with the types of software that they utilize with their students. Teachers who only used open-ended software had the strongest learner-centered perspectives and the weakest computer-directed perspectives. Teachers who utilized only skill-based (e.g. drill and practice) software had the strongest computer-directed and lowest learner-centered perspectives. Teachers who used both types of software fell somewhere in between the other two groups.

In sum, among efforts to define technology integration and how technology can be used in the classroom, two main views on technology integration have emerged. Early views were grounded on the behaviorist learning theories (drill and practice approach) and focused on using technology as a tutor to teach students basic skills. Later views were based on constructivist learning theories and focused on using technology to help students construct their knowledge. The following two sections address these two views of technology use.

*Technology Integration from a Behaviorist Perspective*

Behaviorism is a view of learning that accounts for behavior in terms of environmental events (e.g. reinforcement, physical conditions) (Schunk, 2001). This view holds that behavior can be shaped by changing the environment. In other words, behavior takes place as a function of a changing environment (B= f (E)). The behaviorist view concentrates on performance rather than the reasons learners act in a particular way (Von Glasersfeld, 1995), and it sees the mind as a blank slate in the sense that responses to stimulus can be observed, completely discarding mental states taking place in the mind.
Learning in this perspective is defined as the formation of associations between stimuli and responses (Bell-Gredler, 1986). The behaviorist learning view places heavy emphasis on behavioral consequence: behavior followed by satisfying outcomes (e.g. reward) strengthens the association between stimulus and response, whereas behavior followed by unpleasant outcomes (e.g. punishment) weakens the association (Thorndike, 1911). The cornerstone of this view is that the strengthening of behavior springs from reinforcement. If a pigeon, for example, is rewarded with food for key pecking, then the key-pecking response frequency will increase (Bell-Gredler, 1986).

The behaviorist perspective defines the role of teacher, student, and technology. The teacher’s role is to arrange contingencies of reinforcement to increase the probability that the student will acquire the desired behavior. The role of the student is to receive awards or punishment based on their performance. Technology serves as a tool to provide “skill and drill” exercises that allow students to master basic skills and receive feedback based on their performance (Mayer, 2003).

Using technology in education from this perspective can be traced back to Pressey’s (1926) classic teaching machine. His machine was designed to provide drill and practice problems in a random order for students in his introductory courses. This machine looked like a typewriter carriage that revealed a question with four possible answers. The user was asked to make a choice among the four possible answers by pressing a numbered key. If the user made the correct choice, the machine revealed the next question; if not, the user pressed another key. This process continued until the user gave the correct response. According to Skinner (1968), Pressey
appears to have been the first theorist to stress the importance of giving students immediate feedback and came up with a mechanism in which each student could progress at their own rate.

Skinner (1968) created several teaching machines based on Pressey’s machine, but differed in three main aspects. First, Skinner incorporated instruction. Second, in Skinner’s teaching machines, the student composed his/her response instead of choosing it from a set of possible options because Skinner believed that he/she should recall, not simply recognize responses. Third, Skinner’s machine presented information in a carefully designed order.

The basic mechanism behind Skinner’s machine is that materials were presented in small frames. Learners answered a question in each frame and received immediate feedback on the accuracy of their answer. They were allowed to go to the next frame if they gave the correct answer. If not, they were provided with supplementary material. In this way, learners were allowed to proceed through the instruction at their own pace. The use of teaching machines in education did not last long because of the poorly designed materials and clumsiness of the machines (Bell-Gredler, 1986).

Advances in the microcomputer created an occasion to implement the principles of behaviorist learning in the form of Computer Assisted Instruction (CAI). In CAI the computer functions as a tutor to present specific skills and knowledge, reinforce concepts, and allow students to practice what they learn and receive immediate feedback (Center for Educational Research and Innovation, 1989). Computer Assisted Instruction was predominantly utilized with drill and practice activities in basic skill areas, and such activities provide exercises in which the student masters skills that were previously learned. In a typical drill and practice software, a question appears as a stimulus on the computer screen (e.g. 5+8=___), the student types in the
answer and then receives feedback. The feedback for the correct answer might be “Great Job! You gave the correct answer,” whereas the feedback for the wrong answer might be “Try Again!”

Much CAI software has been organized in network-based systems called “Integrated Learning System” (ILS). The ILS is an appropriate environment for skill-based learning. In an ILS, the student has an individualized program and progresses through sequential levels of difficulty to learn a concept. Moreover, the ILS provide students with diagnostic data through pre-tests, instruction on the basis of diagnostic data, and continuous monitoring of students’ progress with adjustments in instruction when necessary (Norton & Sprauge, 2001).

Although the technology use from the behaviorist perspective is still of interest to some, it has been criticized for not putting enough emphasis on meaning and understanding and failing to deal with the issue of transfer (Mayer, 2003). The shortcomings of behaviorist-based technology integration resulted in the development of different perspectives on integrating technology in the classroom.

*Technology Integration from the Constructivist Perspective*

The cornerstone of the constructivist learning view is that learners actively create their own knowledge through interpretation of their experiences rather than passively receiving it in the way presented to them. In other words, knowledge is experience taking place through continuous interaction between the learner and environment (Jonasssen, 1991). It is not a thing but a process (Piaget, 1980 as Cited in Bell-Gradler, 1986, p.105). It is also not a “stimulus-response phenomenon. It requires self-regulation and building of conceptual structures through
reflection and abstraction” (Von Glasersfeld, 1995, p. 4). There are different types of constructivism, four of which are cognitive, critical, radical, and social. Although differing in some respects, they share the common belief that learners create their knowledge through participation in certain experiences.

Learners, according to the constructivist perspective, go through a process called “sense making.” This process consists of three parts: (a) paying attention to incoming information; (b) mentally organizing it into a coherent structure; and (c) integrating it with prior knowledge (Mayer, 2003). This “sense making” process leads to an in-depth understanding of the material, and the result is a student with both “conceptual knowledge… and strategic knowledge of how to plan and monitor problem solutions” (Mayer, 2003, p. 143).

Classroom activities are structured in a way that learners are assigned authentic tasks which enable them to develop higher order thinking skills such as problem solving, interpretation, and analysis. Assessment of student learning focuses on understanding which involves more than retention and recall of isolated facts and skills. It should be assessed by discovering the students’ ability to transfer the knowledge and skills they have acquired to other situations. This type of assessment involves the use of “higher mental processes that … enable students to apply their knowledge” (Mayer, 2003. p. 128).

The constructive perspective assigns new roles to teachers, students, and technology. The teacher role in this view is to provide students with authentic tasks in which they learn and practice skills in context. The students’ role is to actively engage in the learning process and
make sense of the material. Technology assumes the role of a tool with which to learn (Jonassen, Peck & Wilson, 1999).

The use of technology in this perspective means utilizing technological applications, such as word processing, spreadsheets, databases, and multimedia products to enhance learning. Mindtools (Jonassen, 1996) and multimedia environments (Cognition and Technology Group at Vanderbilt, 1996) are two examples of how technology can be used from this perspective. Mindtools enable learners to organize and interpret their existing knowledge through the use of computer applications such as databases, spreadsheets, and concept mapping. For example, databases help systematically organize subject matter, spreadsheets help students analyze numerical data, especially when answering “what if” questions, and concept maps help students organize information in a visually appealing way that enables them to see the connection between concepts.

Multimedia applications are another example of using technology a tool in instruction. For example, the Adventures of Jasper Woodbury is a video-based multimedia application aimed at promoting reasoning and problem-solving. Each adventure is a 15-20 minute story, which provides a natural context for learning mathematics, history, and science. Each story ends with a problem that the major character faces, and students in the classroom must solve the problem before they are allowed to see how the movie character solved the problem. Data necessary to solve the problem is found within the story itself. (Cognition and Technology Group at Vanderbilt, 1996).
Although learning theories like constructivism and behaviorism provide frameworks for how technology can be used in education, they do not specifically concentrate on what true technology integration is and how it looks like. Several researchers (i.e. Mishra & Koehler, 2006) came up with different technology integration models to address this issue. Of the models, Technological-Pedagogical-Content Knowledge Model has received a great deal of attention by many researchers and educators.

Technology Integration Models

Three theoretical models regarding technology integration which are typically cited in technology integration research are Technological-Pedagogical-Content Knowledge (Mishra & Koehler, 2006; Pierson, 2001), the Information Technology Integration Model (Johnson & Liu, 2000), and the Information Technology Integration Design Model (Liu & Velasquez-Bryant, 2003). Teachers must have content knowledge and pedagogical knowledge, the intersection of which is described as pedagogical-content knowledge, or knowledge about learners, curriculum, and the most effective and efficient way to represent the specific subject being taught. After investigating how teachers at various levels of technology skills and teaching abilities employed technology and how technology use was associated with teaching practice, another component to the model, technological knowledge, was suggested (Pierson, 2001). This knowledge would not only include basic technology skills, but also requires an understanding of the unique features of specific types of technologies that would lend themselves to particular aspects of the learning process. A teacher who effectively integrates technology into classroom activities should possess content and pedagogical knowledge, in combination with technological knowledge. The intersection of the three knowledge areas, or technological-pedagogical-content knowledge,
would define true and effective technology integration (Pierson, 2001). Figure 2.1 shows the possible relationships among types of teacher knowledge.

Figure 2.1. Relationships among content, pedagogical and technological knowledge

Johnson and Liu’s Information Technology Integration Model (2000) is built on a meta-analysis of 102 case studies relating to integrating information technology into the classroom. The purpose of their research was to come up with a statistical model that would reflect the important components present in successful case studies. They initially found six instructional components common to all 102 case studies: (1) use of software, (2) use of Web-based instruction, (3) use of Web information resources, (4) use of problem-based learning, (5) instructional design choice, and (6) tailoring multimedia courseware. After running logistic
regression, Johnson and Liu determined that the best model (i.e., the best set of variables) for predicting the success of technology integration was a model that included variables of use of software, use of problem-based learning, and instructional design choice. Based on their analysis, it was indicated that the chances for successful integration are increased when (1) type II software (software that supports learner-centered pedagogy) is utilized, (2) problem-based assignments are given, and (3) constructivist learning environments are established (see Figure 2.2).

![Figure 2.2. Information Technology Integration Model (Johnson & Liu, 2000)]
The Information Technology Integration Design Model (Liu & Velasquez-Bryant, 2003) consists of a three-dimensional ITD (Information, Technology, and Instructional Design) information technology integration system. As shown in Figure 2.3, each dimension points in a different direction and possesses different functions, emphases, and issues that influence learning. According to this model, technology-based learning takes place as a function of the integration of all of these three dimensions.

![Figure 2.3. The Three-Dimensional ITD Technology Integration System](image)

The first dimension—*information (I)*—represents the teaching or learning content and any supporting resources and materials and requires a number of decisions to be made about content to identify (a) the type of content, facts, and concepts; (b) the presentation of the content according to levels of difficulty; and (c) the scope and sequence of the content in a lesson unit.
The second dimension—technology ($T$)—represents the hardware and software tools that can be utilized to enhance learning and teaching and requires a number of decisions to be made as to (a) what hardware and software to use; (b) how to utilize a particular technology to enhance learning in specific areas; and (c) how to use a particular technology in different learning situations and with students of differing needs and learning styles. The third dimension—*instructional design* ($D$)—deals with a set of rules for instructional design and includes four major phases: (1) planning integration; (2) designing integration; (3) implementing integration; and (4) assessing integration.

The underlying theoretical basis for this model is that of instructional design. Phase one (planning integration) identifies the needs and analyzes learning objectives and available technology tools. Phase two (designing integration) determines the strategies for lessons, methods of delivery, and assessment plans. Phase three (implementing integration) implements the design of learning and instruction, which generates learning outcomes. Phase four (assessing integration) measures the procedure and outcomes and makes suggestions for revising plans and designs.

Since assessment is an important part of technology integration, several researchers have designed instruments to assess how teachers integrate technology into teaching and their competency levels for technology integration. The next section addresses educators’ efforts to create such instruments.
Technology Integration Assessment

Many researchers (i.e. Proctor, Watson, Finger, Grimbeek, & Burnett, 2007) have measured teachers’ educational competencies for using technology in the classroom through self-report surveys. In the self-report surveys, teachers indicate perceptions about their technological skills or frequency of using technology applications in the classroom. For example, Fleming, Motemadi, and May (2007) measured teachers’ educational competencies on several computer applications (e.g. word processing, video production, database, spreadsheet) on a 4-point Likert scale (1-no knowledge of the topic, 2-minimal skills and proficiency, 3-moderate skill, 4-proficiency and ability to teach). In another instrument called “ICT (Information and Communication Technology) Curriculum Integration Performance” (Proctor, Watson, Finger, Grimbeek, & Burnett, 2007), teachers’ educational technology was assessed through 45 items, all of which started with the stem “In my class students’ use ICTs to….” followed by sentences such as “… actively construct their own knowledge in collaboration with their peers and others” and “… demonstrate what they have learned.” Using a four-point scale (1-never, 2-sometimes, 3-often, 4-very often), teachers were asked to indicate the current frequency of student use of ICT for each of the 45 items and their preferred of use of technology.

Although self-report surveys reflect teachers’ technology integration competencies to a certain degree, the basic problem with these surveys is that teachers may either underestimate or overestimate their competency, failing to accurately capture their level of competencies.

Realizing this, a number of researchers have conducted studies in regard to the actual development of a performance assessment instrument to measure teachers’ educational technology competencies. An example of a performance-based instrument was created by
Researchers at the University of Connecticut, based on the ISTE standards and Connecticut Teacher Technology Competencies (Holcomb, Brown, Kulokowich & Jordan, 2004). This instrument was designed to measure the extent to which teachers possess educational technology competencies and consists of three levels. Level 1 competencies focused on basic computer skills involving the use of a microcomputer system as well as productivity tool such as Microsoft Word and Excel. Level 2 competencies concentrated on pedagogical issues related to application of educational technologies and required educators to come together through an asynchronous discussion system to show their ability to plan and design technology-based learning environments to facilitate student learning. Level 3 competencies centered on teachers’ ability to integrate technology in the classroom, social and ethical issues related to use of technology, and the influence that technology has on student productivity.

Researchers at Bowling Green State University made another attempt to create a performance assessment instrument to measure pre-service teachers’ educational technology competencies (Vannatta, Ross & Banister, 2006). Based on ISTE standards, this instrument focused on basic computer skills and pre-service teachers’ ability to use a number of productivity software products including Word, Excel, and PowerPoint. Pre-service teachers were shown three digital products and given set of instructions to replicate them in a 90-minute lab session in this instrument. While this instrument has value in measuring pre-service teachers’ computer competencies, it mainly focuses on measuring basic computer skills, not technology integration skills.

Realizing the limitations of self-report surveys and other performance-based instruments, Britten and Cassady (2005) created the Technology Integration Assessment Instrument (TIAI).
This instrument was designed to measure teachers’ skills in integrating Type II uses of computers into their lesson plans. The basic rationale for creating this instrument was that “the lesson plans maintain higher degree of validity in response than self-report instruments…The use of lesson plans as an evaluative data set provides a greater level of contextual validity in the analyses” (Britten & Cassady, 2005, p. 52). The TIAI provides for ratings across seven dimensions of a lesson plan, with four levels of categorization within each dimension. The researcher decided to use this instrument in this study because it provides an authentic way of measuring pre-service teachers’ performance in technology integration. Further information about this instrument is provided in chapter 3.

*Teacher Preparation and Technology Integration*

A large body of literature supports the idea that technology training is the most important factor that could help teachers develop necessary technical and pedagogical skills in technology integration. (i.e. NCES, 2000; Yildirim, 2000). Recognizing teacher development needs, many efforts have been made to ensure that pre-service teachers will be ready to integrate technology into teaching.

The International Society for Technology in Education (ISTE), in collaboration with the National Council for Accreditation of Teacher Education (NCATE), developed educational technology standards in support of pre-service teacher preparation programs. These standards, which define the essential concepts, knowledge, skills, and attitudes for using technology in educational settings, are divided into six categories:
(1) *Technology Operations and Concepts*: Teachers demonstrate a sound understanding of technology operations and concepts. (2) *Planning and Designing Learning Environments and Experiences*: Teachers plan and design effective learning environments and experiences supported by technology. (3) *Teaching, Learning and Curriculum*: Teachers implement curriculum plans that include methods and strategies for applying technology to maximize student learning. (4) *Assessment and Evaluation*: Teachers apply technology to facilitate a variety of effective assessment and evaluation strategies. (5) *Productivity and Professional Practice*: Teachers use technology to enhance their productivity and professional practice. (6) *Social, Ethical, Legal, and Human Issues*: Teachers understand the social, ethical, legal, and human issues surrounding the use of technology in PK-12 schools and apply those principles in practice (ISTE, 2000, p. 9).

The Preparing Tomorrow’s Teachers to Use Technology (PT3) grant program was another example of collaborative efforts to improve technology integration among in-service and pre-service teachers. PT3 is an initiative of the U.S. Department of Education aimed at improving teacher preparation programs by concentrating on the preparation of pre-service educators to more effectively integrate technology into their classroom practices.

Pre-service teacher preparation programs also play an important role in the pursuit of successful technology integration (Wilson, 2003). These programs should increase pre-service teachers’ ability to integrate technology into teaching in order to prepare them for tomorrows’ classrooms. Many teacher education institutions offer an introductory instructional technology course 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 teach how to integrate these programs to teaching (Yildirim, 2000).

Since the main goal of introductory instructional technology courses is to increase pre-service teachers’ ability to integrate technology into their future classroom activities, it is useful to examine factors that influence their technology integration ability (as measured by their performance) in such courses. Previous research (Liu & Johnson, 1998; Liu, Maddux, & Johnson, 2004) have suggested that internal factors such as beliefs (e.g. self-efficacy, outcome expectations) and goal setting play an important role in pre-service teachers’ computer or technology integration performance. However, researchers have investigated these factors in isolation and rarely grounded their studies in a theoretical framework. Examining the interactions among these variables within a meaningful theoretical framework may help us develop a better understanding of the role of these factors in pre-service teachers’ technology integration performance in introductory instructional technology courses.

Social Cognitive Career Theory (SCCT) (Lent, Brown, & Hackett, 1994) appears to be a theoretical framework that can help with understanding the role of these factors in pre-service teachers’ technology integration ability or performance. The present study was conducted to shed light on interrelationships among key factors regarding the SCCT including SE, OE, and PG that might influence pre-service teachers’ technology integration performance.
Part II: Theoretical Framework – Social Cognitive Career Theory

The principles of Social Cognitive Theory (Bandura, 1986) have been applied in vocational psychology to examine how people’s career interests develop, how they make career choices, and how they determine their academic/career performance. Hackett and Betz (1981) were first to investigate the role of SE on career choice. They suggested that SE might play an important role in women’s traditional career choices and the restricted range of their career options. This work resulted in investigations of the role of SE on a variety of career-related behaviors.

Social Cognitive Career Theory used SE as the main construct to explain and predict 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. This study used the performance model of SCCT as a theoretical framework to address the research questions listed in chapter 1.

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. Figure 2.4 shows performance attainment level as being influenced, in part, by one’s performance goals. Consistent with Bandura’s (1986) prediction, self-efficacy exerts a direct influence on performance as well as indirect influences through outcome expectations and performance goals. The relationship of outcome expectations is fully mediated by performance goals. In addition, ability is seen as influencing performance through two primary paths: (1)
directly, in the form of (more or less) developed mastery skills; and (2) indirectly via self-efficacy and outcome expectations.

*Figure 2.4. SCCT Performance Model*

The present study tests the hypotheses associated with this model. If hypotheses are supported, it will contribute to our understanding of the role of these variables in pre-service teachers’ technology integration performance. Also, if the effects of SE and OE were found to contribute to technology integration performance, it would suggest an important reason creating educational interventions designed to improve pre-service teachers’ technology integration SE and OE.
Self-efficacy (SE)

Self-efficacy is considered as the key factor in predicting and explaining academic and career related behavior in the Social Cognitive Career Theory. It 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). 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. SE is seen as the most powerful arbiter in human agency and explains why people’s behavior differs even though they have similar ability, and knowledge:

- Efficacy beliefs operate as a key factor in a generative system of human competence.
- Hence, different people with similar skills, or the same person under different circumstances, may perform poorly, adequately, or extraordinarily, depending on fluctuations in their beliefs of personal efficacy. (Bandura, 1997, p. 37).

SE beliefs come from four main sources: (1) mastery experiences, (2) vicarious experiences, (3) verbal persuasion, and (4) physiological 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
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).

SE is an important mechanism in human agency because it appears to motivate people
to increase their competence. Those who judge themselves inept may avoid engaging in
tasks, whereas those with high SE may participate more enthusiastically (Schunk, 2001). High
SE helps to create serenity when dealing with challenging tasks and activities (Pajares, 1996). As
a result of these influences, SE is a powerful predictor of the level of performance that people
attain. For these reasons, it was suggested that “beliefs of personal efficacy constitute the key
factor of human agency” (Bandura, 1997, p. 3).

Research Studies on the Relationship between SE and Performance

The relationship of SE to performance has been examined in several domains, such as
mathematics (Lent, Lopez, & Biseschke, 1993), reading (Shell, Murphy, & Bruning, 1989) and
information technology (Smith, 2002). It was found that, in general, SE was moderately related
to academic performance. In a meta-analysis that examined 36 studies conducted between 1977 and 1988 on the relationship between SE and academic performance or persistence, researchers found that SE was related to academic performance \( (r = .38) \) and it accounted for about 14% variation in academic performance (Multon, Brown, & Lent, 1991).

Several research studies were conducted to examine whether SE makes a unique contribution to predicting academic performance when the influence of ability was controlled (e.g., Lent, Lopez, & Bieschke, 1993; Rangel, Church, Szendre, & Reeves, 1990). For example, one study found a moderate positive relationship between SE for subject matter areas and performance in those areas for high school equivalency program students \( (r = .41) \) (Rangel, Church, Szendre, & Reeves, 1990). The correlation was still found to be significant after the effect of ability was partialed out (partial \( r = .28, p < .01 \)). Another study found that SE accounted for significant additional variance in performance above and beyond the effects of ability \( (R^2 \text{ change} = .08, p < .01) \) in a hierarchical regression model predicting performance of introductory psychology course students (Lent, Lopez, & Bieschke, 1993). Thus, it appears from these studies that SE makes a contribution to predicting performance above and beyond the effects of ability.

Another line of research focused on whether SE had a direct effect influence on performance when it was used with the combination of other variables (e.g. Pajares & Johnson, 1996; Pajares & Valiante, 1997). One path analytical study found that SE had a direct influence on students’ writing academic performance (beta = .395) after controlling for the effect of gender, and writing aptitude (Pajares & Johnson, 1996). Another path analytical study found a direct effect of SE on performance (beta = .356) (Pajares & Valiante, 1997).
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 & Higgins, 1995, p. 192) and was claimed to be to be an important mechanism affecting computer related behavior:

Those who judge themselves to be efficacious in using the computer will anticipate positive and challenging computer experiences. Those who see themselves as inefficacious are likely to expect negative experiences with the computer. The degree of self-efficacy determines how much a person is willing to try, and cope with a situation or task. Therefore, as an individual’s efficacy gains strength, his or her willingness to make an effort will increase. Also, the higher one’s sense of efficacy, the more efficacious the individual will be in achieving the desired outcome. (Oliver & Shapiro, 1993, p. 82)

Research studies have generally supported the contentions of social cognitive theory as regards the role of CSE on computer related behavior. One path analysis study found that CSE had a direct influence on students’ intentions to use computers enrolled in an introductory psychology course (beta = .74) (Hill, Smith, & Mann, 1987). Another path analysis study found that CSE was found to influence computer usage frequency directly (beta = .23) as well as indirectly through its influence on affective states (beta = .04), computer anxiety (beta = -.50) and performance outcome expectations (beta = .24) (Compeau & Higgins, 1995). In another
study involving pre-service teachers, CSE was found to be the only variable predicting students’ performance in a computer literacy course (Karsten & Roth, 1998).

In addition to CSE, researchers in this area also devoted remarkable attention to the “Technology Integration Self-Efficacy” construct in recent years (e.g. Abbitt & Klett, 2007; Wang, Ertmer, & Newby, 2004). The technology integration SE deals with teachers’ perception of their ability to use technology in the classroom. This construct is assessed with survey items such as “I feel confident that I can use educational technology in effective ways in my classroom” and “I feel confident that I can evaluate software for teaching and learning.” Participants are asked to indicate their agreement level with these statements on a Likert-type scale (Wang, Ertmer, & Newby, 2004).

Research involving this construct seems to primarily concentrate on whether pre-service teachers’ increase their technology integration SE as a result of their enrollment in an introductory instructional technology course. In one study, participants enrolled in a course involving technology integration indicated increases in perception of their ability to integrate technology in the classroom. Based on this result, it was suggested that a course design that concentrated more broadly on issues with regard to technology integration was likely to have a more positive on SE beliefs than a course mainly concentrated on developing proficiency skills with specific computer technology (Abbitt & Klett, 2007).

Some researchers examined whether electronic models of exemplary technology-using teachers, presented through CD-ROM, could increase technology integration SE of pre-service teachers enrolled in an introductory instructional technology course (Wang, Ertmer, & Newby, 2004; Ertmer, Conklin, & Lewandowski, 2008). In one pretest-posttest research design study,
pre-service teachers used VisionQuest, a CD-ROM teacher development tool aimed at presenting exemplary technology-using teachers in two 50-minute class sessions. It was found that pre-service teachers increased their SE regarding technology integration ($t = 3.46; p < .01$) from pre to post survey (Ertmer, Conklin, & Lewandowski, 2008). In a $2 \times 2$ mixed factorial research design study, the influence of exposure to electronic models (vicarious experience) and goal setting on pre-service teachers’ SE for technology integration was examined. In this study, pre-service teachers were randomly assigned to one of four experimental conditions: (1) no vicarious experience and no goal setting (the control group); (2) no vicarious experience but with goal setting; (3) vicarious experience with no goal setting; and (4) vicarious learning experiences with goal setting. Pre- and post-surveys were administered to explore participants’ SE for technology integration. Findings revealed significant treatment effects for vicarious experience and goal setting on pre-service technology integration SE. A more powerful influence was found when both vicarious learning experiences and goal setting were present in comparison to when only one of the two factors was present (Wang, Ertmer, & Newby, 2004).

In sum, research in the literature 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. 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. They are defined as the anticipated outcomes of an action. OE can be expressed as “If I do X, Y might happen?” (Lent, Brown, & Hackett, 2002). OE may take a form like “If I integrate technology into my classroom activities, I will increase my effectiveness as a teacher” in the context of technology integration.

OE 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. OE 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). 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.

Human behavior is regulated by three types of outcome expectations in the SCCT: (1) performance outcome expectations (POE); (2) social outcome expectations (SOE); and (3) self-evaluative outcome expectations (SEOE). Within each type, positive OE operate as incentives,
negative ones as discentives (Bandura, 1997). For example, a teacher with positive OE may believe that using technology in the classroom might increase his/her productivity.

POE deal with the degree to which a person believes that taking a particular action will increase his or her performance. A teacher with positive POE might possess the belief that using a particular type of an instructional technology tool will increase his or her effectiveness as a teacher. On the other hand, a teacher with low POE might believe that the use of instructional technology in the classroom will make him or her less productive and reduce the quality of teaching.

SOE involve the anticipated reactions from others and the effect that those reactions have on one’s behavior. For example, a teacher with positive SOE may believe that the use of instructional technology in his or her classroom may allow him or her to gain approval and respect from colleagues, parents, and employers. On the other hand, a teacher with negative SOE may anticipate the feeling of disapproval from others.

SEOE most often take the form of self-satisfaction or self-criticism. For example, an educator with positive SEOE may believe that the use of instructional technology in his or her classroom will make teaching more pleasant and enjoyable. On the other hand, an educator with negative SEOE may believe that using a particular type of an instructional technology tool will make teaching dissatisfying and frustrating.

OE and SE are conceptually related but distinct constructs. Thus, the difference between the two should be understood well (Bandura, 1997). SE refers to one’s beliefs about his/her capabilities of carrying out a specific task successfully, whereas OE focus on the results of such a task. SE focuses on the question “Can I do this task?” whereas outcome expectations deal with
“If I do this task, what is going to happen?” (Lent, Brown & Hackett, 2002). Bandura expanded on the differences between OE and SE:

Efficacy and outcome judgments are differentiated because individuals can believe that a particular course of action will produce certain outcomes, but they do not act on that outcome belief because they question whether they can actually execute the necessary activities. (1986, p. 392)

According to SCCT, OE depend partly on SE beliefs. Therefore, people who have strong SE beliefs typically anticipate successful outcomes, whereas those with a low sense of SE are more apt to anticipate failure. For example, students who are confident in their instructional technology skills may expect high grades in an instructional technology course, whereas those who doubt their abilities may anticipate lower grades:

People’s beliefs about their efficacy influence how they construe situations and the types of anticipatory scenarios and visualized futures they construct. Those who have a high sense of efficacy view situations as presenting realizable opportunities. They visualize success scenarios that provide positive guides for performance. Those who judge themselves to be inefficacious construe uncertain situations as risky and are inclined to visualize failure scenarios. (Bandura, 1997, p. 116)

The strength of the relationship between SE and OE is dependent on the relationship between the quality of performance and outcome. In situations where performance foretells outcome, SE accounts for most of the variance in OE (Bandura, 1997). When the effects of SE are controlled statistically, OE make little or no unique contribution to predict behavior. In other
words, OE may become a redundant variable to predict human behavior above and beyond the effects of SE in situations where performance determines outcome.

OE is claimed to causally come after SE (Bandura, 1997). This claim implies that SE influences OE but not vice versa. In other words, people’s judgment of their ability (SE) influences the outcomes that they anticipate, not the other way around. From this perspective, for example, teachers do not judge that they will increase their effectiveness if they integrate technology in the classroom and then infer that they have high abilities regarding technology integration. Rather, teachers confident in their abilities regarding technology integration will likely anticipate that technology integration will increase their effectiveness. Bandura (1997) put it the following way:

To claim, as some writers have (Eastman & Marziller, 1984), that people visualize outcomes and then infer their own capabilities from the imagined outcomes is to invoke a peculiar system of backward causation in which the outcomes that flow from actions are made to precede the actions. People do not judge that they will drown if they jump in deep water and then infer that they must be poor swimmers. Rather, people who judge themselves to be poor swimmers will visualize themselves drowning if they jump in deep water. (p. 21)

Human behavior and affective states would be best predicted by taking into account both efficacy and outcome beliefs. The influence of different patterns of SE and OE on behavior and affective states is depicted in Figure 2.5 (Bandura, 1997, p. 20). For example, people possessing both high SE and OE will likely show productive engagement in a given activity and experience
personal satisfaction while people with low SE and OE will likely experience resignation and apathy.

![Figure 2.5. The effects of different patterns of efficacy beliefs and performance outcome expectations on behavior and affective states.](image)

Since people’s outcome expectations depend partly on their judgments of what they can achieve, under normal circumstances, OE are less likely to predict behavior than SE (Bandura, 1986). Moreover, SE is directly related to application of skills while OE is related to outcomes or consequences of behavior; OE should be less related to performance than SE. Therefore, beliefs about the probable outcome of successful behavior assume importance as long as people believe that they can execute the behavior successfully (Shell, Murphy, & Bruning, 1989).

**Research Studies on OE and Performance**

The relationship between OE and performance has been the focus of a number of research studies. Findings revealed that OE had a low correlation with academic performance...
(Nicholls, 1979; Hiebert, 1984 as cited in Shell, Murphy, & Bruning, 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, they made little or no contribution to predicting performance (Lent, Lopez, & Biescke, 1993; Shell, Murphy, & Bruning, 1989; Shell, Colvin, & Bruning, 1995; Siegel, Galassi, & Ware, 1985). For example, in two studies that presented hierarchical regressions in which SE followed by OE 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, Galassi, & Ware, 1985) in mathematics and 5 for reading (Shell, Murphy, & Bruning, 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, Lopez, & Bieschke, 1993; Shell, Colvin, & Bruning, 1995).

Besides the investigation of the relationship between OE and performance and predictive ability of OE on performance above and beyond SE beliefs, the moderating role of OE on behavior was examined by a number of researchers to provide insight about whether SE predicts behavior better if people also anticipate positive outcomes. Lent, Lopez, and Bieschke (1991, 1993) examined the moderating role of OE on behavior, and they found that OE moderated the relationship between SE and career choice (Lent, Lopez, & Bieschke, 1991) but not between SE and performance (Lent, Lopez, & Biescke, 1993).

OE in Technology Literature

OE 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
employed it to predict computer-related behavior. 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” (Albion, 2001, p. 324). The term perceived usefulness was refined to “Performance OE” in the context of information technology (Compeau & Higgins, 1995). Performance OE and perceived usefulness items address perceived improvements in performance from using a computer at work (e.g., productivity) or anticipated outcomes from learning how to use computers for current or future work (see Table 2.1).
Table 2.1

Examples from Instruments Measuring Perceived Usefulness

<table>
<thead>
<tr>
<th>Author</th>
<th>Instrument</th>
<th>Sample Item</th>
</tr>
</thead>
<tbody>
<tr>
<td>Knezek &amp; Miyashita (1994)</td>
<td>Computer Attitude Questionnaire</td>
<td>“I will be able to get a good job if I learn how to use a computer.”</td>
</tr>
<tr>
<td>Loyd &amp; Gressard (1984)</td>
<td>Computer Attitude Scale</td>
<td>“I’ll need a firm mastery of computers for my future work.”</td>
</tr>
<tr>
<td>Francis (1993)</td>
<td>Attitude Toward Computer Scale</td>
<td>“Studying about computers is a waste of time.”</td>
</tr>
<tr>
<td>Kay (1993)</td>
<td>Computer Attitude Measure</td>
<td>“Computers would help me organize my work.”</td>
</tr>
<tr>
<td>Davis (1989)</td>
<td>Information Technology Perceived Usefulness Scale</td>
<td>“Using a chart-master in my job would increase my productivity.”</td>
</tr>
<tr>
<td>Compeau &amp; Higgins (1995)</td>
<td>Performance OE Scale</td>
<td>“If I use a computer, I will increase the quality of output of my job.”</td>
</tr>
<tr>
<td>Maurer (1983)</td>
<td>Computer Anxiety Scale</td>
<td>“If I had to use a computer for some reason, it would probably save me some time and work.”</td>
</tr>
<tr>
<td>Smith (2002)</td>
<td>Technology Outcome Expectations Scale</td>
<td>Taking information technology courses will help me make better career decisions</td>
</tr>
</tbody>
</table>

While each of these scales has value in the measurement of Performance OE, they focus only on the perceived usefulness and performance-related dimension of OE. Yet, it was suggested that there are two additional dimensions of OE that deserve attention: Self-Evaluative and Social (Lent et al., 1994). To date, few researchers have devoted serious attention to including these two dimensions in their OE scale.
A 13-item performance expectancy scale was created to measure expected performance improvements from using a computer (Schultz & Slevin, 1975). This scale had several problems (Davis, 1989): (1) validity was assessed through exploratory (rather than verified through confirmatory) factor analysis; (2) the ratio of sample size to scale items was low (2:1); (3) four items had factor loadings less than .5; and (4) several of the items (e.g., “My job will be more satisfying,” “Others will be aware of what I am doing”) loaded on a factor outside the definition of performance expectations. The final point indicates that Schultz and Slevin included self-evaluative and social OE items without distinguishing them from Performance OE, which did not load as expected.

Another computer OE scale was created by Compeau, Higgins (1995). This scale included 6-item Performance OE and 5-item Personal OE subscales. In this scale, Performance OE addressed imagined improvements in job performance (productivity, effectiveness), while Personal OE was defined as “expectations in image or status or expectations of rewards, such as promotions, raises, and praise” (p. 148) and included items related to Social OE (e.g., “If I use a computer, I will be seen as higher in status by my peers”) and Self-Evaluative OE (e.g., “If I use a computer, I will increase my sense of accomplishment”). Like Schultz and Slevin’s scale, the Compeau, Higgins scale was problematic for several reasons: (a) validity was tested through exploratory factor analysis, rather than validated through confirmatory factor analysis; (b) 3 of the 11 items had loadings less than .60; and (c) only 1 item measured self-evaluative OE and it had a factor loading less than .60 on the personal OE factor.

Both Compeau and Higgins’ Computer OE and Schultz and Slevin’s performance expectancy instrument development studies were exploratory and had methodological problems.
A new OE scale was needed, and confirmatory factor analysis (CFA) would provide a more rigorous and systematic test of alternative factor solutions than is possible within the exploratory factor analysis framework. Realizing this, a new technology integration OE scale was created and validated through CFA (Niederhauser & Perkmen, 2008; Perkmen, Niederhauer, & Shelley, 2007). This nine-item scale consisted of three subscales: Performance OE, Self-Evaluative OE, and Social OE, and three items were included for each subscale. Cronbach’s alpha was found to be .84 for the POE subscale, .85 for the SEOE subscale, .92 for the SOE subscale, and .93 for the overall scale. These coefficients showed the high internal consistency of each of the subscales and the total scale. The results of CFA revealed that POE, SEOE, and SOE were distinct constructs.

OE for technology use is important because they influence technology usage (Compeau & Higgins, 1995), the decision to use advanced technologies (Hill, Smith, & Mann, 1987), predict enrollment in computer courses (Campbell, 1992), and influence the desirability of learning computing skills (Zhang & Espinoza, 1998). One path analytical study found that performance OE influenced technology usage directly (beta = .21) and indirectly through its influence on affective states (beta = .32) (Compeau & Higgins, 1995). Another path analytical study found that OE (what the researchers called instrumentality beliefs) had a direct effect on the decision to use advanced technologies (beta = .53) (Hill, Smith, & Mann, 1997). In a multiple regression study, OE (what the researchers called perceived usefulness) contributed significantly to the prediction of desirability of learning computing skills (beta = .42) after controlling for the effects of computer comfort/anxiety (Zhang & Espinoza, 1998). Perceived usefulness was found to be the most important predictor variable for prediction of enrollment in computer courses in another multiple regression study. Perceptions of usefulness of computers accounted for 19% of
variation in enrollment in computer courses. The additional 18% accounted for students’ perceived computer proficiency (12%), failure-task attributions (4%), and perceptions of computers as a male domain (2%) (Campbell, 1992).

Although OE has 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. One study examined the role of four computer attitude variables (enjoyment, motivation, importance (OE), and freedom from anxiety) and three environmental variables (computer access, computer helper, and computer requirement) in predicting computer performance of 208 teacher education students enrolled in a basic computer technology course (Liu & Johnson, 1998). It was found that only enjoyment, motivation, and freedom from anxiety were significant predictors of computer performance, and importance and environmental variables failed to account for significant variance in computer performance. In another study, the relationship of past performance, SE, OE, and performance goal to computer performance of students enrolled in an information technology course was examined. Results did not reveal significant relationship between OE and performance ($r = .13, p > .05$) (Smith, 2002).

In sum, researchers in the area of technology use have predominantly focused on the role of performance OE on computer-revealed behavior and ignored self-evaluative and social OE dimensions. To address these missing components, a new outcome expectations scale was created and used in this research. Although previous studies in the area of technology use did not seem to find a positive relationship between OE and performance, this relationship was examined in this research based on the results of studies conducted in other disciplines.
Goal

Goal is another central mechanism in the 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 & 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 at al., 1994, p. 84). Moreover, a goal motivates people to show necessary effort to meet task requirements and to persist at the task over time (Locke & Latham, 1990).

It is important to note that goal setting does not automatically increase motivation. Rather, the goal’s properties of difficulty, specificity, and proximity increase motivation. Proximal and short-term goals are accomplished more quickly and result in greater motivation than more distant, long-term goals. In addition, goals that have specific standards of performance tend to increase motivation more than do general goals. Finally, challenging but achievable goals enhance motivation better than easy or very difficult goals (Schunk, 2001).

Achievement goal theory has introduced two types of goal orientations within the research on students’ achievement, and different labels were used to characterize these types of goal orientations. Here, the researcher has chosen the labels of mastery-oriented goals and ego-oriented goals. The main difference between the two lies in the criteria used to define success. Mastery oriented goals deals with absolute success, such as a course or assignment grade; whereas ego-oriented goals primarily focus on relative success, such as outperforming others (Tanaka, 2007). Students possessing mastery oriented goals “represent a desire to develop
competence and increase knowledge and understanding through effortful learning, learning goal and task or task involved goals” (Murphy & Alexander, 2000, p. 28). Moreover, those with mastery type goals strive to improve their skills and competence and gain insight and knowledge (Vermetten, Lodewigs, & Vermunt, 2001). They believe that success depends mostly on effort and that they must work hard to become successful. In contrast, students possessing ego-oriented goals are interested in showing their ability to others, tend to be competitive, and feel most successful if they perform better than others (Elliot & Dweck, 1988).

There are two additional goal orientations that have been introduced in the SCCT: (1) choice goals and (2) performance goals. Choice goals refer to “the type of activity domain one wishes to pursue,” whereas performance goals deal with “the level or quality of performance toward which one aspires within a given domain” (Lent & Brown, 2006, p. 120). Choice goals are typically measured by asking participants to indicate their intent to select or perform a particular activity such as choosing certain types of courses or college majors. For example, participants are asked to indicate their possibility of selecting an activity along a scale of likelihood, from extremely unlikely to extremely likely. On the other hand, performance goals are framed in terms of how well the student aspires to perform the activity (Lent & Brown, 2006). For example, participants might be asked to indicate the grades (e.g. a grade of B) they aim for in a given activity to measure performance goals.

These two types of goals influence motivation in different ways. Choice goals help motivate students to pursue their preferred educational options whereas performance goals help determine the level of success they accomplish at given tasks (Lent & Brown, 2006). Choice goals have been used in the career choice and vocational interest development models, whereas performance goals are used in academic performance models. Performance goals are
hypothesized to be directly influenced by SE and OE and have a direct influence on academic performance in the SCCT academic performance model.

Research Studies on the Relationship Between Goal and Performance

The relationship of goals to academic performance has been examined by many researchers (e.g. Zimmerman, Bandura, & Martinez-Bonz, 1992; Wolters, 1998; Urban, 1997 as cited in Brown & Lent, 2002). One study 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 student final grade ($r = .52$) in social studies (Zimmerman, Bandura, & Martinez-Bonz, 1992). Another two studies examining the relationship between performance goals and grade revealed a low correlation between the two (.13 and .22, respectively) (Urban, 1997; Wolters, 1998 as cited in Brown & Lent, 2002).

Some researchers (e.g. Fenollar, Roman, & Ceustas, 2007; Tanaka, 2007) examined the role of goals on performance when used in conjunction with other variables, such as SE. For example, Fennolar, Roman, and Cuestas (2007) examined the influence of mastery-oriented goals, SE, effort, and class size on academic performance of 553 university students from different faculties. SE was found to have a direct effect on mastery-oriented goals (beta = .40), while mastery-oriented goals influenced performance only indirectly through its effects on effort (beta= .08). Another study examining the influence of goal orientations on 109 ninth-grade students’ task-specific appraisals (i.e. interest, self-efficacy, anxiety) found that different goal orientations had different influences on task-specific appraisals. Task performance was directly influenced by SE (beta= .30), whereas goal orientation operated as a predictor of task
performance indirectly through task-specific appraisals. Thus, it appears from these studies that the effects of goal orientations on performance are mediated through other mechanisms such as effort and SE.

**Goals in Technology Literature**

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. 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).

Some researchers have examined the role of goal setting on pre-service teachers’ self-efficacy for technology integration. As indicated earlier, pre-service teachers were randomly assigned to one of four experimental conditions in one study: (1) no vicarious experience and no goal setting (the control group); (2) no vicarious experience but with goal setting; (3) vicarious experience with no goal setting; and (4) vicarious learning experiences with goal setting. Pre- and post-surveys were administered to explore participants’ SE for technology integration, and
findings revealed significant treatment effects for vicarious experience and goal setting on pre-service technology integration SE. A more powerful influence was found when both vicarious learning experiences and goal setting were present in comparison to when only one of the two factors was present (Wang, Ertmer, & Newby, 2004). In addition, other researchers examined if pre-service teachers’ goals (what they called intentions) and beliefs regarding technology integration change after taking an introductory instructional technology course. One pretest-posttest research design found that pre-service teachers increased their level of intentions regarding technology integration ($F = 26.55; \ p < .001$) from pre to post survey (Anderson & Maninger, 2007).

In sum, goal appeared to be an important mechanism that might influence individuals’ technology-related performance. However, this variable has little received attention by researchers to examine its influence on technology integration performance. It is believed that the present study will provide insight into its predictive ability on pre-service teachers’ technology integration performance.
CHAPTER 3: METHOD

Context

This study took place at a large Midwestern U.S. university in an introductory instructional technology course for PK-6 pre-service teachers. This three-credit hour course was designed to help pre-service teachers understand how technology can be used to enhance learning and how it can be utilized to 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. Each student attends two one-hour lectures and one of six two-hour lab periods each week. The instructor for the course introduces theoretical 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. iPod, Microsoft Office programs) 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%). Ethnic makeup of the participants was 92.8% European Americans and 7.2% other ethnicities. 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 & Cassady, 2005), and the Intrapersonal Technology Integration Scale (Niederhauser & Perkmen, 2008; Perkmen, Niederhauser, & Shelley, 2007; Wang, Ertmer, & Newby, 2004).

Comprehensive Lesson Plan Assignment

The comprehensive lesson plan assignment was developed as a course assessment by the course instructor (see Appendix A). It is designed to show pre-service teachers’ abilities in planning and designing technology-enhanced learning environments. Each student is expected to create a lesson plan that integrates technology into instructional objectives and assessment. The assignment consists of four parts: (1) lesson plan; (2) assessment; (3) student product; and (4) reflection. 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 are 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 are 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

This instrument (see Appendix C) was adapted from the *Technology Integration Assessment Instrument* (see Appendix B) (Britten & Cassady, 2005). It was designed to measure teachers’ skills in planning and creating technology-enhanced lesson plans and 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 instrument. The instrument provides a rubric for rating seven dimensions of a technology-enhanced lesson plan, with four levels within each dimension. The levels reflect a continuum of technology integration; the labels are Technology Not Present (0 points); Non-Essential Technology Component (1 point); Supportive Technology Component (2 points); and Essential Technology Component (3 points). Dimension levels were summed to form a total technology integration performance score, and possible scores on this scale range from 0 to 18, with higher scores indicating higher technology integration performance. One of the dimensions, planning, was not relevant to the comprehensive lesson plan assignment and was not included in the revised rubric.

Content Standards

This dimension addresses the level to which content standards are addressed as a result of technology use. Non-essential uses of technology are characterized by lessons that use technology not related to the addressed content standards, such as using word-processing programs to complete written work that does not include a write-rewrite process (e.g. typing spelling word lists). Using technology in a supportive fashion can be seen in lesson plans where technology use supports the acquisition of standards but is not directly tied to the standard itself. Finally, essential technology makes use of technology to directly address one or more standards.
National Educational Technology Standards for Students (NETS-S)

This dimension deals with the level to which teachers identified or incorporated NETS-S into their lesson plan, with attention to developmental appropriateness. Non-essential technology uses of technology are characterized by lessons in which NETS are present but not up to expected grade level and not identified or embedded into lesson as a learning goal. Using technology in a supportive fashion in this dimension can be seen in lesson plans where NETS are present and grade-level appropriate but not integrated into learning goals. Essential technology uses of technology are characterized by lessons in which NETS are present and addressed through learning activities in the lesson plan.

Attention to Student Needs

This dimension addresses the degree to which technology applications for delivering the content are modifiable and adaptive to meet the needs of students from diverse backgrounds. Non-essential uses of technology are characterized by lessons in which all students use same technology tool or complete same technology-enhanced activity. An example includes having all students complete an online or CD-ROM tutorial that does not take into account individual differences among learners. Supportive technology may include delivering lesson plans that can be preset to provide content at different levels of difficulty, either adjusted by the learner or in advance by the teacher. Such difficulty adjustments can be done in skills-development software or games. Finally essential technology concentrates on providing differentiated learning opportunities to learners that could not be achieved in the absence of technology tools. In this way, technology can be used for remediation as well as enrichment for students, depending on their level.
Implementation (Use of Technology in Learning)

This dimension deals with the lesson from the perspective of the student as technology user and concentrates on integrating technology in the classroom as a means to promote student understanding of the content, or to engage students in the core activity through the help of technology. Non-essential uses of technology are characterized by lessons that provide opportunities for students to use technology but technology use itself is not expected to support learning. Examples involve word-processing for spelling words or utilizing a digital paint program to create a cover for the student’s self-authored book. Supportive technology makes use of technology to enhance the learning environment but only through making tasks easier to accomplish, creating enhanced products, or providing access to additional resources. Finally, essential technology provides unique learning opportunities for students to use technology tools as engagers and facilitators of thinking and knowledge construction.

Implementation (Use of Technology in Teaching)

This dimension addresses the level to which the teacher depends on the technology during an instructional session to teach the lesson. Non-essential uses of technology are characterized by lessons that use technology but technology use itself does not influence implementation of the lesson. Supportive technology can be seen in situations where technology tools facilitate the implementation of the lesson but learning goals could be achieved in the absence of technology tools. Finally, essential uses of technology are characterized by lessons in which technology is infused into classroom activities. That is, technology cannot be separated from the lesson.
Assessment

The varied level of categorization for this dimension is mainly influenced by the ability to assess the learner with technology products. Non-essential uses of technology are characterized by lessons that uses technology, but in which no assessment of product or developed skills associated with the learning process is undertaken. Supportive technology makes use of technology to deliver assessment or concentrates on the product of a technology-enhanced activity in determining understanding of the lesson. Finally, essential technology builds upon the expectations of supportive technology by requiring that technology processes or objectives are directly addressed or assessment relies upon technology use.

Development of Scoring Protocol for the Technology Integration Assessment Instrument

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 researcher with nine technology-enhanced lesson plans created by pre-service teachers enrolled in the same course during a previous semester.

In the first step, three different scorers used the rubric to evaluate three technology-enhanced lesson plans. One rater had served as the teaching assistant for the course for approximately three years, was a primary instructor during a summer session, and holds a PhD in Instructional Technology. The second rater also holds a PhD in Instructional Technology and served as a computer teacher in a private computer course for two years. The third rater (the researcher) is a PhD candidate in Instructional Technology. The inter-rater agreement was found to be 82%. After this, the researcher and raters met to discuss cases where raters did not agree.
The researcher then created decision rules for those cases and made some modifications in the rubric to reduce ambiguity.

In the second step, 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 researcher made additional modifications to the rubric based on the discussion.

In the third step, the raters scored the final three technology-enhanced lesson plans using the modified version of the rubric (see Appendix C). The final inter-rater agreement was established at 93%.

**Intrapersonal Technology Integration Scale**

This scale is designed to measure pre-service teachers’ perception of SE, OE, and PG with respect to technology integration. It consists of three scales: (1) a SE for technology integration scale (16 items); (2) a technology integration OE scale (9 items); and a technology integration PG Scale (1 item).

**Self-Efficacy for Technology Integration Scale**

The Self-Efficacy for Technology Integration Scale (Wang, Ertmer, & Newby, 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 (see Appendix D). This 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 5-point scale, participants indicated
their level of agreement with each statement (0-strongly disagree, 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 scale range from 0 to 64.

Construct validity of this scale was demonstrated by an exploratory factor analysis. The principal component analysis resulted in a one factor solution (Eigen-value = 9.58), which accounted for a total of 59.86% of the systematic covariance among the scale items. This finding showed that the 16 items formed a valid instrument assessing a single construct. (Wang, Ertmer, & Newby, 2004). Of these 16 items, six were used in a validation study by Niederhauser and Perkmen (2008). Findings from an exploratory factor analysis revealed that the six items loaded in a single factor, (Eigen-value = 4.11), which accounted for a 68.59% of the systematic covariance among the scale items. These findings provided strong evidence regarding the construct validity of this scale.

In addition to construct validity, internal consistency analysis was performed to examine the internal consistency for the Self-Efficacy for Technology Integration Scale. Cronbach alpha coefficients of .96 (Wang, Ertmer, & Newby, 2004) and .90 (Niederhauser & Perkmen, in press) were reported in two validation studies with pre-service teachers enrolled in an introductory technology course. These coefficients showed high internal consistency of the scale items.

The Technology Integration OE Scale

The nine-item Technology Integration OE Scale (see Appendix E) was used in this study to measure pre-service teachers’ perceptions about the outcomes of integrating technology into their future classroom activities (Niederhauser & Perkmen, in press). The stem for the scale items was “Integrating technology in 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 rating scale, participants indicated their level of agreement with each statement (0-strongly disagree, 4-strongly agree). Item ratings were summed to form a total OE score, with higher scores reflecting higher OE. Possible scores on this scale range from 0 to 36.

The Technology Integration OE Scale is comprised of three subscales: performance OE, self-evaluative OE, and social OE, and three survey items were included for each subscale. All of these subscales were based on scales developed in two areas including information technology and engineering. Items in these subscales were rephrased to make it relevant for pre-service teachers and technology integration.

The Performance OE subscale is based on Davis’ (1989) Perceived Usefulness scale, and it measures the extent to which pre-service teachers believe that integrating technology into their future classroom activities increase their performance as a teacher. The self-evaluative OE subscale is modified from Lent et al.’s Engineering OE scale (2005) and measures the level of pride, satisfaction, and excitement that pre-service teachers anticipate from integrating technology into their future classroom activities. The items in the Social OE subscale were adapted from the Personal Outcome Expectations Scale (Compeau & Higgins, 1995) and assess pre-service teachers’ anticipated social reactions as a result of integrating technology into their classroom activities.

A pilot study was conducted in the spring 2005 semester to examine the Technology Integration OE scale’s validity and psychometric properties (Niederhauser & Perkmen, in press; Perkmen, Niederhauser, & Shelley, 2007). Two types of validity were addressed: concurrent and
construct validity. The concurrent validity of the Technology Integration OE scale was demonstrated through significant correlations with other constructs, including self-efficacy \((r = .67, p < .01)\) and academic performance \((r = .22, p < .05)\). These results were consistent with the predictions of Social Cognitive Career Theory and previous research findings. Principal Component Analysis with varimax rotation was used to establish the construct validity of the Technology Integration OE scale, and results revealed that POE, SEOE, and SOE items loaded on their appropriate factor, which supported construct validity.

Internal consistency analyses were performed to examine the psychometric properties of the subscales and overall scale. Cronbach’s alpha was found to be .84 for the POE subscale, .85 for the SEOE subscale, .92 for the SOE subscale, and .93 for the overall scale. These coefficients showed high internal consistency of each subscale. Item-item correlations were in the expected range of .41 to .85, indicating homogeneity among the subscale items. Specifically, item-item correlations ranged from .60 to .74 for the POE subscale, .57 to .75 for SEOE subscale, and .76 to .84 for SOE subscale. Furthermore, each item comprising the Technology Integration OE scale was associated with the total test score as demonstrated by the corrected item-total correlations. Corrected-item correlations ranged from .61 to .77 for the POE subscale, .73 to .81 for the SEOE subscale, and .70 to .78 for the SOE subscale. A further estimate of internal consistency of the factor solution ascertained was indicated by the squared multiple correlations (SMC) of factor scores. The SMC ranged from .55 to .72 for the POE subscale, .60 to .67 for the SEOE subscale, and .78 to .88 for the SOE subscale. Since SMC ranged between 0 and 1, the observed variables accounted for substantial variance in the factor scores. Together these findings provided empirical evidence for the internal consistency of the scale.
Technology Integration PG Scale

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

Procedure

The teaching assistants of the course introduced the lesson plan assignment to the pre-service teachers in the seventh week of the semester during their lab periods. They were given three weeks to complete this assignment. The Intrapersonal Technology Integration Scale was administered during their lab periods in the eighth week of the semester. The researcher explained the purpose and significance of the study to the participants. Those who were willing to participate in the study read a consent form and filled out the Intrapersonal Technology Integration Scale. Participants returned their lesson plan assignments in the tenth 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 ISU records with the participants’ permission.
Summary of the Analysis

Based on previous research findings and predictions of SCCT Performance model as shown in Figure 3.1, the researcher tested several hypotheses. The two hypotheses are based on the first research question (To what extent SCCT variables are related to each other and technology integration performance?)

![Diagram of SCCT Performance Model in the Context of Technology Integration]

**Figure 3.1. SCCT Performance Model in the Context of Technology Integration**

*Hypothesis 1: SCCT variables (SE, OE and PG) are significantly related to each other and technology integration performance.*

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

Pearson product-moment correlation coefficients were calculated to determine the relationships among variables and test these hypotheses. The correlation coefficient \( r \) reflects
the degree to which variables are associated. It ranges from -1 to 1. The sign shows the direction of the association. A plus indicates that the association is positive; a minus indicates that the association is negative. A .05 level of significance was utilized in these analyses. Magnitude of the correlations were evaluated according to the following criteria: small \((r < .30)\), moderate \((.30 > r < .60)\) and high \((.60 > r)\).

Hypotheses 3 and 4 are based on the second research question: “Do technology integration SE and OE make a unique contribution to predicting technology integration performance above and beyond the effects of previous performance and academic ability (as measured by GPA and ACT scores)?

*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.*
CHAPTER 4: RESULTS

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

Technology Integration Assessment Instrument

As discussed in chapter 3, participants’ lesson plan assignments (dependent variable) were scored using the technology integration assessment instrument. Ten percent of the lesson plans (N = 11) were randomly selected and double-scored by the researcher and a second, trained rater. The inter-rater agreement estimate was established at 88%. This reflects a fairly high level of agreement between raters, 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 use into their lesson planning. Table 4.1 presents the mean, standard deviation, minimum, 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). This range and standard deviation indicates that the instrument was sensitive to differentiating student performance on this task.
Table 4.1

Descriptive Statistics for the Dependent Variable

<table>
<thead>
<tr>
<th>Variable</th>
<th>M</th>
<th>SD</th>
<th>Range</th>
<th>Min</th>
<th>Max</th>
<th>Possible</th>
</tr>
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<tbody>
<tr>
<td>Overall Performance</td>
<td>12.85</td>
<td>2.98</td>
<td>4 17</td>
<td>4</td>
<td>17</td>
<td>0 - 18</td>
</tr>
<tr>
<td>1. Content standards</td>
<td>2.58</td>
<td>.78</td>
<td>0 3</td>
<td>0</td>
<td>3</td>
<td>0 - 3</td>
</tr>
<tr>
<td>2. NETS</td>
<td>2.48</td>
<td>.73</td>
<td>0 3</td>
<td>0</td>
<td>3</td>
<td>0 - 3</td>
</tr>
<tr>
<td>3. Attention to students’ needs</td>
<td>1.06</td>
<td>.24</td>
<td>1 2</td>
<td>1</td>
<td>2</td>
<td>0 - 3</td>
</tr>
<tr>
<td>4. Technology in learning</td>
<td>2.14</td>
<td>.68</td>
<td>1 3</td>
<td>1</td>
<td>3</td>
<td>0 - 3</td>
</tr>
<tr>
<td>5. Technology in teaching</td>
<td>2.42</td>
<td>.75</td>
<td>1 3</td>
<td>1</td>
<td>3</td>
<td>0 - 3</td>
</tr>
<tr>
<td>6. Assessment</td>
<td>2.15</td>
<td>.75</td>
<td>0 3</td>
<td>0</td>
<td>3</td>
<td>0 - 3</td>
</tr>
</tbody>
</table>

To further examine student performance, descriptive analyses were conducted on the six dimensions that constitute the dependent variable. Findings suggest 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 Questionnaire

A 25-item survey 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 (See Appendix G). 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
provide 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.

Internal consistency analyses were then performed on (1) the Self-efficacy for Technology Integration Scale and (2) Technology Integration Outcome Expectations Scale. Cronbach’s alpha, corrected-item correlations, and squared multiple correlations (SMC) were used to measure the internal consistency of the scales. Adequate alpha values should be higher than 0.70 and values higher than 0.80 are considered as excellent, while adequate levels of corrected-item correlations range from 0.3 to 0.9. SMC values of higher than .4 are considered to be adequate (Stevens, 1986).

Cronbach’s alpha was .92 for the Self-Efficacy for Technology Integration Scale. Corrected-item correlations ranged from .44 to .70 and squared multiple correlations (SMC) from .45 to .71. Cronbach’s alpha was .91 for the Technology Integration OE Scale. Corrected item correlations ranged from .58 to .77 and SMC from .48 to .73. Together these findings indicate homogeneity among the scale items and provide 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 4.2 presents the mean, standard deviation, minimum, and maximum scores for all variables. Participants had a fairly high sense of SE ($M = 44.26$, $SD = 7.41$) and positive OE ($M = 27.30$, $SD = 4.24$). They also aimed for high scores in the lesson plan assignment as indicated by their performance goals ($M = 10.14$, $SD = 1.18$). An examination of frequency of participants’ responses revealed that 53% of
the students hoped to earn an A in the assignment, resulting in a negatively skewed distribution, which may have attenuated correlations involving this variable.

Table 4.2

Description of the Predictor Variables

<table>
<thead>
<tr>
<th>Variable</th>
<th>Interpretation of higher score</th>
<th>M</th>
<th>SD</th>
<th>Min</th>
<th>Max</th>
<th>Possible</th>
</tr>
</thead>
<tbody>
<tr>
<td>SE</td>
<td>Stronger sense of SE</td>
<td>44.26</td>
<td>7.41</td>
<td>24</td>
<td>64</td>
<td>0 - 64</td>
</tr>
<tr>
<td>OE</td>
<td>More positive OE</td>
<td>27.30</td>
<td>4.24</td>
<td>15</td>
<td>36</td>
<td>0 - 36</td>
</tr>
<tr>
<td>PG</td>
<td>More challenging PG</td>
<td>10.14</td>
<td>1.18</td>
<td>4</td>
<td>11</td>
<td>0 - 11</td>
</tr>
</tbody>
</table>

Testing the predictions of SCCT Performance Model

Two research questions were addressed in this 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 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.
Pearson correlations were calculated to examine these hypotheses. All variables in the present study had a significant correlation with technology integration performance. GPA had the highest correlation, followed by OE (see Table 4.3). A moderate positive correlation ($r = .38, p < .05$) between SE and OE was also found; however, neither SE nor OE correlated with PG. The lack of correlations between SE/PG and OE/PG may be due to the limitations of the PG variable discussed earlier. In light of these findings, the first hypothesis was only partially supported. Further, hypothesis 2 was rejected since OE had a higher correlation with performance than did SE. ($r = .33, p < .01$ versus $r = .19, p < .05$).

Table 4.3

<table>
<thead>
<tr>
<th>Variable</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>GPA</td>
<td>-</td>
<td>.54**</td>
<td>-.14</td>
<td>.08</td>
<td>.38**</td>
<td>.43**</td>
</tr>
<tr>
<td>ACT</td>
<td>-</td>
<td>-.01</td>
<td>.00</td>
<td>.27**</td>
<td>.28**</td>
<td></td>
</tr>
<tr>
<td>SE</td>
<td>-</td>
<td>-</td>
<td>.38**</td>
<td>.05</td>
<td>.19*</td>
<td></td>
</tr>
<tr>
<td>OE</td>
<td>-</td>
<td>-</td>
<td>.12</td>
<td>-</td>
<td>.33**</td>
<td></td>
</tr>
<tr>
<td>PG</td>
<td>-</td>
<td>-</td>
<td>.27**</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Performance</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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

A series of correlation analyses were conducted with academic major and grade level as moderator variables to further examine relationships among these variables. This resulted in four analyses: (1) correlation between SE and performance by academic major; (2) correlation between SE and performance by grade level; (3) correlation between OE and performance by academic major; and (4) correlation between OE and performance by grade level. 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).
Only one of these analyses appeared to be meaningful. Self-efficacy/performance correlation was stronger in the upper grade level group \((r = .44)\) than in the freshman group \((r = .03)\) when examining the correlation between SE and performance across grade levels (see Figure 4.1, 4.2, 4.3). This suggests that self-efficacy served as a stronger predictor of performance for the upper level students. Figure 4.2 and Figure 4.3 shows the relationship between SE and Performance for freshman and upper level students, respectively.

\[\text{Figure 4.1. Relationship between SE and performance by grade level}\]
Figure 4.2. Relationship between SE and performance for freshman group

Figure 4.3. Relationship between SE and performance for upper level group
Thus, it appeared that grade level may have served as a *moderator* variable. Forced order hierarchical regression was conducted to test the likelihood that grade level moderates the relationship between SE and technology integration performance. The SE x Grade Level interaction term was entered into the regression equation after SE and Grade Level, with technology integration performance serving as the dependent variable. As can be seen in Table 4.4, the interaction term was significant, leading to the conclusion that grade level did, in fact, moderate the relationship between SE and performance.

<table>
<thead>
<tr>
<th>Variable</th>
<th>$R$</th>
<th>$R^2$ change</th>
<th>$F$ change</th>
</tr>
</thead>
<tbody>
<tr>
<td>SE</td>
<td>.19</td>
<td>.04</td>
<td>3.94*</td>
</tr>
<tr>
<td>Grade Level</td>
<td>.19</td>
<td>.00</td>
<td>.09</td>
</tr>
<tr>
<td>SE x Grade Level</td>
<td>.28</td>
<td>.04</td>
<td>5.03*</td>
</tr>
</tbody>
</table>

* $p < .05$.

Based on these findings, two separate correlation matrices were created; one for freshman and another for upper level students (see Table 4.5). A moderate relationship between SE and OE existed for both groups; however, for the freshman group SE was correlated with performance and PG. Thus, hypothesis 1 was partially supported for the freshman group. Since OE had a higher correlation with performance than did SE, hypothesis 2 was rejected for these students.
Table 4.5

*Correlations among Variables by Grade Level*

<table>
<thead>
<tr>
<th>Variable</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Freshman Students (n = 58)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. GPA</td>
<td>-</td>
<td>.51**</td>
<td>-.21</td>
<td>.05</td>
<td>.32*</td>
<td>.50**</td>
</tr>
<tr>
<td>2. ACT</td>
<td>-</td>
<td>.00</td>
<td>.06</td>
<td>.21</td>
<td>.26*</td>
<td></td>
</tr>
<tr>
<td>3. SE</td>
<td>-</td>
<td>.38**</td>
<td>-.07</td>
<td>.03</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. OE</td>
<td>-</td>
<td>.11</td>
<td>.32*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. PG</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Performance</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Upper Level Students (n = 53)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. GPA</td>
<td>-</td>
<td>.62**</td>
<td>.09</td>
<td>.52**</td>
<td>.32*</td>
<td></td>
</tr>
<tr>
<td>2. ACT</td>
<td>-</td>
<td>.03</td>
<td>-.04</td>
<td>.36*</td>
<td>.31*</td>
<td></td>
</tr>
<tr>
<td>3. SE</td>
<td>-</td>
<td>.42**</td>
<td>.28*</td>
<td>.45**</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. OE</td>
<td>-</td>
<td>.17</td>
<td></td>
<td>.38**</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. PG</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Performance</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* p < .05.  ** p < .01.

Results for the upper level group revealed a pattern that was much more consistent with 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. SE 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 performance, hypothesis 1 was supported. Hypothesis 2 was also supported since SE had a higher a higher correlation with performance than did OE ($r = .45$ versus $r = .38$). 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 only 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.

**Q2: Do SE and OE make a contribution to predicting technology integration performance above and beyond the effects of previous performance and academic ability?**

Hypothesis 3 and 4 address whether SE and OE account for unique variance in technology integration performance above and beyond the effects of previous performance and academic ability:

*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.*

Forced-order hierarchical regression analysis was conducted to test these hypotheses. Using this analysis enabled removal of variance associated with previous academic performance and academic ability. Based on the SCCT theoretical framework, predictor variables were entered into the regression equation in the following order: GPA, ACT, PG, SE, and OE. Results presented in Table 4.6 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 contributes 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.

Table 4.6

Forced-order Hierarchical Regression Predicting Performance

<table>
<thead>
<tr>
<th>Variable</th>
<th>$R$</th>
<th>$R^2$ change</th>
<th>$F$ change</th>
</tr>
</thead>
<tbody>
<tr>
<td>GPA</td>
<td>.44</td>
<td>.19</td>
<td>9.24**</td>
</tr>
<tr>
<td>ACT</td>
<td>.44</td>
<td>.00</td>
<td>.02</td>
</tr>
<tr>
<td>PG</td>
<td>.45</td>
<td>.01</td>
<td>.51</td>
</tr>
<tr>
<td>SE</td>
<td>.53</td>
<td>.08</td>
<td>4.15*</td>
</tr>
<tr>
<td>OE</td>
<td>.62</td>
<td>.09</td>
<td>5.19*</td>
</tr>
</tbody>
</table>

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

In sum, findings revealed that SCCT hypotheses were largely verified when the freshman students were not included in the analyses. Self-efficacy and outcome expectations were correlated with each other and both made a significant contribution to predicting technology integration performance. Implications of these results will be discussed in the next section.
CHAPTER 5: 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 researchers have examined the role of these variables on pre-service teachers’ computer using performance in technology integration courses they rarely grounded their studies in a theoretical framework (e.g. Karsten & Roth, 1998). The present study was undertaken to address these two issues. First, the criterion variable in this study was technology integration rather than general computer skills. Second, Social Cognitive Career Theory (SCCT) served as a theoretical 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 nonredundant information to predict technology integration performance. Thus, SCCT appears to be a good theoretical framework that enables us to understand the role of intrapersonal factors on pre-service teachers’ technology integration performance.

Instruments

Technology Integration Assessment Instrument

Technology integration is a multidimensional construct. According to Liu and Velasquez-Bryant (2003), it is made up of four dimensions: (1) planning, (2) designing, (3) implementation, and (4) evaluation. Although findings revealed the Technology Integration Assessment Instrument used in this study was helpful in differentiating pre-service teachers’ technology integration
integration performance, it deals with only the first two dimensions of technology integration (planning and designing). Pre-service teachers might have abilities to plan and design learning environments supported by technology. This does not necessarily mean that they will be able to effectively use technology in a real classroom environment to promote student learning. 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.

*Intrapersonal Technology Integration Scale*

Results indicated that SE and OE were different constructs and the scales used to measure them possessed good psychometric properties. Therefore, researchers and educators should feel confident in using these scales to measure pre-service teachers’ self-efficacy and outcome beliefs for technology integration.

Results also indicated that, unlike SE and OE scales, the PG scale did not possess good properties to be used in the analyses. The fundamental problem was that this variable was measured with only one question. Participants’ PG scores were not normally distributed, which may have attenuated correlations involving this variable. Contrary to theoretical predictions, this variable did not correlate with SE and OE. Thus, it would also be useful for further research to develop and test instruments that tap PG in relation to a wide variety of technology integration-related behavior. Such efforts might include having multiple questions to measure PG, examine its construct validity and determine its relation to other constructs such as SE and OE.
Hypotheses Testing

*Self-efficacy*

Although SCCT would predict that SE would a stronger predictor of performance than OE, initial testing of 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 served as a stronger predictor of pre-service teachers’ technology integration performance than did their technology integration OE for the upper level group and supported previous research studies that also indicated that SE was the more potent of the two belief constructs (Lopez, & Bieschke, 1991, 1993; Lopez, Lent, Brown, & Gore, 1997). For example, Lopez, Lent, Brown and Gore’s study (1997) revealed that SE was much stronger predictor of students’ end-of-term mathematics grade than OE. It appears that SE serves as a stronger predictor of performance than does OE in both mathematics and technology integration contexts.

Hypotheses testing across grade levels revealed other interesting results. The SE/performance relationship was found to be stronger in the upper group than in the freshman group. This finding was consistent with the results of another research study (Shell, Murphy, & Bruning, 1989), which suggested that the relationship between beliefs and performance become stronger as persons become more skilled. In their study, researchers 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 and maturity to judge their skills 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.

The relationship between technology integration SE and OE also deserved attention. SE 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 she could use integrate technology into her teaching, it was more likely that she anticipated positive outcomes from using technology in her classroom. This finding was consistent with theoretical predictions based on Bandura’s work (1997) and previous research studies which found similar relationships among the two variables (Lent, Lopez, & Bieschke, 1991, 1993; Lopez, Lent, Brown, & Gore, 1997). For example, Lopez, Lent, Brown and Gore (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 depend 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 to predict technology integration performance and supported previous research findings in different contexts, such as engineering (Lent, Brown, & Larkin, 1984) and mathematics (Lent, Lopez, & Bieschke, 1993).
Outcome Expectations

Results revealed that OE was positively related to performance for 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, ACT) and SE was removed. These findings contradicted theoretical predictions, and previous research, that found OE made little or no contribution to predicting performance above and beyond the effects of SE (Lent, Lopez, & Bieschke, 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 on 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 theoretical approaches like TPCK). In spite of these efforts, there are still challenges related to pre-service teachers’ 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 ability (SE) and how well they perform in a given technology integration task. According to SCCT, there should be a positive relationship between their SE and performance if they judged their ability accurately. Since freshman students may not be able to accurately represent their technology integration ability, 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, the present study suggests that teacher educators need to be sensitive to their students’ level of SE and encourage them to judge their ability before approaching a new technology integration task. In this process, pre-service teachers might consider asking themselves the kinds of questions suggested by Schunk (2001): (1) Do I have prerequisite skills to complete this task? (2) What do I already know about this task? (3) Are there any resources available to help me when I have difficulty finishing the task? (4) Can I divide this task into smaller tasks so that it will be easier to finish? With such questions, pre-service teachers may judge their skills for completing the technology integration tasks. If self-efficacy is high, pre-service teachers should feel confident about starting the task. If self-efficacy is low, pre-service teachers should seek help, resources, or strategies to make it more likely that they will be able to succeed at the task.

For example, goal setting would be a strategy to help pre-service teachers to increase their SE for task completion. Some pre-service teachers might have initial doubts about completing a technology integration task that includes writing a technology enhanced lesson plan, creating a technology product or writing a reflection paper (like the task used in this study).
In those cases, Schunk (2001) suggests that faculty can approach the issue by dividing the task into short-term goals. By doing so, pre-service teachers are more likely to believe that they can achieve the sub-tasks, and sub-task attainment increases their SE for producing a good technology-enhanced lesson plan.

In sum, the present study increased our understanding of the role of SE and OE in pre-service teachers’ technology integration performance. Since the effects of SE and OE were found to contribute to technology integration performance, it suggested an important reason to create educational interventions designed to enhance pre-service teachers’ technology integration SE and OE. To the extent that OE depends partly on SE beliefs, interventions that increase SE might also enhance OE.
REFERENCES


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APPENDIX A.
COMPREHENSIVE LESSON PLAN ASSIGNMENT

Comprehensive Lesson Plan Assignment

C I 201 – Introduction to Instructional Technology

(60 Points)

Curriculum and lesson planning is a routine activity for all teachers. Good planning on the part of the teacher can lead to successful student learning. The purpose of this project is for you to develop stronger and deeper conceptions about technology’s role in PreK-6 classroom when planning lessons and curriculum materials.

This assignment will illustrate students' abilities to plan and design effective learning environments and experiences supported by technology (i.e. TPCK). Each student will prepare a 'lesson plan' that integrates technology effectively as it relates to instructional objectives and assessments.

The lesson packet must contain the following:

1. **Lesson Plan**: Complete, comprehensive lesson plan allowing for the integration of a minimum of two different technologies (i.e. software programs, hardware, etc.) This plan should be designed to cover content material from at least two different subject areas.
2. **Assessment**: Assessments for measuring student outcomes and learning (e.g. rubrics, quiz/test, checklist, etc.)
3. **Student Product**: Example of student work completed during the unit.
4. **Reflection**: write a personal reflection about your learning while completing this comprehensive lesson packet.

Note: Each piece must be available in an electronic form.

**1. Lesson Plan**

The lesson plan should include the following components:

a) **Summary/Overview of Lesson:**

What is the synopsis of your lesson? Provide a brief paragraph description that concisely summarizes your entire plan.

b) **Grade Level:**

What grade level are you designing this lesson for? All activities designed should be grade level appropriate.
c) Learning Objectives:

What will the students participating in your lesson learn and/or be able to do as a result of your lesson?

d) Content Standards:

What content standards will be addressed in this lesson? These should connect back to the learning objectives.

- Science
- Math
- Language Arts
- Social Studies/History
- Other?

e) Technology Standards:

What technology standards (NETS) will be addressed in this lesson? These should connect back to the learning objectives.

National Educational Technology Standards for Students (NETS•S)

http://www.iste.org/AM/Template.cfm?Section=NETS

f) Description of Instructional Context:

In what environment will the lesson take place? Here are some ideas to think about depending upon technologies available and selected for lesson. Give instructions for single computer classroom, multi-computer classroom and lab situation, discuss the ability level of your students and what provisions you will make for varying abilities in your classroom and possible learning challenges, prior knowledge of the subject being taught, etc.

g) List of Materials:

What materials are needed for the teacher to teach the lesson and for the students to participate in the lesson? Are any volunteers or materials needed from the community? What technology provisions need to be gathered or prepared before teaching the lesson? Prepare examples of any student handouts or resources to be given to the students.

h) Lesson Procedures (step-by-step)

What will the lesson involve? Provide a ‘rich’ description of the step-by-step procedures taken to complete the lesson. What will the students do? What will the teacher do?
i) What is the role of the technology?

Take a step back from this lesson for a moment and reflect upon and examine the long-term impact that the technology will have on student learning. How was technology used to engage learners in a meaningful learning activity? Could it have been done just as effectively without using the technology you selected? Was the technology used to engage students in an active, meaningful learning activity? Was technology used to promote collaborative learning? Was technology used to promote reflective learning?

j) Extension Activities (after the lesson)

What other activities will be used to transition from this lesson to the next lesson, area of curriculum, or subject area? Provide creative ideas for extending and enhancing the learning in this lesson.

k) References

Any works used in the creation of this lesson plan should be properly cited in APA format (guidelines posted on WebCT under resources) and included in a reference list. If you used a ‘teacher idea’ book (e.g. An Author a Month by Sharron L. McElmeel), textbook, (or webpage (e.g. Read Write Think - www.readwritethink.org) to generate any ideas for this lesson please include them in a reference list at the end of your lesson plan.

2. Assessment

The assessment plan should include the following:

a) Description of evaluation of learning outcomes

Write a paragraph that describes how you will evaluate student learning and progress based upon the stated student objectives and standards. Will steps be taken during the lesson to assess student progress and adjustments made? How will the student product be assessed?

b) Evaluation Tool(s):

What will the students do to demonstrate success? Include example(s) of actual evaluation rubrics, exams, checklists, etc. that will be used to assess student learning and outcomes.

3. Student Product

For the lesson, PreK-6 students in your classroom will be required to complete a technology project or projects. You are required to complete the project or projects as if you are one of your students.
4. Reflection

As required for all of the 201 assignments we want you to write a personal reflection about your learning while completing this comprehensive lesson packet. Although this is only ‘one’ lesson plan, the idea of designing and developing engaging learning environments is a complex task that a teacher encounters on a daily basis. Reflecting on a lesson after it has been completed is something every teacher does in order to make adjustments and plan future lessons.

Questions to Guide Your Reflections

• Tell a story about the activity and how you felt as a learner completing the activity. These can include emotions, light bulb learning moments and frustrations.

• Talk about how you felt as a teacher, in other words what thoughts did you have about how to implement this type of lesson into your future classroom? What changes would you make? What other content areas could you integrate this lesson into?

• What did you learn about the content? In other words, yes we know you are learning about technology in this course but you are also learning about various content topics as you choose animals to hunt for, historical events to make a movie about, etc.

• Make connections between the activity you just did and topics from lecture and the readings required during this activity. Talk about those connections and what they mean to you as a future teacher.

• Make connections between prior learning experiences and this activity. These could include experiences in other teacher education classes, in the classroom with children and your own experiences in the classroom. How have things changed? How did this prior experience impact how you looked at and completed this activity?
### APPENDIX B.

**ORIGINAL VERSION OF THE TIAI**

<table>
<thead>
<tr>
<th>Dimension</th>
<th>Technology not present</th>
<th>Non-essential technology component</th>
<th>Supportive technology component</th>
<th>Essential technology component</th>
</tr>
</thead>
<tbody>
<tr>
<td>Planning (materials, equipment, etc.)</td>
<td>No mention of technology</td>
<td>Uses computer to plan for lesson.</td>
<td>Uses computer to plan for lesson. Makes mention of necessary equipment and technologies for replication purposes.</td>
<td>Computer is essential to planning of lesson (e.g., WebQuest). Equipment and technologies are built into lesson design and objectives, and are discussed within the context of the lesson and not as an external component.</td>
</tr>
<tr>
<td>Standards (content)</td>
<td>No mention of technology. OR No mention of content standards.</td>
<td>Uses technology in lesson not related to the addressed standards.</td>
<td>Uses technology supports or promotes the acquisition of standards in the lesson, but is not directly tied to the standard itself.</td>
<td>Technology use in the lesson is directly linked to one or more standards, making acquisition of that standard possible.</td>
</tr>
<tr>
<td>Standards (NETS-S)</td>
<td>No mention of technology. OR No mention of NETS.</td>
<td>NETS are present but not identified or embedded into lesson as a learning goal. NETS addressed are not up to expected grade level.</td>
<td>NETS are present but not identified or embedded into lesson as a learning goal.</td>
<td>NETS are present and integrated into grade-level appropriate learning goals.</td>
</tr>
<tr>
<td>Attention to student needs</td>
<td>No mention of technology.</td>
<td>Technology is not used in an adaptable fashion. All students use same technology tool or complete same technology-based activity.</td>
<td>Technology can be modified by the teacher or student to meet the needs of students from diverse backgrounds.</td>
<td>Technology is the only means by which this lesson can be adapted to meet the needs of students from diverse backgrounds; that is, the technology tool or activity is designed to be adaptive.</td>
</tr>
<tr>
<td>Dimension</td>
<td>Technology not present</td>
<td>Non-essential technology component</td>
<td>Supportive technology component</td>
<td>Essential technology component</td>
</tr>
<tr>
<td>-------------------------------</td>
<td>------------------------</td>
<td>------------------------------------</td>
<td>----------------------------------</td>
<td>---------------------------------</td>
</tr>
<tr>
<td>Implementation (use of technology in learning)</td>
<td>No mention of technology.</td>
<td>Technology is not expected to directly impact learning.</td>
<td>Learning is impacted in time, quality, or wealth of resources by the use of technology.</td>
<td>Technology impacts learning by presentation, product, or process.</td>
</tr>
<tr>
<td>Implementation (use of technology in teaching)</td>
<td>No mention of technology.</td>
<td>Lesson uses technology but does not impact implementation (product-oriented technology).</td>
<td>Lesson is facilitated with technology, but learning goals could be achieved without technology in place (process-oriented and/or product oriented technology).</td>
<td>Equipment and technologies are built into lesson design and objectives and are discussed within the context of the lesson and not as an external component. Lesson requires the use of technology (process and product are dependent upon technology).</td>
</tr>
<tr>
<td>Assessment</td>
<td>No mention of assessment. OR No mention of technology.</td>
<td>Technology is not used in the assessment component (neither the use of technology nor a product of technology).</td>
<td>Technology-based product is assessed, or technology application is used to deliver and/or score the assessment instrument. However, similar assessment could be replicated without technology.</td>
<td>Technology products and/or processes are directly assessed, or assessment relies upon the use of technology for delivery or collection. Identified assessment could not be conducted without technology. NETS are identified as part of assessment.</td>
</tr>
</tbody>
</table>
APPENDIX C.
MODIFIED VERSION OF TIAI

<table>
<thead>
<tr>
<th>Dimension</th>
<th>Technology not present</th>
<th>Non-essential technology component</th>
<th>Supportive technology component</th>
<th>Essential technology component</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standards (content)</td>
<td>No mention of technology. OR No mention of content standards.</td>
<td>Technology use in lesson not related to the addressed standards.</td>
<td>Technology use supports or promotes the acquisition of standards in the lesson, but is not directly tied to the standard itself.</td>
<td>Technology use in the lesson is directly linked to one or more standards, making acquisition of that standard possible.</td>
</tr>
<tr>
<td>Standards (NETS-S)</td>
<td>No mention of technology. OR No mention of NETS.</td>
<td>NETS are present but not identified or embedded into lesson as a learning goal. NETS addressed are not up to expected grade level.</td>
<td>NETS are present but not identified or embedded into lesson as a learning goal. NETS are grade-level appropriate.</td>
<td>NETS are present and integrated into grade-level appropriate learning goals.</td>
</tr>
<tr>
<td>Attention to student needs</td>
<td>No mention of technology.</td>
<td>Technology is not used in an adaptable fashion. All students use same technology tool or complete same technology-based activity.</td>
<td>Technology can be modified by the teacher or student to meet the needs of students from diverse backgrounds.</td>
<td>Technology is the only means by which this lesson can be adapted to meet the needs of students from diverse backgrounds; that is, the technology tool or activity is designed to be adaptive.</td>
</tr>
<tr>
<td>Dimension</td>
<td>Technology not present</td>
<td>Non-essential technology component</td>
<td>Supportive technology component</td>
<td>Essential technology component</td>
</tr>
<tr>
<td>---------------------------------</td>
<td>------------------------</td>
<td>-------------------------------------</td>
<td>---------------------------------</td>
<td>---------------------------------</td>
</tr>
<tr>
<td>Implementation (use of technology in learning)</td>
<td>No mention of technology.</td>
<td>Technology is not expected to directly impact learning.</td>
<td>Technology tools enhance the learning environment, but only through making tasks easier to accomplish, creating enhanced products, or providing access to additional resources.</td>
<td>Technology tools are used as engagers and facilitators of thinking and knowledge construction (e.g. technology is used for representing learners’ ideas, understandings and beliefs; for helping learners to articulate and represent what they know).</td>
</tr>
<tr>
<td>Implementation (use of technology in teaching)</td>
<td>No mention of technology.</td>
<td>Lesson uses technology but does not impact implementation (product-oriented technology).</td>
<td>Lesson is facilitated with technology, but learning goals could be achieved without technology in place (process-oriented and/or product oriented technology).</td>
<td>Equipment and technologies are built into lesson design and objectives and are discussed within the context of the lesson and not as an external component.</td>
</tr>
<tr>
<td>Assessment</td>
<td>No mention of assessment. OR No mention of technology.</td>
<td>Technology is not used in the assessment component (neither the use of technology nor a product of technology).</td>
<td>Technology-based product is assessed, or technology application is used to deliver and/or score the assessment instrument.</td>
<td>Technology processes are directly assessed, or assessment relies upon the use of technology for delivery or collection. OR Technology objectives and/or NETS are addressed in the assessment.</td>
</tr>
</tbody>
</table>
APPENDIX D.
TECHNOLOGY INTEGRATION FOR SELF-EFFICACY SCALE

The following statements relate to your SELF-EFFICACY (confidence) with instructional technology in the classroom. Please use the following scale and for each statement, **CIRCLE** the response that best describes your current belief.

<table>
<thead>
<tr>
<th>Statement</th>
<th>Strongly Disagree (1)</th>
<th>Disagree (2)</th>
<th>Neither Agree Nor Disagree (3)</th>
<th>Agree (4)</th>
<th>Strongly Agree (5)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. I feel confident that I have the skills necessary to use computer for instruction.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>2. I feel confident that I can successfully teach relevant subject content with appropriate use of technology.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>3. I feel confident about assigning and grading technology-based projects.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>4. I feel confident that I can consistently use educational technology in effective ways.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>5. I feel confident that I can motivate my students to participate in technology-based projects.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>6. I feel confident that I can help students when they have difficulty with the computer.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>7. I feel confident that I can mentor students in appropriate uses of technology.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>8. I feel confident that I can provide individual feedback to students during technology use.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>9. I feel confident that I can be responsive to students’ needs during computer use.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>10. I feel confident that I can regularly incorporate technology into my lessons when appropriate to student learning.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>11. I feel confident that I understand computer capabilities well enough to maximize them in my classroom.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td></td>
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<tr>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td></td>
</tr>
<tr>
<td>12. I feel confident about using technology resources (such as spreadsheets, electronic portfolios) to collect and analyze data from student tests and products to improve instructional practices.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>13. I feel confident about selecting appropriate technology for instruction based on curriculum standards.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>14. I feel confident in my ability to evaluate software for teaching and learning.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>15. I feel confident that I can use correct computer terminology when directing students’ computer use.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>16. I feel confident that I can effectively monitor students’ computer use for project development in my classroom.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>
APPENDIX E.

TECHNOLOGY INTEGRATION OUTCOME EXPECTATIONS SCALE

Using the stem below, please indicate the extent to which you agree or disagree with each of the following statements.

<table>
<thead>
<tr>
<th>Integrating technology into my future classroom activities will likely allow me to …</th>
<th>Strongly Disagree (1)</th>
<th>Disagree (2)</th>
<th>Neither Agree Nor Disagree (3)</th>
<th>Agree (4)</th>
<th>Strongly Agree (5)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1…. do work that I would find satisfying.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>2…. increase my effectiveness as a teacher.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>3…. increase my colleagues’ respect’ of my teaching ability.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>4…. increase my sense of accomplishment.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>5…. increase my productivity.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>6…. do exciting work.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>7…. be seen as competent by my colleagues.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>8…. increase the quality of my work.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>9…. be seen as higher in status.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>

APPENDIX F.

TECHNOLOGY INTEGRATION PERFORMANCE GOALS SCALE

Using the scale below, please indicate which grade you are aiming for in the comprehensive lesson plan assignment.

- [ ] A  - [ ] A-  - [ ] B+  - [ ] B  - [ ] B-  - [ ] C+  - [ ] C  - [ ] C-  - [ ] D+  - [ ] D  - [ ] D-
APPENDIX G.

FACTOR LOADINGS

Rotated Component Matrix (a)

<table>
<thead>
<tr>
<th></th>
<th>Component</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>SE1</td>
<td>.732</td>
<td>.095</td>
<td></td>
</tr>
<tr>
<td>SE2</td>
<td>.710</td>
<td>.239</td>
<td></td>
</tr>
<tr>
<td>SE3</td>
<td>.723</td>
<td>.069</td>
<td></td>
</tr>
<tr>
<td>SE4</td>
<td>.748</td>
<td>.035</td>
<td></td>
</tr>
<tr>
<td>SE5</td>
<td>.670</td>
<td>-.028</td>
<td></td>
</tr>
<tr>
<td>SE6</td>
<td>.608</td>
<td>.195</td>
<td></td>
</tr>
<tr>
<td>SE7</td>
<td>.679</td>
<td>.133</td>
<td></td>
</tr>
<tr>
<td>SE8</td>
<td>.681</td>
<td>.194</td>
<td></td>
</tr>
<tr>
<td>SE9</td>
<td>.722</td>
<td>.229</td>
<td></td>
</tr>
<tr>
<td>SE10</td>
<td>.635</td>
<td>.281</td>
<td></td>
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<tr>
<td>SE11</td>
<td>.714</td>
<td>.237</td>
<td></td>
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<tr>
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<tr>
<td>SE13</td>
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<tr>
<td>SE14</td>
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<tr>
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</tr>
<tr>
<td>SE16</td>
<td>.651</td>
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<td></td>
</tr>
<tr>
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<td>.616</td>
<td></td>
</tr>
<tr>
<td>OE2</td>
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<td>OE3</td>
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<td>OE4</td>
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<td>OE5</td>
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</tr>
<tr>
<td>OE8</td>
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<td>.812</td>
<td></td>
</tr>
<tr>
<td>OE9</td>
<td>.112</td>
<td>.787</td>
<td></td>
</tr>
</tbody>
</table>

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.
a Rotation converged in 3 iterations.