Exploring Changes In Computer Self-Efficacy During Graphics Skills Acquisition

Michele Dames
University of South Carolina

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EXPLORING CHANGES IN COMPUTER SELF-EFFICACY DURING GRAPHICS SKILLS ACQUISITION

By

Michele Dames

Bachelor of Arts
The College of New Jersey, 1995

Master of Arts
University of South Carolina, 2003

Submitted in Partial Fulfillment of the Requirements
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College of Education
University of South Carolina

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Accepted by:

Susan Schramm-Pate, Major Professor
Suha Tamim, Committee Member
Michele Maher, Committee Member
Tena B. Crews, Committee Member

Lacy Ford, Senior Vice Provost and Dean of Graduate Studies
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ABSTRACT

The present action research study involved a participant-researcher and her undergraduate students enrolled in the Course: Visual Arts Computing, at the University of South Carolina from 2012 to 2013. This research examined six sections of the course with an average of 20 students in each section, totaling 120 participants. The overarching Research Question for the present study was: What factors from social cognitive theory (cognitive, environmental, behavior) influenced students’ self-efficacy with computer technology in an undergraduate graphic arts course? To answer this question the participant-researcher administered a pretest and posttest of the computer self-efficacy scale by Compeau and Higgins (1995b). The course focused on learning foundational art and graphic design concepts through projects created with the graphics software, Adobe Photoshop. “Graphic Skills Acquisition” (GSA) which is associated with improved “computer self-efficacy,” was used in this action research study to increase students’ confidence levels with computers and enhance feelings of positivity when interacting with technology in general. The research showed, based on the pretest and posttest scale, GSA has the potential to influence academic student achievement, workplace productivity, and personal computer self-efficiency outside of the course. The factors identified from Bandura’s social cognitive theory were: independent learning (environmental), new and unfamiliar tasks (cognitive), and behavior modeling (behavior).
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CHAPTER ONE

INTRODUCTION

The purpose of Chapter One: Introduction is to provide an overview of the present action research study, which aimed to address the following research question:

What factors from social cognitive theory (cognitive, environmental, behavior) influenced students’ self-efficacy with computer technology in an undergraduate graphic arts course?

The present action research study involved the ways in which developed or developing societies and nations require citizens to integrate technology into everyday life and rise to the challenge of actively participating in the global digital World Wide Web. This integration involves electronic transactions across fields of communication, finance, research, transportation, education, and government (Petrina, 2000). The volume of information is increasing at an accelerating pace, adding to databases, search engines, libraries, and other resources as technological innovations continually arrive at homes, schools, and places of employment. However, do these citizens feel efficacious in actually using and integrating technology within everyday lives and professions? To answer this overarching question, the present action research study focused on and the researcher-participant investigated undergraduate students at the University of South Carolina who are involved in a visual arts computing course from 2012 to 2013.
In 2008, the Cooperative Institutional Research Program (CIRP) reported 40% of incoming first-year university students nationwide self-reported abilities of above average or in the highest 10% in computer skills. Madigan, Goodfellow, and Stone (2007) surveyed first year students at a large university and reveal “students are actually less skilled than they perceive” (p. 413). First year college students are presumed to be technologically advanced and possess high computer self-efficacy, however in reality introductory skills are weak (2007).

Technology elevates education by increasing control and access to support individual potential. Through educational tools and software, learners can be tracked through metrics and assessments customized from independent needs (Collins, 2009). These educational technologies may be visual, oral, or computer-based, with portability options through an array of devices. These advanced instruments collect rich data which can inform decisions involving students, educators, administrators, professionals, and business people.

**Bandura’s Social Cognitive Theory**

How efficacious do visual art students feel when it comes to utilizing and integrating technology? The present study was based on the work of psychologist Albert Bandura (1986; 1991; 1997) who asked questions regarding the human power to steer personal choices in education and life. Bandura argued efficacy acts as the gatekeeper for every individual educational journey and progress is moderately dependent on unique conscious self-assessments. Skills are the acquisition of knowledge, facts, and processes independent from self-efficacy, which is what an individual believes can be accomplished with those skills.
Self-efficacy is rooted in social cognitive theory, a concept involving three major classes of interactive determinants: cognitive and personal factors, behavior, and environment. Cognitive and personal factors include beliefs, values, outlook, and lessons learned from triumphs and failures. Behavior is built from continuous interactions and reactions, individual experience, and noticing the behavior of others. The environmental components include tangible habitats as well as what people, culture, and atmosphere exist inside.

Cognition, behavior, and environment function “interactively as determinants of each other” in a cycle of reciprocal determinism (Bandura, 1986, p. 23). Therefore, thoughts and feelings lead to behaviors and attract people to specific locations; a student interested in drawing may enroll in an art course. An efficacious student may enroll in a particular course expecting success. Environment has the potential to shape behavior when the efficacious student realizes personal shortcomings, struggles in the class, and changes the level of effort. Finally, surroundings can alter behavior when the course is in the evening hours and the student is a morning person.

It is evident movement in one part of the triad influences the other components with returned effort, but not necessarily at the same time or with equal strength (Bandura, 1986). A person trying to lose weight fails with cognition alone because behavioral changes, such as exercise and monitoring the environment are crucial pieces. Experience in the form of unhealthy habits, may impact effort when a person with an eating disorder attempts to lose weight with distinct environment, cognitive, and behavioral challenges.

The present study was based within the work of social cognitive theory (Bandura 1986; 1991; 1993) and argues learners who aim to think individually, understand, and guide their own educational experience identify as more efficacious. This base and
framework contends traditional one-sided classroom environments do not engage learners or allow independent thinking and therefore fail to maximize the educational experience. Freire (1970) described this as the “banking concept of education,” where students are empty accounts and simply receive what the teacher deposits (p. 72). Dewey (1933) indicated collecting facts and data alone does not develop learning habits, a deeper thirst for continued knowledge, or the motive to be an active participant in society (Dewey, 1933). Bandura (1986; 1991; 1993) discussed social cognitive theory and self-regulation, the process of empowerment through concentrating attention on efforts and directing efforts towards set goals.

The participant-researcher of the present study advocated democratic classroom methods fostering the growth of self-efficacy and empowering the student during GSA. Bandura (1991) stated experience as the most powerful influence on self-efficacy and the course structure provides substantial time for interaction with the graphic software, Adobe Photoshop. The course met for 2 hrs 45 min twice a week and the computer lab classroom was available for extra time. Independent work time was encouraged and students worked at various paces and made decisions about what projects to concentrate on. The projects allowed the students a lot of creative freedom and expression. The student voice was essential to individual progress and was treated with value and worth, observing and encouraging self-examination, promotion, and self-efficacy.

**Compeau and Higgins Scale**

The present action research study was not only based on Bandura’s social cognitive theory and self-efficacy, but also on a scale designed to measure computer self-efficacy. Computer self-efficacy is defined as where self-efficacy, technology, and education intersect and consider “a judgment of one’s capability to use a computer”
In the present action research study, the participant-researcher identified low computer self-efficacy in undergraduate students during graphics skills acquisition (GSA). Evidence of low computer self-efficacy was identified through observation and reflective entries, then the participant-researcher explored options to potentially assist the students.

The Compeau and Higgins’s (1995b) Scale was used by the participant-researcher to determine if GSA impacted the participants’ computer self-efficacy. The participant-researcher chose this particular scale since previous research suggests a positive relationship between GSA and computer self-efficacy in preservice teachers (Chu, 2003), military trainees (Downey & Zeltmann, 2009), and non-traditional students (Hasan, 2003). These students were similar to the group of participants in the present study. In particular, the present study examined 120 undergraduates enrolled in six sections of the Visual Arts Computing Course at the University of South Carolina over the years 2012 - 2013.

**Statement of the Problem**

Karsten and Schmidt (2008) report college students have low computer self-efficacy; the participant-researcher in the present study identified low computer self-efficacy in her college students. This problem was identified through observation and reflective writings of some undergraduate art students enrolled in the Course: Visual Arts Computing at USC. This Course focused on learning foundational art and graphic design concepts through projects created with the graphics software, Adobe Photoshop.

The participant-researcher of the present action research study identified the problem through observation and journal entries where her students in her Visual Arts Computing course at USC reported on progress and if any material was unclear. For
example, one student expressed concern with the pace of the instruction and memory, stating difficulty with working quickly enough or remembering the steps to complete a task. Another student shared feelings of confusion and struggle with the graphic software.

This feedback prompted the participant-researcher to explore options to potentially assist the students. A lack of computer self-efficacy negatively impacts the will to pursue difficult tasks and persist, both important to academic achievement (Bandura, 1977, 1997; Torkzadeh & Van Dyke, 2002). Computer self-efficacy has been shown to have a significant, positive relationship with academic self-efficacy (Jan, 2015).

Venkatesh and Davis (1996) discussed the need to design effective training in an effort to improve user acceptance and computer self-efficacy. The research utilized the Compeau and Higgins (1995b) computer self-efficacy scale at two different points in time to determine if changes occurred in undergraduate students enrolled in an introductory systems course. Following Venkatesh and Davis (1996), the participant-researcher of the present action research study began using this scale at the beginning and end of each semester from 2012-2013 to investigate the relationship between GSA and computer self-efficacy in her students. The participant-researcher of the present action research study examined six sections of the course with an average of 20 students in each section, totaling 120 participants.

**Justification for the Study**

Individuals with higher computer self-efficacy have less anxiety, more confidence, and increased positivity when interacting with technology (Conrad & Munro, 2008; Morris & Thrasher, 2009). These benefits can influence everything connected to technology including academic student achievement, workplace productivity, personal efficiency, and life occurrences in a gratifying way. This supports a need to develop and
raise computer self-efficacy to foster engaged, curious, independent, and confident digital citizens.

Computer self-efficacy has the potential to be strengthened through experience and training, (Cassidy & Eachus, 2002; Chu, 2003; Brinkerhoff, 2006; Beas & Salanova, 2006) especially if the participant sees the relevance and connects the new knowledge to future success (Albion, 2001). Early research in this field is rooted in business, originating from researchers in the 1970s noticing resistance to new machines and then attempting to identify what components drive a person to adopt or reject technology (Compeau & Higgins, 1995b). This background prompted focused research on business applications and often suites of programs including graphics or presentation software. Studies on these suites indicated a significant positive relationship between graphics and presentation software and computer self-efficacy (Chu, 2003; Downey & Zeltmann, 2009; Hasan, 2003).

Individuals often have less experience with graphics software and Bandura (1986) noted challenging and unfamiliar tasks have the strongest influence self-efficacy. Productivity software is often taught first, such as word processing software so individuals understand the basics before moving to more advanced software. The nature of art and design is interdisciplinary and activates thinking skills in visual drawing, planning and drafting, math, and computer science (Ettinger, 1988). Graphics have the potential to form and increase computer self-efficacy and trainers and educators should provide more opportunities for interactions with this area of study (Busch 1995; Hasan 2003). This earlier research found connections between graphics and computer self-efficacy using standard graphic software, such as Microsoft PowerPoint. The present study was concentrated the advanced graphics program, Adobe Photoshop, a
comprehensive and powerful graphics program considered the industry standard for image manipulation (Clawson, 2015; Cookman, 2003).

**Action Research Methodology**

The present action research study is a systematic inquiry designed to gain knowledge about a singular situation (Mertler, 2013). Undergraduate students enrolled in the course, Visual Arts Computing at the University of South Carolina were studied. Data from the Compeau and Higgins (1995b) computer self-efficacy scale were analyzed.

The participant-researcher of the present action research study was also the instructor of the visual graphics computing courses at USC and the 120 undergraduate students who were examined. Mertler (2013) states an action research approach is commonly used in educational research and provides the opportunity to preserve the actions of real events. The participant-researcher administered the Compeau and Higgins (1995b) scale in 2012 after identifying low computer self-efficacy through observing and reflective writings for two years.

The participant-researcher of the present action research study used the ten item scale designed by Compeau and Higgins (1995b) based on social cognitive theory and computer self-efficacy. The first part of each question asked respondents in the present action research study to anticipate abilities on a computer task through a fictitious scenario, reading “I could complete the job using the software package… […]if I had…” The second part involved participants completing the sentence with options for support such as the software manual, additional time, and human assistance. Participants indicated personal level of confidence based on the varying degrees of support and what would be more helpful (see Appendix A). The Scale is also designed to push the
participants to consider future behavior as opposed to prior past proficiencies (Bandura, 1986; Compeau & Higgins, 1995b).

The data for the present study collected from the Computer Self-Efficacy Scale was examined using Microsoft Excel and the Statistical Package for the Social Sciences (SPSS). The present action research study used a single group pretest posttest design. Data was analyzed using a paired sample t-test conducted to compare the change between pre-post scores of the computer self-efficacy scale. Six sections of the course were analyzed to verify results and recognize trends within the local and particular student population studied.

**Research Question**

What factors from social cognitive theory (cognitive, environmental, behavior) influenced students’ self-efficacy with computer technology in an undergraduate graphic arts course?

**Purposes of the Study**

The primary purpose of the present action research study was to investigate if the use of graphics software impacts computer self-efficacy as previous research suggests (Chu, 2003; Downey & Zeltmann, 2009; Hasan, 2003). Factors influencing computer self-efficacy during graphic skills acquisition were identified by the participant-researcher from Bandura’s Social Cognitive Theory (i.e., cognitive, environmental, behavior factors).

The secondary purpose of the study was to recognize trends within the local and particular student population studied since individuals with higher computer self-efficacy have less anxiety, more confidence, and increased positivity when interacting with technology (Conrad & Munro, 2008; Morris & Thrasher, 2009). The tertiary purpose of
the study was to report on the advanced graphics program, Adobe Photoshop. This comprehensive program is considered the industry standard for image manipulation (Clawson, 2015; Cookman, 2003). The final purpose is to report the results of the Compeau and Higgins (1995b) computer self-efficacy scale used to determine the factors which influenced computer self-efficacy with the 120 undergraduates.

**Additional Theory**

In previous research, Chu (2003) found frequent use of computer graphics and presentation software to be a strong predictor of computer self-efficacy. Downey and Zeltmann (2009) researched the relationship between six different software packages and computer self-efficacy. Results showed a strong correlation with graphics presentation software (Microsoft PowerPoint) and the high competency group, which also had higher computer self-efficacy. Hasan (2003) investigated specific types of computer experience and found a significant positive relationship between individuals with graphics applications experience and computer self-efficacy beliefs.

These positive connections between graphics and computer self-efficacy support a need to increase experience with graphics software to raise computer self-efficacy. Research shows users report the least amount of experience with graphics software compared to other applications (Hasan 2003; Wilfong 2006). Bandura (1986) stated new and intriguing tasks are the most influential on self-efficacy. Focused inquiry on an advanced graphics program, specifically Adobe Photoshop, has not been examined and the present study intended to give attention to this under researched area.

**Definitions of Terms**

The following definitions are for the purposes of this study:
1. Art Studio: This is an area of study within the Art Department at the University of South Carolina encompassing the making of art in a studio setting. Graphic design, computer graphics, photography, ceramics, painting, and illustration are included in art studio. Art studio classes typically meet for longer class period because the intent is to have studio resources to work with in an extended time frame. Additional areas of study in art may include art history, media arts, and art education (Art Department, 2016).


3. Graphics: An image created or edited through using a computer. Graphics software may refer to a generic program included with the computer, within an application suite (Microsoft PowerPoint), or an independent application. The present study researched an advance graphics program called Adobe Photoshop, this may be installed as part of the Adobe suite.

4. Self-Efficacy: A psychological term referring to an individual’s belief in personal abilities. “Expectations of personal efficacy determine whether coping behavior will be initiated, how much effort will be expended, and how long it will be sustained in the face of obstacles and aversive experiences” (Bandura, 1977, p. 191).

**Researcher’s Positionality**

The participant-researcher of the action research study was also the instructor in the courses examined between 2012–2013. As the participant-researcher, my underlying assumption is individuals, educators, and trainers should enhance and improve computer self-efficacy. This assumption implies people strive to be active and engaged in a
technological environment and as part of a global digital citizenry also known as the World Wide Web. The participant-researcher assumes students are honest in answering the questions on the Computer Self-Efficacy Scale developed by Compeau and Higgins (1995b). The participant-researcher also assumes the majority of the 120 undergraduate students who participated in the present action research study desire a democratic classroom where students strive for ownership and yearn to be more than spectators in the learning process while increasing self-efficacy in computer technology.

As the participant-researcher in the present action research study, I considered my insider/outsider status in regards to position, power, and knowledge construction (Merriam, et al., 2001). My insider access allowed me to reach my community of graphic arts students and create a dialog about the subject matter; as a former graphic arts student myself, this was very rewarding. I believe my own computer self-efficacy, graphic arts, and Adobe Photoshop experience worked as positive modeling for the students. I strived to create an open, safe, classroom environment where students were encouraged to ask questions and experiment.

My outsider professor status clearly marked me as authoritative, non-peer, and other. These undergraduate students often remarked about my vast knowledge of Adobe Photoshop and often voiced frustration about never reaching my level of expertise. As an outsider, I was considered the expert who everything comes easy to. The considerable age difference between myself and these student participants also confirmed my outsider status.

I was comfortable switching between insider and outsider positions because it gave me great insight from within and perspective from afar. As the participant-researcher, I often reflected on my position through the research process and remembered
the present action research represents only one local and particular situation in one local and particular course. I aimed to report accurate data not altered or filtered through my personal lens and to minimize participant-researcher bias.

The participant-researcher of the present action research study considered ethical issues and the special needs of the population being studied. Individuals in the present study were treated with respect and participation in class activities were encouraged. The surveys were not required for the class and data collected was used for feedback, not for any grading. This action research was reviewed by the USC Institutional Research Board (IRB) and exempt from human subject research.

All research may be impacted by additional independent variables, potentially altering the dependent variable (Johnson & Christensen, 2000). In the present action research study, the 120 undergraduate student respondents engaged in other technology interactions, which may have possibly altered computer self-efficacy. To maximize validity all responses occur in a formal classroom instruction setting. The Compeau and Higgins (1995b) computer self-efficacy scale was distributed, completed, and collected immediately and then stored in a secure location.

Limitations

The present research study was limited to one course over six different sections of the course in 2012 and 2013 in the Art Department at the University of South Carolina. Undergraduate student participants were the research subjects and the participant-researcher was the professor of record for the course in each section offered between 2012 and 2013. Therefore, a limitation of the present study involves this select group of students who were aware of completing a task for an authority figure (the participant-researcher) responsible for reporting the final grade in the course.
Participants enrolling in a graphics course may have a more positive attitude about the subject matter and could have previous experience with photography, journalism and school newspapers, altering individual perspective and computer self-efficacy (Cookman, 2015). The course involved learning foundational art and graphic design concepts through projects created with the graphics software, Adobe Photoshop. Research on one software package is also a limitation of the present study. In addition, all data is collected in evening courses and this may impact results if individual cognitive resources are depleted late in the day.

**Scope**

The present action research study aimed to determine what factors originating from social cognitive theory influence computer self-efficacy during graphics skills acquisition by using the Compeau and Higgins (1995b) scale. Student-participants were undergraduate students enrolled in a graphic arts course at the University of South Carolina. Results found from the present action research study regarding the relationship of the students’ skills development to computer self-efficacy can recognize trends within the local and particular student population studied.

**Significance of the Study**

The present study describes a local and particular graphic arts course in higher education and identifies what factors influenced the development of computer self-efficacy in 120 student-participants. The present study examined computer self-efficacy in undergraduate students enrolled in the course, Visual Arts Computing at the University of South Carolina.

Previous studies showing connections between GSA and computer self-efficacy researched standard graphic software, such as Microsoft PowerPoint (Downey &
Zeltmann, 2009; Hasan, 2003). The present study involved focused inquiry on an advanced graphics program, Adobe Photoshop. This comprehensive program is considered the industry standard for image manipulation (Clawson, 2015; Cookman, 2003). Identifying factors influencing the development of computer self-efficacy can help recognize trends within the local and particular student population studied. Increased computer self-efficacy equals less anxiety, more confidence, and higher positivity when interacting with technology (Conrad & Munro, 2008; Morris & Thrasher, 2009).

**Knowledge Generation.** Improving GSA and computer self-efficacy fosters technological literacy so students can gain the knowledge necessary to find credible information and learn. This is especially essential with the growing amount of data on the Internet students need to identify, navigate through, and evaluate for validity. Digital skills are also crucial for daily employment tasks, registering for a class, financial management, and communicating inside and outside of work.

**Professional Application.** Society and educational institutions often assume a direct correlation to youth and technology, however sometimes students inflate internal technological knowledge. First year college students are “assumed to possess a high degree of technological sophistication” when in reality individual introductory skills are weak (Madigan, Goodfellow, & Stone, 2007, p. 410). This contributes to teachers and trainers making assumptions about starting knowledge, forming irrelevant curriculum, and reporting inaccurate results about what has been gained and achieved in the environment. In contrast, teachers and trainers who can discern what factors influence computer self-efficacy can be more prepared to teach and develop positive attitudes and confidence (Oliver & Shapiro, 1993).
Understanding changes in computer self-efficacy can help moderate and guide curriculum, adjusting for students with low and high levels. Oliver and Shapiro (1993) proposed advanced tasks for those who are prepared and need extra stimulation while providing encouraging activities for students who need support and direction. This customized curriculum aligns with Dewey (1900; 1902; 1910; 1922; 1934) and Friere (1970) through forming a learner centered atmosphere where students are involved participants.

Businesses who hire recent graduates and working adults with high computer self-efficacy could potentially save time and money on training in addition to becoming more efficient and profitable (Morris & Thrasher, 2009). Prior knowledge about computer self-efficacy of employees can supply organizations with an estimate of current skills and how much training may be needed, both vital for resource and project planning (Kher, Downey, Monk, 2013). Organizations will be able to understand more about what workers are technologically capable of and formulate personal growth plans for professional development. Developing computer self-efficacy for current workers is worthwhile because employees are valuable human resources, a productive and experienced group in an ongoing use content (Deng, Doll, & Truong, 2004). Individuals are more engaged when training is found to be personally relevant and Albion (2001) stated the training content needs to emphasize the importance of computers to accomplish future successes.

**Social Change.** When computer self-efficacy grows, it builds a foundation for confidence with technology and future successes, leading to expanded adoption of information technology throughout schools and businesses. A person is more inclined to do something achievable; Potosky (2002) asked “who is likely to learn to use computers
and new software [?] People who think they can” (p. 242). Expanding computer self-efficacy fuels education and economic success as technology infuses communication, finance, health care, transportation, academics, and business.

Increased computer self-efficacy can also assist in closing the digital divide, the space separating those who have technology to use and learn from, with those who have limited to no access (Servon & Nelson, 2001). Those with less experience have lower computer self-efficacy and higher levels of anxiety about technology. Servon and Nelson (2001) promote education through community technology centers, a location where novice users can learn basic skills and build computer self-efficacy.

**Findings of the Present Study**

Findings include factors identified from Bandura’s social cognitive theory involving:

1. Environmental: Independent Learning
2. Cognition: New and Unfamiliar Tasks
3. Behavior: Behavior Modeling

**Summary**

This present study identified factors and provided information to assist in developing methods to foster and grow computer self-efficacy in a graphics context. An important factor in modern society, computer self-efficacy contributes to constructive use of information systems in educational and professional environments (Stephens, 2006). The Compeau and Higgins (1995b) computer self-efficacy scale from several semesters of a graphic arts course provide data for analyzing. Action research methods were
administered to answer the research question and generate knowledge. The research showed based on the pre-and posttest scale, GSA has the potential to influence academic student achievement, workplace productivity, and personal computer self-efficiency outside of the Course.

Chapter One presented theoretical background and terminology while introducing the problem, purpose, and research question. Chapter Two contains a detailed literature review on the history of computer self-efficacy, the sources, and findings in previous studies. Chapter Three is the methodology and includes information about the Action Research, theoretical framework, participants, and data analysis. Chapter Four reports the detailed results of the research and Chapter Five provides a summary discussion and suggests areas for future research.
CHAPTER TWO
LITERATURE REVIEW

The purpose of Chapter Two: Literature Review is to describe the literature associated with computer self-efficacy which influenced the present study. Information presented here is used to address the following research question:

What factors from social cognitive theory (cognitive, environmental, behavior) influenced students’ self-efficacy with computer technology in an undergraduate graphic arts course?

The present study explored graphic skills acquisition as related to computer self-efficacy over the academic years 2012-2013 in a graphic arts course with undergraduate students at the University of South Carolina. The students were exposed to the program Adobe Photoshop in the course. The sources of efficacy, early computer studies, physiological states and methods of measurement are discussed in this Chapter Two which also provides the context of the methodology and establishes the need for further exploration into graphics and computer self-efficacy.

Problem Statement

The participant-researcher of the present action research study identified low computer self-efficacy as a problem in her classroom. This problem was identified through observation and journal entries of undergraduate students enrolled in her graphics arts course. This prompted the participant-researcher to explore options
through action research methods to better her teaching and increase students’ computer self-efficacy.

Previous research showed computer self-efficacy can be strengthened through experience as well as training (Cassidy & Eachus, 2002; Chu, 2003; Brinkerhoff, 2006; Beas & Salanova, 2006). Additional studies indicated a significant positive relationship between graphics and computer self-efficacy (Chu, 2003; Downey & Zeltmann, 2009; Hasan, 2003). The participant-researcher began to administer the Compeau and Higgins (1995b) computer self-efficacy scale to gain knowledge for developing an action plan to incorporate change and improve her teaching practice.

**Purpose Statement**

The purpose of the present action research is to describe the undergraduate students’ self-efficacy in a computer graphic arts course. The secondary purpose is to administer a scale developed by Compeau and Higgins (1995b) to align with Bandura’s (1977) social cognitive theory. This scale considers the various determinants of social cognitive theory (cognitive, behavior, environment) and two of the dimensions of self-efficacy, magnitude (level) and strength.

Chapter Two also focuses on “experience,” the most influential source of computer self-efficacy and also the most frequently studied. The research presented in Chapter Two certified the power of experience and specifically examined confidence, environment, emotion, and the relationship with different types of experience, including graphics. Evidence in this literature review demonstrated the need for dedicated research in the area of graphics and computer self-efficacy. Studies including graphics, reporting intriguing findings, or calling for further exploration in this area are also discussed.
Social Cognitive Theory

Social cognitive theory examines human development including thought, motivation, and action to steer life choices (Bandura, 1986). This theory proposes individual behavior is not a pure result of static thoughts, instinctive responses, or pressure from outside influences. Bandura (1986) explains social cognitive theory drives people through three major classes of interactive determinants: cognitive or personal factors, behavior, and environment.

Cognitive and personal factors include beliefs, values, outlook, and lessons learned from triumphs and failures. Behavior is built through individual continuous interactions, the results of those actions, personal observations, and reflection. The environmental components include tangible habitats as well as items and people who exist inside the area.
The triad of cognition, behavior, and environment function “interactively as determinants of each other” in a cycle of reciprocal determinism (Bandura, 1986, p. 23). Thoughts and feelings lead to behaviors and draw people to specific locations, thus a smoker may frequent a restaurant where smoking is permitted on the outside patio. Environment has the potential to shape behavior when a child learns what is acceptable or not satisfactory through family and region. Also, environment can alter behavior when a talkative person enters a library or a quieter person attends a boisterous sporting event.

Bandura (1986) states movement in one part of the triad influences the other components with returned effort, but not at the same time or with equal strength. A person attempting weight loss will likely fail with cognition alone because behavioral changes, such as exercise and monitoring the environment are crucial pieces. Experience in the form of unhealthy habits, may impact effort when a person with an eating disorder attempts to lose weight with distinct environment, cognitive, and behavioral challenges.

The triad of reciprocity grows with the principles of self-regulation, a motivational process of observing, guiding, and shaping efforts to promote advancement to desired goals. This self-regulation cycle creates constant review with an internal pulse and the ability to strategize when necessary. Bandura describes this as an “ongoing exercise of self-influence” (Bandura, 1991, p. 248).

Self-Efficacy

Self-efficacy is a component of social cognitive theory involving, “people’s judgments of their capabilities to organize and execute courses of action required to attain desired types of performances” (Bandura, 1986, p. 391). Bandura (1986) expresses self-efficacy is not individual actions or abilities but rather what a person believes can be
accomplished with those attributes. Efforts will be met with resistance and failures and those with strong self-efficacy will persevere.

Personal assessment of task ability determines self-efficacy while belief about the task result is regarded as outcome expectation (Bandura, 1986, 1997). Decisions concerning what to engage in and how committed an individual will be are made in conjunction with self-efficacy (Compeau & Higgins, 1995b). Individuals guide thoughts into believing “a given course of action will cause a given outcome (outcome expectation), yet question whether or not they can carry out the action (efficacy)” (Oliver & Shapiro, 1992, p. 82). For example, a person who considers herself a bad speaker imagines delivering an incoherent presentation. People are more compelled to attempt an activity if the outcomes have clear and positive benefits; the potential gains from the outcomes could be material, sensory, token, or social (Bandura, 1986, 1997).

**Efficacy dimensions.** These individual evaluations of self-efficacy fluctuate by level, strength, and generality (Bandura, 1986, 1997). Magnitude or level relates to how hard a task is and if a person believes it can be accomplished. For instance, an individual may feel intimidated by an arduous task but comfortable and confident with an easy task. Each potential task is evaluated and judged therefore every assessment will vary in strength. These evaluations are substantiated by positive and negative feedback from experiences. Self-efficacy generality is rooted in situations and circumstances therefore perceptions may not be transferrable.

**Sources.** Bandura (1977, 1997) identifies four primary sources for self-efficacy: enactive experience, vicarious experience, verbal persuasion, and physiological state. Enactive experiences (referred to as performance accomplishments in earlier work) are
developed through practice, succeeding and failing, on the way to mastery. Vicarious experience shows individuals difficult things are possible through modeling; observing successes in someone similar helps the person believe in personal abilities and future achievements. Verbal persuasion through positive oral feedback encourages and motivates people. Physiological states (emotional arousal in earlier work) are the influence of feelings such as anxiety on self-efficacy.

Various factors can contribute to each source of self-efficacy, such as behavior modeling to vicarious experience, suggestion to verbal persuasion, and attribution to physiological states. Bandura (1977) advises contributing factors are not exclusive. For example, relaxation as a source most likely contributes to self-efficacy through physiological state. However, a relaxed state may strongly influence an experience.

**Enactive/Vicarious experience.** Enactive experiences are any activities directly involving individuals through participation and learning through doing. These activities have the most powerful impact on self-efficacy, built during triumphs and reduced when facing defeats. Multiple negative exchanges can deflate positive beliefs efficiently however instant abundant achievement produces high expectations and a presumption such trend will continue. When experiencing several successes, inevitable failures can surprise and confuse individuals who will withdraw and surrender responsively. Self-efficacy requires cultivation through positive and negative experiences and the recognition these do not have to paralyze progress. Perseverance is imperative to improve self-efficacy and enable individuals to discover what can be accomplished with maintained drive (Bandura, 1977).
Vicarious experience is acquired through indirect learning experiences such as reading, observation, or modeling. These build self-efficacy for individuals because it provides the opportunity to stay protected while witnessing model behavior free from potential harm. Observation instead of participation is less reliable in generating self-efficacy, yet spectators can view from a safe area and gain valuable knowledge about the task and standard expectations (Bandura, 1997). The chief benefit of modeling is people gain new perspectives on personal capabilities which previously had no reference for comparison (Bandura, 1997; Bandura & Jourden, 1991; Wood, 1989).

**Verbal persuasion.** Verbal persuasion from others is a popular method of increasing self-efficacy. Although simple and convenient to deliver, this approach may not always be accepted by the recipients with reservations about personal abilities. Bandura (1997) states the strongest contributor to self-efficacy is the authentic self, but when additional people express confidence in someone it can help quell personal doubts. A conflict arises when the individual dismisses the message shared because it challenges personal negative and low beliefs about abilities. Great success can arrive from reasonable and rational suggestions the person finds attainable and therefore accepts (Bandura, 1997).

**Physiological states.** Physiological and affective states are the final and least powerful source of self-efficacy; often occurring when difficult situations trigger and breed anxiety, impacting abilities and self-confidence (Bandura, 1997). These uncomfortable feelings often begin early in anticipation of the upcoming situation and the powerful emotions commonly grow to a degree which surpasses the prompt. For example, a person with social anxiety may build strong concerns and obsess for weeks
about an upcoming event. This may be similar to an athlete experiencing heightened pain before an extremely competitive game. This preliminary behavior is likely to create more anxiety than the occasion itself would warrant. Bandura (1997) states some physiological states, although individualized and highly unique, can be moderated through stress reduction, healthy lifestyle, and connections to others.

**Effects.** Self-efficacy gains more recognition as researchers realize the impact it has on various situations including learning, careers, academics, and health. Bandura and Schunk (1981) examine self-motivation and goal setting to report student “persistency increased the likelihood of success” and self-efficacy worked like an omen for achievement (p. 596). Several studies establish substantial positive relationships between academic areas and self-efficacy (Multon & Brown, 1991; Schunk & Ertmer, 1990; Wood & Locke, 1987).

Additional work examines behaviors such as weight management and states self-efficacy is “an important mediating mechanism” (Clark, Abrams, & Niaura, 1991, p. 739). Research also discovers women with low self-efficacy neglect personal talents and choose to not pursue potential career choices (Hackett & Betz, 1981). These studies are a small representation of early self-efficacy studies. At this point it is evident self-efficacy has tremendous power to impact personal choices.

**Computer Self-Efficacy**

The self-efficacy research of Bandura and others begins to be applied to computers. Bandura (1978) defines self-efficacy as a “judgment of one’s ability to execute a certain behavior pattern” (p. 240). Computer self-efficacy is defined as “a judgment of one’s capability to use a computer” (Compeau & Higgins, 1995b, p. 192).
Self-efficacy involves making personal estimates about performance pertaining to future events (Compeau, 1992). These judgments go beyond smaller “component acts” such as how to start or shift a car and consider overall behavior or “generative capabilities” like navigating difficult traffic (Bandura, 1986, p. 397). Similarly, computer self-efficacy is not pertaining to an individual’s computer skills, but rather the power to collectively utilize those skills to accomplish a task (Compeau, 1992).

Personal assessments of self-efficacy will vary by level, strength, and generality (Bandura, 1986, 1997). A person appraises self-efficacy level by thinking about how hard a task is and if it seems possible to accomplish it. Challenging tasks may intimidate while easier tasks appear to be within reach and more achievable. Strength is formed when possible tasks are evaluated and judged; these are substantiated by positive or negative feedback and past experiences. Self-efficacy generality is rooted in situations and circumstances, therefore perceptions may not be transferrable.

Self-efficacy is rooted in social cognitive theory, where cognitive, behavioral, and environment determinants exist in an ongoing reciprocal relationship. This theory proposes decisions and actions are not merely based on individual factors such as knowledge, skills, and motivation but rather in conjunction with self-efficacy acting as gatekeeper. Bandura (1977) claims “choice behavior and effort expenditure are governed in part by percepts of self-efficacy rather than by a drive condition” (p. 203).

**History.** Computer self-efficacy has a strong base in business and management information science (MIS) disciplines. “Understanding the factors that influence an individual's use of information technology has been a goal of MIS research since the mid-1970s, when organizations and researchers began to find the adoption of new technology
was not living up to expectations” (Compeau & Higgins, 1995b, p. 189). Any
information learned about why individuals accept or reject technology had the potential
to streamline processes and conserve capital where substantial amounts of money can be
invested into systems the users refuse to use (Venkatesh & Davis, 1996). For example,
research is conducted on assembly line workers (Rozell & Gardner, 1999), business
executives, and employees (Burkardt & Brass, 1990). Early research from prominent
computer self-efficacy researchers Compeau and Higgins (1995b, 1999) gather data from
subscribers of a business periodical.

Computer self-efficacy research also occurs in higher education environments.
Torkzadeh and Koufteros (1994) found an increase in computer self-efficacy post
training in undergraduates enrolled in an introductory computer course. Employees at
several large state universities (Gist, Schwoerer, & Rosen, 1989; Harrison & Rainer,
1992, 1997) and undergraduates in computer courses have been investigated to learn how
to enhance computer self-efficacy (Ertmer, Evenbeck, Cennamo, & Lehman, 1994;
Karsten & Roth, 1998). Undergraduates in business, education, nursing (Kinzie,
Delcourt, & Powers, 1994), psychology (Mitchell, Hopper, Daniels, George-Falvey, &
James, 1994), and graduate business students (Davis, Bagozzi, & Warshaw, 1989) were
also used as subjects in computer self-efficacy research. Undergraduates in an art or
graphics context are underrepresented in the research and the present study aimed to
address this gap.

**General and task specific.** Computer self-efficacy research primarily studies
general computer self-efficacy however there are other perspectives; selected
contributions related to the present study will be identified here. Marakas, Yi, and
Johnson (1998) introduce a division of computer self-efficacy into two categories. The category of general computer self-efficacy (GCSE) is defined as spanning many applications and is gathered over time. Task specific computer self-efficacy (TSE) broadly encompasses an application (specific) or a particular work activity (task).

Agarwal, Sambamurthy, and Stair (2000) propose software-specific self-efficacy (SSE), defined as a person’s “feeling of self-efficacy relative to a specific software package” (p. 422). This construct asks subjects to demonstrate proficient and successful use of specific features of software packages. Downey and McMurtrey (2006) introduce summative general computer self-efficacy (SGCSE), which is task based and combines results from “specific self-efficacies of computer activities” (p. 385). Subjects are asked to evaluate personal capabilities over six sub-domains by agreeing or disagreeing with statements like, “I believe I have the ability to cut, copy, and paste in a word processing document” (Downey and McMurtrey, 2006, p. 393.). The results from these questions about specific computer self-efficacy and used to form summative general computer self-efficacy (SGCSE).

These constructs all support expanded computer experiences, which naturally supplements general computer self-efficacy. The specific method is debated to be essential for measuring the degree of self-efficacy as it correlates to a detailed task or application, whereas general measures are considered crucial for generality and static results (Torkzadeh, Chang, & Demirhan, 2006). Specific (SCSE) produces fast, immediate results and advancement, while general (GCSE) develops gradually as overall computing knowledge increases (Agarwal, 2000; Marakas, Yi, & Johnson, 1998).
Guinea and Webster (2011) report task self-efficacy affects computer self-efficacy more if one operation is familiar and one is new. Personal assessment on a specific task may be higher if the general software context is familiar. Conversely, the general computer self-efficacy could also be higher if a computer task is recognized. If a task or software package are new to a person, the individual will spend more time analyzing and preparing skills before moving forward (Gist & Mitchell, 1992). With this discovery Guinea and Webster (2011) recognized computer self-efficacy modifications “do not occur in a vacuum, but in the context of a task” (p. 978). The present study involved the graphics program Adobe Photoshop and how it impacts general computer self-efficacy as defined by Compeau (1992). Data from the Compeau and Higgins (1995b) computer self-efficacy scale, a general construct, will be analyzed.

**Experience.** Bandura (1977, 1997) states experience is the strongest source of self-efficacy and it is widely studied in relation to computer self-efficacy. One of the earliest studies finds consenting, novice users with little computer experience as fearful and intimidated because the unfamiliar brings discomfort (Hill, Smith, & Mann, 1987). Despite good intentions and a motivation to learn, results found students with low self-efficacy were less likely to enroll in computer courses. These individuals are discouraged when sensing a lack of control and inability to regain it. The research concludes experience alone will not impact future individual computer usage, but rather efficacy must be altered (Hill, Smith, & Mann, 1987).

**Vicarious Experience.** The concept of computer self-efficacy is also explored through vicarious experience as Gist, Rosen, and Schwoerer (1988) study various training methods to assist users with learning to work with computers and the growing amount of
technology in the workplace. Modeling achieved the greatest results and allowed users to expand trust in personal potential. Bandura (1977) reported subjects achieved higher skill development through modeling than other techniques; modeling also benefitted people who started with high self-efficacy. Training incorporating behavior modeling is shown to influence computer self-efficacy more than traditional lecture methods (Moos & Azevedo, 2009).

**Types and time.** The dynamic relationship between experience and self-efficacy is affected by the type, time, and variety of exposure. An assortment of software experiences produces a positive relationship with computer self-efficacy (Cassidy & Eachus, 2002; Chu, 2003). Acquiring a high quality and wide variety of skills promotes liking, and people who devote more time to computers identify as more knowledgeable (Beckers & Schmidt, 2003). The nature of computer self-efficacy is alive and active, requiring nourishment and reinforcement through technical participation.

One recommendation encourages a prescription of more than three computer training courses, each covering a separate software application to increase computer self-efficacy (Havelka, 2003). As expected, more computer courses also contributed to higher computer self-efficacy, especially classes covering spreadsheets and databases (Albion, 2001). The work of Johnson (2005) agreed, it proved users with database software experience have higher application specific computer self-efficacy. Students who reported more hours per week of total computer use had higher computer self-efficacy (Albion, 2001).

Salanova, Grau, and Llorens (2000) study workers at five different companies and report a positive relationship between computer use times and computer self-efficacy.
The high efficacy group also exhibited low levels of burnout or disinterest in work; this supports the connection between self-efficacy, confidence and perseverance. Havelka (2003) researches the impact of years of usage, computer courses, and number of software or packages or programming languages learned. Results suggest a positive correlation between years and software self-efficacy with the largest positive correlation in computer self-efficacy between participants reporting over five years of experience.

Kher, Downey, and Monk (2013) conduct a longitudinal investigation to determine how long training needs to be in order to increase computer self-efficacy. This research learned the ideal length of training is two and half months noting the nonlinear growth process is slow to start with the biggest change occurring in the last half of the time period. After about two months computer self-efficacy had improved and any additional time beyond allowed for the benefits to be applied (Kher, Downey, & Monk, 2013). Brinkerhoff (2006) attributes substantial growth to the longer format of a structured technology academy where participation included instruction, projects, and exercises. The surveys in the present study were given at the beginning and end of a semester spanning approximately 15 weeks (3 months and a half months).

Karsten and Schmidt (2008) report over 80% of business students use a computer daily, but increased usage did not translate into higher computer self-efficacy when compared to previous years. This may be attributed to students using computers more often and for greater purposes in the most recent years. Expanded use includes communication through email, expanded online offerings in content, news, social media, and services such as online banking and shopping. However this increased usage did not produce higher levels of general computer self-efficacy, perhaps because those tasks are
not challenging and merely demand “repetitive use of a limited range of skills, primarily entering text” (Karsten & Schmidt, 2008, p. 449). This supports a premise from Bandura (1986) stating self-efficacy is significantly altered through challenging and unfamiliar tasks, expanding user perspective.

**Home possession.** Hours of total computer use time is also influenced by home possession, usage is likely to increase if computers are easily accessible and in close proximity (Albion, 2001). Home access as part of a supportive family and educational atmosphere has a strong connection to computer use (Hsu & Huang, 2006). Cassidy and Eachus (2002) presented additional support for computer ownership and total software programs acquainted with and both in positive alignment with computer self-efficacy. Bauer (2003) substantiates the powerful associations between computer self-efficacy and usage hours, reported ubiquitous experience, and the number of software programs used. The present study involved significant computer use time, the class meets in the evenings two times a week and each session is 2 hours and 45 minutes.

**Environment.** Users identify the most desirable environment as supportive, casual, and subdued, with skilled assistance available (Beckers & Schmidt, 2003). A positive, encouraging, “non-threatening” atmosphere fosters extended confidence in computer self-efficacy and propels individuals to overcome obstacles (Bandura, 1986; Ertmer, Evenbeck, & Cennamo, 1994, p. 58). Success breeds confidence, while defeat creates perennial negativity, especially if the deficiency happens at the beginning of the experience (Bandura, 1977). Additional research reveals self-efficacy derived from computer experience is most influenced by pertinent encounters centered on “quality rather than quantity” (Ertmer et. al, 1994, p. 58; Karsten, 1998).
Positive conditions and experiences connect and cycle to form a sustained sequence of healthy, hopeful general computer instincts and beliefs. These broad computer opinions anticipate understanding and comfort level of an application more than the time spent working on the same software (Venkatesh, 2000). This occurs in part because increased self-efficacy beliefs create relaxed, secure working conditions by reducing anxiety and anger; a light, playful atmosphere fosters experimentation free from harsh consequences (Potosky, 2002; Wilfong, 2006). Bandura (1977) concurs people are prone to believe it is possible to achieve favorable outcomes when there are no feelings of strain or anxiety. Therefore a steady, calm environment fosters a pleasant, assured temperament, leads users to expand personal possibilities and potential.

Emotion. Agarwal and Karahanna (2000) call for a more holistic approach to technology interactions to foster intrinsic motivation, richer participation, and encourage an atmosphere of play. Potosky (2002) shows users who are playful during training instruction demonstrated the greatest efficacy after the workshop was completed. Compeau and Higgins (1995a) also mention the power of physiological states on performance, for instance participants can see the tasks as enjoyable and associate those tasks with play.

Additional research by Webster and Martocchio (1992) establishes a positive relationship between computer self-efficacy and playfulness. Motivation can act as a gatekeeper for self-efficacy, permitting only what the individual deems as enjoyable or pertinent to the personal mission (Deng, Doll, & Truong, 2004). It is also possible individuals enter into a certain state of mind or ‘flow,’ as a result of being fully immersed in the work (Csikszentmihalyi, 1990). Agreeable interactions nurture acceptance and
can develop into a positive attitude towards computers, suggesting each individual point of view about computers is actually a “self-fulfilling prophecy” (Rozell & Gardner, 1999). Computers can function as a Rorschach inkblot test, where deep rooted past ideas and experiences surface and heavily impact the present (Turkle, 1980).

Psychological states can alter attitudes about technology, for example a positive state of mind can evoke confidence, increase self-efficacy and decrease computer anxiety (Beas & Salanova, 2006; Conrad & Munro, 2008). Individuals with high self-efficacy were more frequent computer users, and experienced less anxiety Compeau & Higgins, 1995b). Personalities with negative tendencies may feel less in control and be quick to blame others for failures but self-efficacy has the power to regulate anxiety and as knowledge grows, anger and anxiety are reduced (Johnson, 2005; Kay, 2008; Saade & Kira, 2009). Intrinsic motivation, curiosity, and positive attitude all positively impact computer self-efficacy (Moos & Azevedo, 2009).

Rozell (2000) utilizes Seligman’s causal attribution studies to conclude optimists envision success and are more apt to persevere when encountering technical issues. Situations prompt positive or negative reactions based on self-efficacy and can generate an inner conflict equal to the outer condition (Bessière, Newhagen, Robinson, & Shneiderman, 2006). This can create a competition and fight for control between the individual and the computer, similar to winning or losing a game.

State of mind and self-assessment of capabilities contain the power to either steer a user toward a positive outcome or to sabotage it. Beckers and Schmidt (2001) express “emotion influences beliefs” instead of the reverse, confirming actions are led by feelings (p. 46). Humans are subjective, and maintaining a conscious awareness of attitude is
difficult to achieve. Deng, Doll, and Truong (2004) discover intrinsic motivation indirectly connects computer self-efficacy and effective application use, working as a catalyst for determination. Conviction collaborates with attention, prolonged attempts, dedication, and action to create a platform to achievement. Efforts lead to achievements and the outcome is celebrated, intensifying self-efficacy and intrinsic motivation.

Kim, H. Chan, and Y. Chan (2007) investigate how thoughts and feelings effect decisions to continue, delay, or abandon technology usage. This research describes technology users as active service customers and analyzes attitude, beliefs, and possible and emotional gains of these users. The results report the largest influence on continued use is pleasure, formed from responses including happy, pleased, and satisfied. Arousal ranks second, linking to excitement and stimulation; usefulness places third, attached to task completion and saving time.

**Resource allocation.** Experiences build familiarity and comfort while preparing the brain to connect and construct advanced knowledge by shifting resource allocation. The process of learning new information entails laborious, concentrated, beginning stages where “few spare resources [exist during] skill acquisition,” however as experience and ability grow, tasks become automated and use fewer cognitive resources (Hackbarth, Grover, & Yi, 2003; Kanfer & Ackerman, 1989, p. 687). Technical, detailed steps transform into instinctive, undemanding processes individuals promptly master creating forward momentum and a confident environment for efficient learning at a faster, higher level. Technology interactions allow individuals to develop abilities through usage and practice until identifying technology structures is increasingly effortless (Hackbarth, Grover, & Yi, 2003).
Changes over time. Bhattacherjee and Premkumar (2004) present user attitudes and beliefs as dynamic results of current and past experiences, focusing on the under-researched area of “temporal changes” occurring during the course of usage (p. 230). Bhattacherjee (2001) suggests favorable outcomes are contingent upon “continued use rather than first-time use” (p. 342). Technology resources have to extend beyond the initial activities to provide value and established usage after adoption is essential is essential to affirm mastery (Hackbarth, Grover, & Yi, 2003; Kim, H. Chan, & Y. Chan, 2007).

Survey data acquired one year apart shows the relationship between self-efficacy and computers does not have an expiration date as the results continue to provide valuable and accurate predictions (Compeau, Higgins, & Huff, 1999). Venkatesh and Davis (1996) collect computer self-efficacy measures at different points in time and confirm efficacy did not change. This is problematic as individuals are inclined to “form and hold stronger computer self-efficacy beliefs, both positive and negative” (p. 473). There is evidence to suggest adoption may stem from human or organizational pressure but continued utilization is grounded exclusively in beliefs (Karahanna, Straub, & Chervany, 1999).

Computer Self-Efficacy Scale

Methods to measure computer self-efficacy develop in the late 1980s and early 1990s. These first studies utilize questionnaires to inquire about individual levels of comfort with software and tasks, working styles, the benefits of computer education, and future plans to purchase or use computers (Gist, Rosen, and Schwoerer, 1988; Hill, Smith, & Mann, 1987). Several researchers also work with computer instructors to
develop scales from the literature to target confidence (Davis, Bagozzi, & Warshaw, 1989; Murphy, Coover, & Owen, 1989).

Compeau (1992) examined how self-efficacy impacted computing, researched these established scales, and started to formulate her own measure. Compeau critiqued existing scales and noted her construct aims to stay authentic to Bandura’s social cognitive theory. (1986, 1987). This is achieved through applying the three determinants of social cognitive theory, cognition, behavior, and environment; as well two dimensions of self-efficacy, magnitude (or level) and strength. The scale does not directly measure generality, the third dimension of self-efficacy. The initial work on forming the scale is part of Compeau’s (1992) dissertation with chief advisor, Dr. Chris Higgins.

The Compeau and Higgins (1995b) computer self-efficacy scale is published several years later. The authors define self-efficacy as “the belief that one has the capability to perform a particular behavior,” and determine computer self-efficacy pertains to the “judgment of one’s capability to use a computer” (Compeau & Higgins, 1995b, p. 189, p. 192). The Compeau and Higgins (1995b) scale develops into a leading measurement in computer self-efficacy research and is widely adopted in various forms for numerous projects (Agarwal & Karahanna, 2000; Chu, 2003; Downey & Zeltmann, 2009; Hasan, 2003; Huffman, Whetten, & Huffman, 2013; Jan, 2015).

**Social Cognitive Theory Determinants.** The Compeau and Higgins (1995b) scale applies social cognitive theory to computer self-efficacy. The questions asked relate to the determinants, cognition, behavior, and environment. The instrument contains ten items and the first part of each question asks respondents to anticipate abilities on a computer task through a fictitious scenario. The first part is “I could complete the job
using the software package… […] if I had…]” (Compeau & Higgins, 1995a, p. 140). The second part completes the sentence with options for support such as the software manual, additional time, and human assistance. Next the individual ranks the varying degrees of support by what would be most helpful (see Appendix A). The scale is designed to push the subjects to consider future behavior and efficacy as opposed to prior proficiencies (Bandura, 1986; Compeau & Higgins, 1995b).

**Self-Efficacy Dimensions.** The Compeau and Higgins (1995b) scale incorporates two dimensions of self-efficacy, magnitude (or level) and strength. Magnitude or level is defined as “the level of task difficulty one believes is attainable” (p. 192). The scale measured magnitude by counting the number of yes or no responses to the ten questions. Bandura (1977) states magnitude becomes apparent when a person decides what is personally achievable from a list of tasks. An individual with a higher magnitude of self-efficacy can envision completing a challenging task while those with lower magnitude may only picture success.

The second element of self-efficacy is strength, the “level of conviction about the judgment” and is scored through the number rating for each question (Compeau & Higgins, p. 192). The person with a low degree of strength lives on an unstable foundation easy to diminish; higher strength creates a firm base and is more likely to persist in challenging circumstances. Perceptions of strength are substantiated by positive or negative feedback and experiences.

**Graphics**

Graphics include digital images created entirely within computer software or just edited using computer software and tools. Images are widely used across many
disciplines and so are graphics, visuals are often produced to communicate messages in business. Often these graphics are in the form of low to medium quality when a part of presentation software. In news, marketing and advertising images are of higher quality for mass production and high profile campaigns. Medical imaging is excellent quality too as precision and measurement are paramount.

Early graphics included with computers were simple and now imaging is more advanced with the Adobe Photoshop software. Image manipulation used to be limited to shapes, objects, or color however Adobe Photoshop gives users the power to edit images by individual pixels. This comprehensive program is considered the industry standard for image manipulation (Clawson, 2015; Cookman, 2003). Additional software exist for developing page layout, logo creation, and website design. There are some intersections between those programs and Adobe Photoshop, but Photoshop is primarily for digital imaging and creating graphics. The present study examined graphics and computer self-efficacy through the discipline of art and management information science (MIS).

In the field of graphics arts, Nielsen, Fleming, and Kumarasuriyar (2010) attempt to improve student self-efficacy in a digital communications course by restructuring it to mandate additional technology and digital software tools. The instructor changed the behavior of students by mandating these tools and the course outcomes showed improvement in student satisfaction, course completion, and an increase in grades. These positive outcomes signify the need to expand opportunities for graphics interactions, especially in curriculum and training environments (Busch 1995; Hasan 2003).

One graphics instructor reports technology deficiencies in students “complicate instruction” and hinder communication because many “concepts and terms are alien”
(Koning, 2012, p. 82). This instructor alters behavior through customized course software, streamlining difficult technical processes for the students. This change releases cognitive resources in the students and redirects it to the more creative aspects of the project.

Additional studies related to art and graphics stress the positive environment and peer support. Stokrocki (1986) reports prominent technical support issues but students praised the playful moments and encouraging teacher. Freedman and Relan (1992) research computer graphics and social processes to show how peer interaction is crucial to aesthetic choices.

In business environments, applications including word processing, spreadsheet, and database software are frequently analyzed in connection to computer self-efficacy (Busch 1995; Compeau & Higgins, 1995a; Kinzie, Delcourt, & Powers, 1994; Rozell & Gardner, 1999). Computer self-efficacy and graphics are under researched. Torkzadeh and Koufteros (1994) do mention graphics in a listing of other microcomputer applications, plausibly referring to presentation software (Microsoft PowerPoint) part of the suite.

Studies analyzing the impact of various computer applications on computer self-efficacy have shown experience with graphics tasks and software to have powerful effects. Hasan (2003) explores computer experience through eight types of specific software. Results show standard applications such as word processing yielded negligible change, but experience with graphics and programming generated the greatest advancement in computer self-efficacy.
Graphics programs are frequently used less than other applications and are considered advanced, demanding applications requiring users to stretch skills beyond basic, typical usage. Participants report the least amount of experience with graphics yet it is found to have significant impact on computer self-efficacy (Chu, 2003; Wilfong, 2006). This confirms while familiar operations are tedious and unchallenging, unexplored, demanding actions inspire and heighten self-efficacy assessment (Bandura 1986).

Graphics programs in this business context are primarily defined as PowerPoint presentation software and the participants rate personal computer self-efficacy, competence, or frequency of use on a specific measure. This example from Downey and McMurtrey (2007) asks the respondent to complete the sentence with a yes or no answer and provides a scale to capture magnitude ranging from minimal to full confidence.

“Graphic Programs AS-CSE [Application-Specific Computer Self-Efficacy]
I believe I have the ability...

. . . to copy an individual slide from one graphic slide presentation to another.
. . . to import text from another application (e.g., word processor) to a slide.
. . . to use a graphic presentation program (e.g., Power-Point) to convey information to others.
. . . to manipulate objects on a slide (align, tilt, rotate, etc.).
. . . to add color to words or objects on a slide.
. . . to copy or delete slides from a graphic slide presentation.
. . . to use a slide template to create a new graphic slide presentation”

(Downey & McMurtrey, 2007, p. 393).
Hasan (2003) explores different types of computer experiences to determine how each impacts computer self-efficacy and concludes graphics have a powerful and important effect. Students in a computer information system class use a survey to report experiences with eight different application domains and computer self-efficacy is collected using an adapted version of the Compeau and Higgins (1995b) scale. Outcomes show individuals have the highest experience with word processing and computer games and the lowest amount of experience with computer programming, database experience, and graphics.

Multiple regression reveals computer programming and graphics applications rank as the top two strong influencers on computer self-efficacy while more standard applications like word processing had little effect. This demonstrates graphics are beyond conventional computer knowledge and therefore strengthen self-efficacy in a more substantial manner, precisely as Bandura (1986) stated new and demanding tasks influence self-efficacy more than simple and effortless exercises (Hasan, 2003).

Wilfong (2006) concentrates on five of the eight application domains from Hasan (2003) and produces similar support for graphics in the context of computer anxiety and anger. The participants are students in an assortment of courses with the majority from health and community service and the remaining from math, computer science, and psychology. The highest experience applications are word processing and internet browsing while the applications with the lowest experience are graphics and spreadsheet programming. The low experience software is also the most challenging; it proves to have strong connections to anxiousness and anger and graphics are found to have the most significant impact on computer anxiety. This finding shows enhancing computer
self-efficacy through demanding applications such as graphics using social cognitive theory and behavior modeling has the potential to provide comfort and confidence (Bandura 1977, 1986; Wilfong 2006).

Downey and Zeltmann (2009) agree graphics programs may increase computer self-efficacy; the research analyzed application domain competency levels to determine how efficacy is shaped, asking as competence grows does computer self-efficacy grow in equal proportion? The study collects computer competency through the scale designed by Munro, Huff, Marcolin, and Compeau (1997) and computer self-efficacy utilizing the Compeau and Higgins (1995b) measure. Results for six different programs are separated into high or low competency groups and graphic programs place in the high zone, above spreadsheets and databases.

The researched discovered the connection between competence and computer self-efficacy is contingent upon the domain application used and graphics programs are shown to have a strong relationship for the high competence group. Individuals in the lower competence group less familiar with graphic programs have lower computer self-efficacy, thus results suggest graphics may be a useful application domain for enhancing computer self-efficacy.

Additional research on preservice teachers offers evidence affirming the value of graphics and the possible contributions it can provide to computer self-efficacy. Chu (2003) discusses results of a study to increase computer self-efficacy, “one unexpected finding was the use frequency of computer graphic as the significant predictor of computer self-efficacy” and calls for additional research (p. 139). The present action
research study explored changes in computer self-efficacy during a specific course dedicated to one advanced graphics application, Adobe Photoshop.

**Conclusion**

Chapter Two: Literature Review presented the important aspects of previous work in the field of computer self-efficacy, beginning with a history of self-efficacy and the early connections to computing. Relevant research is synthesized and themes such as sources, experience, emotion, and measurement are identified and explored. The majority of the studies are within a business, information technology, MIS, or health sciences context (Haffer & Raingruber, 1998; Nevalainen, Mantyranta, & Pitkala, 2010; Saeed, Yang, & Sinnappan, 2009; Thorpe, 2004; Williams, 2004). However there are indicators graphics have a significant influence on computer self-efficacy and there is a need for further research in this area.
CHAPTER THREE

METHODOLOGY

The purpose of Chapter Three: Methodology is to describe the action research methods used to address the following research question:

What factors from social cognitive theory (cognitive, environmental, behavior) influenced students’ self-efficacy with computer technology in an undergraduate graphic arts course?

Problem Statement

The participant-researcher of the present action research study identified low computer self-efficacy as a problem in her classroom. This problem was identified through observation and journal entries of undergraduate students enrolled in her graphic arts course. This prompted the participant-researcher to explore options through action research methods to better her teaching and increase students’ computer self-efficacy.

Previous research showed computer self-efficacy can be strengthened through experience as well as training (Cassidy & Eachus, 2002; Chu, 2003; Brinkerhoff, 2006; Beas & Salanova, 2006). Additional studies indicated a significant positive relationship between graphics and computer self-efficacy (Chu, 2003; Downey & Zeltmann, 2009; Hasan, 2003). The participant-researcher began to administer the Compeau and Higgins (1995b) computer self-efficacy scale to gain knowledge for developing an action plan to incorporate change and improve her teaching practice.
Purpose Statement

The purpose of the present action research is to describe the undergraduate students’ self-efficacy in a computer graphic arts course. The secondary purpose is to administer a scale developed by Compeau and Higgins (1995b) to align with Bandura’s (1977) social cognitive theory. This scale considers the various determinants of social cognitive theory (cognitive, behavior, environment) and two of the dimensions of self-efficacy, magnitude (level) and strength.

The growth of technology calls for digitally developed users and creates a need to raise computer self-efficacy, leading to less anxiety, more confidence, and increased positivity when interacting with technology (Conrad & Munro, 2008; Morris & Thrasher, 2009). The present action research study took place over the 2012-2013 academic year at the University of South Carolina with undergraduate students who enrolled in the course, Visual Arts Computing. The scale developed by Compeau and Higgins (1995b) to align with Bandura’s (1977) social cognitive theory was administered to the participants. This instrument considers the determinants of social cognitive theory, cognition, behavior, and environment. It also looks at the two dimensions of self-efficacy, magnitude (level) and strength.

Magnitude

Compeau and Higgins (1995b) define magnitude as “the level of task difficulty one believes is attainable” (p. 192). Bandura (1977) states magnitude becomes apparent when individuals decide what is personally achievable from a list of tasks ranked in order of difficulty. A person with a higher magnitude of self-efficacy can envision completing a challenging task while those with lower magnitude may only picture success with the
easier tasks. In the present study, magnitude was scored from the scale through counting the number of yes or no responses to the ten questions.

**Strength**

Strength refers to the “level of conviction about the judgment” (Compeau & Higgins, p. 192). A low degree of strength lives on an unstable foundation and can be easily diminished while higher strength creates a firm base and is more likely to persist in challenging circumstances. In the present study the computer self-efficacy scale was scored using the number rating to measure strength.

**Action Research Design**

The present study uses action research with a single group pretest posttest design within six different sections of a single undergraduate graphic arts course at the University of South Carolina. The participant-researcher conducted systematic inquiry in the teaching and learning process and aimed to improve quality or effectiveness. According to Mertler (2013), there are four steps to the action research process:

1. Focus Stage: Developing and Area of Focus
2. Acting Stage: Data Collection
3. Analysis Stage: Data Analysis
4. Action Plan Stage: Developing a Plan

**Focus Stage: Developing an Area of Focus**

The first step in the present action research study is a planning stage and the development of an area of focus. In the present study an area of focus was identified when the participant-researcher observed low computer self-efficacy in students during graphics skills acquisition (GSA). The participant-researcher was also the instructor in
the courses examined (Cohen, Manion, & Morrison, 2011). This educational research provided the participant-researcher the opportunity to preserve the actions of real events in the graphics arts classroom while improving the utility and effectiveness of the instructional process and students’ scholarly activity (Mertler, 2013).

**Acting Stage: Data Collection**

The second step in action research methods is the acting stage, including data collection. Fraenkel and Warren (1993) discuss three types of data collection: observation, interviews, and documents. In the present action research study observation occurred in the classroom the participant-researcher noted and recorded student actions. The participant-researcher in the present study observed low computer self-efficacy in college students during graphic skills acquisition (GSA).

A second type of data collection used in action research methods are existing documents. The students in the present study kept class journals to report progress and any unclear information. One participant shared concerns with not being fast enough in completing all steps to successfully achieve a workflow. Another student reported feeling overwhelmed and confused.

The third type of data collection can happen through interviews or written questions or forms through a survey, in the present study action research study this is represented as a scale (Mertler, 2013). The Compeau and Higgins (1995b) computer self-efficacy scale was distributed in a paper format once within the first two weeks of the course and again during the last two weeks of end of the semester. The concept of computer self-efficacy was discussed when the scale was distributed; students were told the goal of the scale was to explore changes in computer self-efficacy after graphic skills acquisition.
The Compeau and Higgins (1995b) computer self-efficacy scale consist of ten questions which each have two parts (see Appendix A). The first part of each question asks respondents to predict abilities on a computer task through a fictitious scenario, “I could complete the job using the software package… […] if I had…” (Compeau & Higgins, 1995a, p. 140). The user completes the sentence in the second part with options for support such as the software manual, additional time, and human assistance. Last, the individual ranks the varying degrees of support by what would be most helpful. The scale is designed to push the subjects to consider future behavior and efficacy as opposed to prior proficiencies (Bandura, 1986; Compeau & Higgins, 1995b).

The scales were collected from six different sections of the course, two sections occurred in the spring semester of 2012, two in the fall semester of 2012, and two in the spring semester of 2013. Each section was comprised of pre and post scales, though not always in equal numbers, as class size changed from start to finish. Each set was coded with a letter and number to indicate the semester, section, and whether it was from the beginning or end of the semester.

Scales were identified as invalid if one or more parts were incomplete, this situation occasionally happened with the first part when subjects missed the yes or no question before the scale (see Appendix A). After eliminating invalid scales, the remaining scale results were reported outload by the independent reader and then recorded into a Microsoft Excel spreadsheet.

Reflective Stage: Data Analysis

The participant-researcher reflected on the data with her student-participants. Through reflective writings for four years the participant-researcher worked with students to improve the effectiveness of the graphic arts course. The scales examined by the
participant-researcher were collected from 2012-2013. Scales were identified as invalid if one or more parts were incomplete, this occasionally happened with the first part when subjects missed the yes or no question before the scale (see Appendix A). After eliminating invalid scales, the remaining scale results were reported outload by the independent reader and then recorded into a Microsoft Excel spreadsheet.

The total number of valid pretest scales collected at the beginning of the semester was 120. The pretest was distributed and collected by the participant-researcher within the classroom environment. The posttest was also distributed and collected by the participant-researcher in the classroom at the end of the semester when class size is smaller, due to students dropping the class. The total number of valid posttest scales collected at the end of the semester was 88, this equals a response rate of 73%. The study was reviewed by the Institutional Review Board (IRB) and approved, it was found to be exempt from human research subject regulations.

**Analysis Stage: Reflecting on the Data**

The participant-researcher reviewed the Compeau and Higgins (1995b) scale administered to the students, the ten-item scale applies social cognitive theory to computer self-efficacy. The first part of each question asks respondents to anticipate abilities on a computer task through a fictitious scenario, reading, “I could complete the job using the software package… […]if I had…]” (Compeau & Higgins, 1995a, p. 140). The second part completes the sentence with options for support such as the software manual, additional time, and human assistance.

The individual then ranked the varying degrees of support by what would be most helpful (see Appendix A). The scale was designed to push the subjects to consider future behavior as opposed to prior proficiencies (Bandura, 1986; Compeau & Higgins, 1995b).
The participant-researcher reviewed each item on the scale with the students in order to develop an effective action plan to improve the students' self-efficacy and thus the utility and effectiveness of the course.

The third step in the action research methods process involves the developing stage and analyzing the data. The data collected from the computer self-efficacy scale was examined using Microsoft Excel and the Statistical Package for the Social Sciences (SPSS). The answers from the participants were inspected for accuracy and then entered into the software Microsoft Excel and later exported into Statistical Package for the Social Sciences (SPSS) for additional analysis. Microsoft Excel was used to calculate totals, averages, and percentages of scale responses and detailed results. Statistical Package for the Social Sciences (SPSS) was used for the paired sample t-tests.

The present study used action research with a single group pretest posttest design. Data was analyzed using a paired sample t-test conducted to compare the change between pre-post scores of the computer self-efficacy scale. A t-test was selected for analysis because it compares two means from the same groups. Six different sections of the course were analyzed to verify results and recognize trends. The detailed findings will be discussed in Chapter Four.

**Theoretical Framework**

The theoretical framework for this research was grounded in the work of Bandura (1986, 1991, 1993), Dewey (1900; 1902; 1910; 1922; 1934), and Friere (1970). Bandura and social cognitive theory show human conduct as a collection of individual cognitive and personal factors, behavior, and environment, all constantly interacting. Dewey and progressive educational theory support critical thinking, active change, and student development in education. Friere discusses critical education theory and the importance
of student voice and a democratic educational experience. These theories encourage students to be personal pedagogical leaders and engage in independent thought, rather than simply receiving information from authority figures.

**Participants**

The participants included in this study were 120 undergraduate students enrolled in an Art Studio course, Visual Arts Computing at the University of South Carolina in Columbia, South Carolina during 2012 and 2013. This class was mandatory for most art majors. However, it was also open to all students and served as a general arts requirement depending on major. The class met twice a week in the evenings and each session was 2 hrs 45 min, standard length for an Art Studio course. Classes designated as Art Studio need specific equipment in the room, such as a pottery wheels for ceramics or a darkroom for processing photographs. In the present study the course objectives required expensive computer equipment and software, specifically the graphics software Adobe Photoshop.

The students in the course were taught foundational art concepts through the digital imaging graphics program, Adobe Photoshop. Each student in the course would learn about tools and methods and be given the opportunity to apply the new knowledge to various projects. For example, one project concentrates on creating depth through different values, meaning the lightness or darkness of color. The participant-researcher demonstrates various ways to achieve this through examples but each student has different personal images to work. The students would customize methods in individual projects.
Summary

Utilizing the Compeau and Higgins (1995b) computer self-efficacy scale, the present study identified factors originating from social cognitive theory (cognitive, environmental, behavior) influencing computer self-efficacy during graphic skills acquisition. This study used a convenience non random sample of students enrolled in Visual Arts Computing, a course open to all students and may serve as a general arts requirement.

This present study utilized an action research method approach and there are four steps involved in the process. First the area of focus was identified as low computer self-efficacy in the participant-researcher’s class. Second data collection occurred in the form of observation, surveys, and document data. For the third step, results were analyzed using a paired sample t-test to compare the change between pre-post scores of the computer self-efficacy scale. Six different sections of the course were analyzed to verify results and recognize trends. The fourth step in action research design is developing an action plan and this will be presented in Chapter Five.

This Chapter Three described the methodology used for the present study and Chapter Four presents the results of the collected data.
CHAPTER FOUR
RESEARCH FINDINGS

The purpose of Chapter Four: Research Findings is to present the results of the research findings used to address the following research question:

What factors from social cognitive theory (cognitive, environmental, behavior) influenced students’ self-efficacy with computer technology in an undergraduate graphic arts course?

Problem Statement

The participant-researcher of the present action research study identified low computer self-efficacy as a problem in her classroom. This problem was identified through observation and journal entries of undergraduate students enrolled in her graphic arts course. This prompted the participant-researcher to explore options through action research methods to better her teaching and increase students’ computer self-efficacy.

Previous research showed computer self-efficacy can be strengthened through experience as well as training (Cassidy & Eachus, 2002; Chu, 2003; Brinkerhoff, 2006; Beas & Salanova, 2006). Additional studies indicated a significant positive relationship between graphics and computer self-efficacy (Chu, 2003; Downey & Zeltmann, 2009; Hasan, 2003). The participant-researcher began to administer the Compeau and Higgins (1995b) computer self-efficacy scale to gain knowledge for developing an action plan to incorporate change and improve her teaching practice.
Purpose Statement

The purpose of the present action research is to describe the undergraduate students’ self-efficacy in a computer graphic arts course. The secondary purpose is to administer a scale developed by Compeau and Higgins (1995b) to align with Bandura’s (1977) social cognitive theory. This scale considers the various determinants of social cognitive theory (cognitive, behavior, environment) and two of the dimensions of self-efficacy, magnitude (level) and strength.

Chapter One contained an overview of the research study, including theoretical background, problem, purpose, and research question. Increased computer self-efficacy has the potential to positively influence academic student achievement, workplace productivity, and personal efficiency. Research has found college students have low computer self-efficacy (Karsten & Schmidt, 2008). The participant-researcher in the present study observed low computer self-efficacy in undergraduate students enrolled in the course, Visual Arts Computing, at the University of South Carolina.

The present study investigated a course focused on teaching foundational art and graphic design concepts through projects created with the graphics software, Adobe Photoshop. There is evidence graphics can have a significant positive relationship with computer self-efficacy (Chu, 2003; Downey & Zeltmann, 2009; Hasan, 2003). The Compeau and Higgins (1995b) computer self-efficacy scale was administered to the students enrolled in this graphics course, Visual Arts Computing. The present study analyzed the results of the scale to identify factors influencing computer self-efficacy during graphic skills acquisition.
The research question for this study is as follows:

What factors from social cognitive theory (cognitive, environmental, behavior) influenced students’ self-efficacy with computer technology in an undergraduate graphic arts course?

Chapter Two of this dissertation provides a detailed literature review concentrating on the history of computer self-efficacy, the sources, and findings in previous related studies. Computer self-efficacy is a specific type of self-efficacy and a component of social cognitive theory. This theory examines human development, including thoughts, motivations, and actions to steer life choices (Bandura, 1986). Self-efficacy is a person’s judgment of personal capabilities to achieve something, it is not their skills but rather what an individual believes can be accomplished with those skills (Bandura, 1986).

Self-efficacy is researched in relation to numerous topics, including academic achievement, weight loss, and motivation. Computer self-efficacy studies started within business environments to gain more knowledge about why individuals accept or reject technology. The impact of environment, emotion, computer experience, and graphics experience on computer self-efficacy were addressed.

**Findings**

The Compeau and Higgins (1995b) computer self-efficacy scale begins with a sample answer at the top to assist respondents (Figure 4.1). In the sample response the individual reported yes to completing the job when provided with step by step instructions and felt moderately confident (level of 5).
Table 4.1 displays the questions on the scale and Table 4.2 shows the percent change for each question between pretest and posttest. The computer self-efficacy composite score was derived from the levels of the questions where the respondent answered yes. This procedure of totaling the positive responses was utilized by Lee and Bobko (1994) in work on self-efficacy beliefs. This same process was employed successfully by Downey and McMurtrey (2007) and Downey and Zeltmann (2009).

Table 4.2 displays the average of the total responses for each question and then calculates the percent change across all six sections of the course. The most significant increase (42%) is if the subject had never used a similar package before (Q-2). The second largest increase (33%) reported subjects rated higher computer self-efficacy if no one is around to assist (Q-1).

Social cognitive theory has three determinants: cognition, behavior, and environment. Bandura (1986) connects the determinant of environment to tangible habitats and human assistance. There are six questions on the Compeau and Higgins (1995b) computer self-efficacy scale related to the determinant of environment. Three of these questions link to human support, two questions involve software support resources, and one relates to having no time constraints.
Table 4.1

*Computer Self-Efficacy Scale Questions*

<table>
<thead>
<tr>
<th>Item</th>
<th>Question Text</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q-1</td>
<td>I could complete the job using the software package… if there was no one around to tell me what to do as I go.</td>
</tr>
<tr>
<td>Q-2</td>
<td>I could complete the job using the software package… if I had never used a package like it before.</td>
</tr>
<tr>
<td>Q-3</td>
<td>I could complete the job using the software package… if I had only the software manuals for reference.</td>
</tr>
<tr>
<td>Q-4</td>
<td>I could complete the job using the software package… if I had seen someone else using it before trying it myself.</td>
</tr>
<tr>
<td>Q-5</td>
<td>I could complete the job using the software package… if I could call someone for help if I got stuck.</td>
</tr>
<tr>
<td>Q-6</td>
<td>I could complete the job using the software package… if someone else helped me get started.</td>
</tr>
<tr>
<td>Q-7</td>
<td>I could complete the job using the software package… if I had a lot of time to complete the job for which the software was provided.</td>
</tr>
<tr>
<td>Q-8</td>
<td>I could complete the job using the software package… if I had just the built in help facility for assistance.</td>
</tr>
<tr>
<td>Q-9</td>
<td>I could complete the job using the software package… if someone showed me how to do it first.</td>
</tr>
<tr>
<td>Q-10</td>
<td>I could complete the job using the software package… if I had used similar packages before this one to do the same job.</td>
</tr>
</tbody>
</table>

Table 4.2

*Computer Self-Efficacy: Percent Change by Question*

<table>
<thead>
<tr>
<th>Item</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q-1</td>
<td>19</td>
<td>31</td>
<td>9</td>
<td>34</td>
<td>44</td>
<td>59</td>
<td>32.67</td>
</tr>
<tr>
<td>Q-2</td>
<td>5</td>
<td>50</td>
<td>29</td>
<td>38</td>
<td>40</td>
<td>89</td>
<td>41.83</td>
</tr>
<tr>
<td>Q-3</td>
<td>4</td>
<td>18</td>
<td>-13</td>
<td>8</td>
<td>47</td>
<td>16</td>
<td>13.33</td>
</tr>
<tr>
<td>Q-4</td>
<td>-1</td>
<td>23</td>
<td>17</td>
<td>16</td>
<td>32</td>
<td>31</td>
<td>19.67</td>
</tr>
<tr>
<td>Q-5</td>
<td>-8</td>
<td>10</td>
<td>1</td>
<td>6</td>
<td>10</td>
<td>13</td>
<td>5.33</td>
</tr>
<tr>
<td>Q-6</td>
<td>-6</td>
<td>4</td>
<td>-1</td>
<td>11</td>
<td>22</td>
<td>13</td>
<td>7.17</td>
</tr>
<tr>
<td>Q-7</td>
<td>3</td>
<td>9</td>
<td>-1</td>
<td>12</td>
<td>16</td>
<td>22</td>
<td>10.17</td>
</tr>
<tr>
<td>Q-8</td>
<td>3</td>
<td>9</td>
<td>22</td>
<td>15</td>
<td>34</td>
<td>24</td>
<td>17.83</td>
</tr>
<tr>
<td>Q-9</td>
<td>-5</td>
<td>-2</td>
<td>0</td>
<td>7</td>
<td>11</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Q-10</td>
<td>-3</td>
<td>-3</td>
<td>2</td>
<td>10</td>
<td>8</td>
<td>2</td>
<td>2.67</td>
</tr>
</tbody>
</table>

Average 1.1 14.9 6.5 15.7 26.4 27 15.27
The three questions aligned to environment through the availability of human assistance ask if is there a person present to guide me (Q-1), to help me get started (Q-6), or accessible through phone for assistance (Q-5). The participants in the present study report higher computer self-efficacy when there is no person available to assist (32%), get started (7%), or accessible by phone (5%).

Two questions are associated to environment in a support capacity, access to software manuals (Q-3) and built-in help (Q-8). These questions show about a 15% increase from pretest to posttest. The last item relating to environment is time and proposes the subject has plenty of time to work on the software package (Q-7). This question also showed an increase after graphic skills acquisition (10%).

Bandura (1986) states cognition calls for thought, recall, and comparison, this relates to two questions in the Compeau and Higgins (1995b) scale. The questions requiring thought, recall, and comparison asked the subject about previous experience with similar packages to accomplish a comparable task. One question asked if there was no previous similar experience (Q-2) and the other questions asked if there previous experience with similar packages to accomplish a comparable task (Q-10). The respondents reported a strong increase in computer self-efficacy (42%) if there was no prior use with a package like it before. This supports research stating higher computer self-efficacy equals more confidence and increased positivity when interacting with technology, especially new and challenging tasks (Bandura, 1986; Conrad & Munro, 2008; Morris & Thrasher, 2009).

Questions connected to the social cognitive theory determinant of behavior align to modeling from a guide rather than human assistance; vicarious experience is the second strongest source of self-efficacy (Bandura, 1997). Observation instead of participation
allows participants to view from a safe area and gain valuable knowledge about the task and standard expectations (Bandura, 1997). Individuals can gain new perspectives on personal capabilities that previously had no reference for comparison (Bandura, 1997; Bandura & Jourden, 1991; Wood, 1989).

Two questions related to behavior describe a successful person accomplishing the task. The posttest reports a 20% increase in computer self-efficacy for the question about the participant being able to complete the job if witnessing someone else doing it before personally trying it (Q-4). The question about participants being shown how to do something before attempting it (Q-9) increased 2%. These findings suggest participants want to observe, experiment, and be independent thinkers who are provided support through behavior modeling instead of being told how to do something systematically.

**Magnitude**

The present action research methods study identified factors from Bandura’s social cognitive theory influencing computer self-efficacy. The instrument used incorporated two dimensions of self-efficacy: magnitude (level) and strength (Bandura, 1977). Magnitude or level is defined as “the level of task difficulty one believes is attainable” (Compeau & Higgins, 1995b, p. 192). In the present study, magnitude was scored from the scale through counting the number of yes answers (Compeau & Higgins, 1995b).

Table 4.3 shows these results of magnitude across six different sections of the course, it was strong in both pretest and posttest with a small increase in the majority of sections. Sections 6 had the highest change and sections 2 and 4 showed no change, both of these sections met for class on Tuesdays and Thursdays.
Table 4.3
Magnitude: Percent Change by Section

<table>
<thead>
<tr>
<th>Section</th>
<th>N</th>
<th>Pretest</th>
<th>Posttest</th>
<th>Percent Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>26</td>
<td>.85</td>
<td>.92</td>
<td>.01</td>
</tr>
<tr>
<td>2</td>
<td>17</td>
<td>.95</td>
<td>.95</td>
<td>0</td>
</tr>
<tr>
<td>3</td>
<td>24</td>
<td>.95</td>
<td>.97</td>
<td>.02</td>
</tr>
<tr>
<td>4</td>
<td>17</td>
<td>.94</td>
<td>.94</td>
<td>0</td>
</tr>
<tr>
<td>5</td>
<td>14</td>
<td>.89</td>
<td>.92</td>
<td>.03</td>
</tr>
<tr>
<td>6</td>
<td>24</td>
<td>.91</td>
<td>.96</td>
<td>.06</td>
</tr>
</tbody>
</table>

Average | 20 | .91 | .94 | .02 |

Table 4.4 shows changes in magnitude by percent change per question, pretest to posttest by question on the Compeau and Higgins (1995b) computer self-efficacy scale. The average change over all the questions is very small (-.12%) and the question with the highest change (-.18%) asked if the respondent had used a similar package (Q-10). The question with the second highest change (-.17%) asked about if someone showed the respondent how to do it first (Q-9). The question regarding previous use of similar packages (Q-2) barely changed at all (-.03%). The question relating to the absence of human assistance (Q-1) showed almost no change (-.08%). The question about access to software manuals (Q-3) also displayed minimal change (-.06%).

Strength

The second dimension of self-efficacy is strength, referring to the “level of conviction about the judgment” (Compeau & Higgins, 1995b, p. 192). Individual thoughts mold and regulate strength, partially built through successes and reduced by failures (Bandura, 1986). Strength was scored following the Compeau and Higgins (1995b) method of summarizing the respondent’s answer on the confidence level...
scale, ranging from one to ten. This scoring method recommends counting a response of no as a zero and the present study also follows this process.

Table 4.5 displays the percent change for strength across the six different sections of the course by section. The average change in strength from pretest to posttest was minimal (.14%) and the strongest increases were in section 5 (.24%) and 6 (.25%). These two sections with the highest increase are both from the spring semester of 2013. The lowest change was in section 1 (.01%) and section 3 (.07%), both from 2012.

Table 4.6 shows the percent change strength by question, an overall an increase of 19.77%. The question with the highest increase (73%) is when the respondent never used a package like it before (Q-2). The question with the second most
Table 4.5  
*Strength: Percent Change by Section*  

<table>
<thead>
<tr>
<th>Section</th>
<th>N</th>
<th>Pretest</th>
<th>Posttest</th>
<th>Percent Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>26</td>
<td>6.50</td>
<td>6.58</td>
<td>.01</td>
</tr>
<tr>
<td>2</td>
<td>17</td>
<td>6.92</td>
<td>7.73</td>
<td>.12</td>
</tr>
<tr>
<td>3</td>
<td>24</td>
<td>6.99</td>
<td>7.45</td>
<td>.07</td>
</tr>
<tr>
<td>4</td>
<td>17</td>
<td>6.81</td>
<td>7.68</td>
<td>.13</td>
</tr>
<tr>
<td>5</td>
<td>14</td>
<td>5.75</td>
<td>7.16</td>
<td>.24</td>
</tr>
<tr>
<td>6</td>
<td>24</td>
<td>5.97</td>
<td>7.44</td>
<td>.25</td>
</tr>
</tbody>
</table>

Average 20 6.49 7.34 .14

Table 4.6  
*Strength: Percent Change by Question*  

<table>
<thead>
<tr>
<th>Item</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>Percent Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q-1</td>
<td>23</td>
<td>31</td>
<td>25</td>
<td>20</td>
<td>71</td>
<td>87</td>
<td>43.83</td>
</tr>
<tr>
<td>Q-2</td>
<td>-4</td>
<td>63</td>
<td>67</td>
<td>68</td>
<td>102</td>
<td>142</td>
<td>73</td>
</tr>
<tr>
<td>Q-3</td>
<td>25</td>
<td>37</td>
<td>-34</td>
<td>-2</td>
<td>44</td>
<td>36</td>
<td>17.67</td>
</tr>
<tr>
<td>Q-4</td>
<td>3</td>
<td>23</td>
<td>17</td>
<td>23</td>
<td>12</td>
<td>31</td>
<td>18.17</td>
</tr>
<tr>
<td>Q-5</td>
<td>-8</td>
<td>10</td>
<td>6</td>
<td>6</td>
<td>10</td>
<td>13</td>
<td>6.17</td>
</tr>
<tr>
<td>Q-6</td>
<td>-6</td>
<td>4</td>
<td>-1</td>
<td>11</td>
<td>22</td>
<td>13</td>
<td>7.17</td>
</tr>
<tr>
<td>Q-7</td>
<td>-2</td>
<td>9</td>
<td>-1</td>
<td>12</td>
<td>16</td>
<td>21</td>
<td>9.17</td>
</tr>
<tr>
<td>Q-8</td>
<td>8</td>
<td>2</td>
<td>35</td>
<td>5</td>
<td>34</td>
<td>29</td>
<td>18.83</td>
</tr>
<tr>
<td>Q-9</td>
<td>-5</td>
<td>-2</td>
<td>0</td>
<td>7</td>
<td>11</td>
<td>3</td>
<td>2.3</td>
</tr>
<tr>
<td>Q-10</td>
<td>-3</td>
<td>-5</td>
<td>2</td>
<td>10</td>
<td>8</td>
<td>2</td>
<td>2.3</td>
</tr>
</tbody>
</table>

Average 3.1 17.2 11.6 16 33 37.7 19.77
significant increase (44%) was (Q-1) if no one was around to tell respondent what to do along the way. The third and fourth most significant increases involve if the participant had seen someone else using it before trying it (Q-4) and if just the built-in help facility was available for assistance (Q-8).

Computer self-efficacy magnitude displayed the least percent change (2%) in the questions regarding if someone showed the subject how to do it first (Q-9), if there was prior use with similar packages before (Q-10), and if someone could be called for assistance when needed (Q-5).

Table 4.7 displays a percent change comparison of magnitude, strength, and computer self-efficacy by question. The highest positive increase was in using new and unfamiliar software (Q-2). Strength was raised 20%, higher than the computer self-efficacy composite of 15%. The second highest positive increase was shown in the question regarding no one around to tell the use what to do along the way (Q-2). The question with the third highest positive increase addresses the use of built in help for assistance (Q-8). Conversely, the questions with the lowest changes involve if someone showed the individual how to do it first (Q-9) and if the user had used a similar software before this one to do the same job (Q-10).

Table 4.8 shows the results of a paired samples t test, conducted to evaluate whether students in Section 1 reported different confidence outcomes across pretest and posttest outcomes. There was a significant difference in the scores for the posttest (M=7.44, SD=2.71) as compared to the pretest (M=5.88, SD=2.98) conditions; t(351)= -5.19, p<0.05.
Table 4.7
Magnitude, Strength, Computer Self-Efficacy: Percent Change Comparison

<table>
<thead>
<tr>
<th>Item</th>
<th>Question</th>
<th>Magnitude</th>
<th>Strength</th>
<th>Computer Self-Efficacy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q-1</td>
<td>…if there was no one around to tell me what to do as I go</td>
<td>-0.08</td>
<td>43.83</td>
<td>32.67</td>
</tr>
<tr>
<td>Q-2</td>
<td>…if I had never used a software like it before</td>
<td>-0.03</td>
<td>73</td>
<td>41.84</td>
</tr>
<tr>
<td>Q-3</td>
<td>…if I had only the book or software manuals for reference</td>
<td>-0.06</td>
<td>17.67</td>
<td>13.167</td>
</tr>
<tr>
<td>Q-4</td>
<td>…if I had seen someone else using it before trying it myself</td>
<td>-0.16</td>
<td>18.17</td>
<td>19.67</td>
</tr>
<tr>
<td>Q-5</td>
<td>…if I could call someone for help if I got stuck</td>
<td>-0.16</td>
<td>6.17</td>
<td>5.34</td>
</tr>
<tr>
<td>Q-6</td>
<td>…if someone else had helped me get started</td>
<td>-0.13</td>
<td>7.17</td>
<td>7.17</td>
</tr>
<tr>
<td>Q-7</td>
<td>…if I had a lot of time to complete the job for which the software was provided</td>
<td>-0.16</td>
<td>9.17</td>
<td>10.17</td>
</tr>
<tr>
<td>Q-8</td>
<td>…if I had just the built-in help for assistance</td>
<td>-0.11</td>
<td>18.83</td>
<td>17.83</td>
</tr>
<tr>
<td>Q-8</td>
<td>…if someone showed me how to do it first</td>
<td>-0.17</td>
<td>2.3</td>
<td>2</td>
</tr>
<tr>
<td>Q-10</td>
<td>…if I had used a similar software before this one to do the same job</td>
<td>-0.18</td>
<td>2.3</td>
<td>2.67</td>
</tr>
<tr>
<td></td>
<td><strong>Average</strong></td>
<td>-0.12</td>
<td>19.77</td>
<td>15.25</td>
</tr>
</tbody>
</table>

As required for the pair samples t-test, an equal number of responses were compared (n this case, 178 cases) in the pretest and posttests. Section 1 represents a course scheduled to meet twice a week, Mondays and Wednesdays during the spring semester of 2012.

Table 4.9 displays a paired samples t test conducted to evaluate whether students in Section 2 reported different confidence outcomes across pretest and posttest outcomes. There was a significant difference in the scores for the posttest ($M=7.14$, $SD=2.98$) as compared to the pretest ($M=5.69$, $SD=2.98$) conditions; $t(253)= -4.01$, $p<0.05$. 

66
Table 4.8
_t-Test: Two Sample Assuming Unequal Variances, Section 1_

<table>
<thead>
<tr>
<th></th>
<th>Pre</th>
<th>Post</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>5.882022472</td>
<td>7.443820225</td>
</tr>
<tr>
<td>Variance</td>
<td>8.816511141</td>
<td>7.332984193</td>
</tr>
<tr>
<td>Observations</td>
<td>178</td>
<td>178</td>
</tr>
<tr>
<td>Hypothesized Mean Difference</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>df</td>
<td>351</td>
<td></td>
</tr>
<tr>
<td>t Stat</td>
<td>-5.185078276</td>
<td></td>
</tr>
<tr>
<td>P (T&lt;=t) one tail</td>
<td>1.82744E-07</td>
<td></td>
</tr>
<tr>
<td>t Critical one-tail</td>
<td>1.6492064</td>
<td></td>
</tr>
<tr>
<td>P (T&lt;=t) two tail</td>
<td>3.65488E-07</td>
<td></td>
</tr>
<tr>
<td>t Critical two-tail</td>
<td>1.966745561</td>
<td></td>
</tr>
</tbody>
</table>

Table 4.9
_t-Test: Two Sample Assuming Unequal Variances, Section 2_

<table>
<thead>
<tr>
<th></th>
<th>Pre</th>
<th>Post</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>5.689922</td>
<td>7.139535</td>
</tr>
<tr>
<td>Variance</td>
<td>9.293726</td>
<td>7.558503</td>
</tr>
<tr>
<td>Observations</td>
<td>129</td>
<td>129</td>
</tr>
<tr>
<td>Hypothesized Mean Difference</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>df</td>
<td>253</td>
<td></td>
</tr>
<tr>
<td>t Stat</td>
<td>-4.01068</td>
<td></td>
</tr>
<tr>
<td>P (T&lt;=t) one tail</td>
<td>3.99E-05</td>
<td></td>
</tr>
<tr>
<td>t Critical one-tail</td>
<td>1.650899</td>
<td></td>
</tr>
<tr>
<td>P (T&lt;=t) two tail</td>
<td>7.97E-05</td>
<td></td>
</tr>
<tr>
<td>t Critical two-tail</td>
<td>1.969385</td>
<td></td>
</tr>
</tbody>
</table>
As required for the pair samples t-test, an equal number of responses were compared (in this case, 129 cases) in the pretest and posttests. Section 2 represents a course scheduled to meet twice a week, on Tuesdays and Thursdays during the spring semester of 2012.

A paired samples t test was conducted to evaluate whether students in Section 3 reported different confidence outcomes across pretest and posttest outcomes. Table 4.10 shows there was a significant difference in the scores for the posttest (M= 7.68, SD= 2.82) as compared to the pretest (M=6.70, SD=2.90) conditions; t(294)= -2.95, , p<0.05.

As required for the pair samples t-test, an equal number of responses were compared (in this case, 148 cases) in the pre and post-tests. Section 3 represents a course scheduled to meet twice a week, Monday and Wednesday during the fall semester of 2012.

Table 4.10
\[
\begin{array}{l|c|c}
\text{t-Test: Two Sample Assuming Unequal Variances, Section 3} & \text{Pre} & \text{Post} \\
\hline
\text{Mean} & 6.695945946 & 7.675675676 \\
\text{Variance} & 8.403520868 & 7.934914506 \\
\text{Observations} & 148 & 148 \\
\text{Hypothesized Mean Difference} & 0 & \\
\text{df} & 294 & \\
\text{t Stat} & -2.948708979 & \\
\text{P (T<=t) one tail} & 0.001723567 & \\
\text{t Critical one-tail} & 1.650052985 & \\
\text{P (T<=t) two tail} & 0.003447134 & \\
\text{t Critical two-tail} & 1.968065689 & \\
\end{array}
\]
Table 4.11 displays results of a paired samples t-test was conducted to evaluate whether students in Section 4 reported different confidence outcomes across pretest and posttest outcomes. There was no significant difference in the scores for the posttest (M=7.38, SD=2.73) as compared to the pretest (M=7.46, SD=2.92) conditions; t(76)=0.12, p>0.05. It should be noted the pretest scores were higher than the posttest scores.

As required for the pair samples t-test, an equal number of responses were compared (in this case, 39 cases) in the pre and post-tests. Section 4 represents a course scheduled to meet twice a week, Tuesdays and Thursdays during the spring semester of 2012.

Table 4.11

<table>
<thead>
<tr>
<th>t-Test: Two Sample Assuming Unequal Variances, Section 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre</td>
</tr>
<tr>
<td>Mean</td>
</tr>
<tr>
<td>Variance</td>
</tr>
<tr>
<td>Observations</td>
</tr>
<tr>
<td>Hypothesized Mean Difference</td>
</tr>
<tr>
<td>df</td>
</tr>
<tr>
<td>t Stat</td>
</tr>
<tr>
<td>P (T&lt;=t) one tail</td>
</tr>
<tr>
<td>t Critical one-tail</td>
</tr>
<tr>
<td>P (T&lt;=t) two tail</td>
</tr>
<tr>
<td>t Critical two-tail</td>
</tr>
</tbody>
</table>

Table 4.12 contains data from a paired samples t-test, conducted to evaluate whether students in Section 5 reported different confidence outcomes across pretest and posttest outcomes. There was a significant difference in the scores for the posttest (M=...
7.68, SD= 2.70) as compared to the pretest (M=6.94, SD=2.76) conditions; t(250)= -2.17, p<0.05.

As required for the pair samples t-test, an equal number of responses were compared (in this case, 126 cases) in the pre and post-tests. Section 5 represents a course scheduled to meet twice a week, on Mondays and Wednesdays during the spring semester of 2013.

Table 4.12
*t-Test: Two Sample Assuming Unequal Variances, Section 5*

<table>
<thead>
<tr>
<th></th>
<th>Pre</th>
<th>Post</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>6.936508</td>
<td>7.68254</td>
</tr>
<tr>
<td>Variance</td>
<td>7.627937</td>
<td>7.322413</td>
</tr>
<tr>
<td>Observations</td>
<td>126</td>
<td>126</td>
</tr>
<tr>
<td>Hypothesized Mean Difference</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>df</td>
<td>250</td>
<td></td>
</tr>
<tr>
<td>t Stat</td>
<td>-2.16579</td>
<td></td>
</tr>
<tr>
<td>P (T&lt;=t) one tail</td>
<td>0.015636</td>
<td></td>
</tr>
<tr>
<td>t Critical one-tail</td>
<td>1.650971</td>
<td></td>
</tr>
<tr>
<td>P (T&lt;=t) two tail</td>
<td>0.031273</td>
<td></td>
</tr>
<tr>
<td>t Critical two-tail</td>
<td>1.969498</td>
<td></td>
</tr>
</tbody>
</table>

Table 4.13 shows a paired samples t test, conducted to evaluate whether students in Section 6 reported different confidence outcomes across pretest and posttest outcomes. There was no significant difference in the scores for the posttest (M= 6.56, SD= 3.01) as compared to the pretest (M=6.48, SD=2.72) conditions; t(467)= -0.30, p>0.05.

As required for the pair samples t-test, an equal number of responses were compared (in this case, 237 cases) in the pre and post-tests. Section 6 represents a course
scheduled to meet twice a week, on Tuesdays and Thursdays during the spring semester of 2013.

Table 4.13
\textit{t-Test: Two Sample Assuming Unequal Variances, Section 6}

<table>
<thead>
<tr>
<th></th>
<th>Pre</th>
<th>Post</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>6.481013</td>
<td>6.561181</td>
</tr>
<tr>
<td>Variance</td>
<td>9.072731</td>
<td>7.382894</td>
</tr>
<tr>
<td>Observations</td>
<td>237</td>
<td>237</td>
</tr>
<tr>
<td>Hypothesized Mean Difference</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>df</td>
<td>467</td>
<td></td>
</tr>
<tr>
<td>t Stat</td>
<td>-0.30424</td>
<td></td>
</tr>
<tr>
<td>P (T&lt;=t) one tail</td>
<td>0.380539</td>
<td></td>
</tr>
<tr>
<td>t Critical one-tail</td>
<td>1.648123</td>
<td></td>
</tr>
<tr>
<td>P (T&lt;=t) two tail</td>
<td>0.761077</td>
<td></td>
</tr>
<tr>
<td>t Critical two-tail</td>
<td>1.965057</td>
<td></td>
</tr>
</tbody>
</table>

\textbf{Summary}

Chapter Four presented the results and statistical analysis of the data collected in the present study. Four of the six sections (66%) showed significant difference in the scores for the posttest as compared to the pretest. This finding supports graphics skills acquisition had a positive influence on computer self-efficacy.

The highest positive increase was in computer self-efficacy with using new and unfamiliar software (Q-2). The second highest positive increase in computer self-efficacy was if no one was around to assist (Q-1). Strength was raised 20%, higher than the computer self-efficacy composite of 15%.
CHAPTER FIVE

IMPLIEDATIONS AND CONCLUSIONS

The purpose of Chapter Five: Implications and Conclusions is to summarize the research study and the findings from the data collection, analysis, and reflection. An Action Plan for graphics arts course improvement is also included in this Chapter. Chapter Five begins with an overview of the action research study and methodology and then transitions to discussion and implications about the Action Plan. Lastly, the Chapter offer suggestions for future research.

The implications and conclusions presented here are used to address the following research question:

What factors from social cognitive theory (cognitive, environmental, behavior) influenced students’ self-efficacy with computer technology in an undergraduate graphic arts course?

Problem Statement

The participant-researcher of the present action research study identified low computer self-efficacy as a problem in her classroom. This problem was identified through observation and journal entries of undergraduate students enrolled in her graphic arts course. This prompted the participant-researcher to explore options through action research methods to better her teaching and increase students’ computer self-efficacy.
Previous research showed computer self-efficacy can be strengthened through experience as well as training (Cassidy & Eachus, 2002; Chu, 2003; Brinkerhoff, 2006; Beas & Salanova, 2006). Additional studies indicated a significant positive relationship between graphics and computer self-efficacy (Chu, 2003; Downey & Zeltmann, 2009; Hasan, 2003). The participant-researcher began to administer the Compeau and Higgins (1995b) computer self-efficacy scale to gain knowledge for developing an action plan to incorporate change and improve her teaching practice.

**Purpose Statement**

This present action research has a purpose, to describe the undergraduate students’ self-efficacy in a computer graphic arts course. A second purpose is to administer the Compeau and Higgins (1995b) scale, developed by to align with Bandura’s (1977) social cognitive theory. This scale considers the various determinants of social cognitive theory (cognitive, behavior, environment) and two of the dimensions of self-efficacy, magnitude (level) and strength.

**Overview of Research Study and Methodology**

Technology is expanding and calling for more digitally developed users to interact, work, develop, and build projects with these new tools and systems. This growth creates a need to raise computer self-efficacy, leading to less anxiety, more confidence, and increased positivity when interacting with technology (Conrad & Munro, 2008; Morris & Thrasher, 2009). Research has discovered experience and training to both have the potential to grow computer self-efficacy (Cassidy & Eachus, 2002; Chu, 2003; Brinkerhoff, 2006; Beas & Salanova, 2006). It is important to note the type and variety of exposure is crucial; an assortment of different interactions can build computer self-efficacy through active technical participation.
Various computer programs have been studied to test the individual program’s impact on computer self-efficacy, including graphics. The Microsoft Office Suite, word processing, spreadsheet, and database software were frequently analyzed in these studies within the academic areas of business and management information science (MIS) disciplines (Agarwal & Karahanna, 2000; Burkardt & Brass, 1990; Compeau & Higgins, 1995a; Rozell & Gardner, 1999). Graphics software was often included in these studies as part of the Microsoft Office Suite, mostly in the form of Microsoft PowerPoint presentation software. Several studies suggested a positive relationship between graphics skills acquisition and computer self-efficacy in preservice teachers (Chu, 2003), military trainees (Downey & Zeltmann, 2009), and non-traditional students (Hasan, 2003).

The present study examined computer self-efficacy in 120 undergraduate students enrolled in graphics course, Visual Arts Computing at the University of South Carolina. The course taught foundational art and graphic design concepts through projects created with the graphics software, Adobe Photoshop. The participant-researcher administered the Compeau and Higgins (1995b) scale in 2012 and 2013 to determine if graphic skills acquisition impacted computer self-efficacy.

The Compeau and Higgins (1995b) computer self-efficacy scale applies the work of Bandura’s (1986) social cognitive theory to computer self-efficacy. The instrument consists of ten items and each question asks respondents to anticipate abilities on a computer task through a fictitious scenario. The first part reads, “I could complete the job using the software package… […] if I had…]” (Compeau & Higgins, 1995a, p. 140). Next, the second part asks the respondent to complete the sentence with options for support including the software manual, additional time, and human assistance. Subjects then rank personal level of confidence on the scale with each resource (see Appendix A).
This design is intended to push the subjects to consider future behavior as opposed to prior proficiencies (Bandura, 1986; Compeau & Higgins, 1995b).

Personal evaluations of self-efficacy change based on magnitude (level) and strength (Bandura, 1986, 1997). Magnitude relates to how hard a task is and if a person believes it can be accomplished. In the present study, magnitude was scored from the scale through counting the number of yes or no responses to the ten questions. Strength refers to the “level of conviction about the judgment” (Compeau & Higgins, p. 192). The present study scored strength through the number rating for level.

Action research methods with a single group pretest and posttest design were used to gain knowledge about the students in the learning environment (Mertler, 2013). Data from the Compeau and Higgins (1995b) computer self-efficacy scale was analyzed using Microsoft Excel and the Statistical Package for the Social Sciences (SPSS). Data was analyzed using a paired samples t-test conducted to compare the change between pre-post scores of the computer self-efficacy scale.

**Findings**

To answer the research question for the present study factors from Bandura’s social cognitive theory are identified. These factors influenced 120 art students’ self-efficacy with computer technology during an undergraduate visual art course. Computer self-efficacy increased in the majority of the sections were examined. Data analysis revealed a significant difference in the scores from the scale for the posttest as compared to the pretest in four out of six sections. The paired samples t test showed no significant difference in section 4 or 6, both are classes scheduled to meet on Tuesday and Thursday nights. However, since section 2 also met on those same days and did show a significant change in computer self-efficacy, no conclusions can be drawn from this observation.
The factors identified from social cognitive theory influencing computer self-efficacy have two dimensions: magnitude (level) and strength (Bandura, 1977). Magnitude refers to task difficulty and whether an individual believes it can be personally accomplished; higher magnitude is usually assigned to easier tasks and lower magnitude to challenging ones. Magnitude was scored through counting the number of yes answers indicated by the respondents (Compeau & Higgins, 1995b). The magnitude did increase in four out of six of the different course sections. The two most recent sections in spring of 2013 had the highest increases, section 5 (.063%) and section 6 (.06%). Section 2 and 4 had no change (0%), both of these sections were met on Tuesdays and Thursdays.

Strength is formed when a person evaluates individual confidence level with a task and this was calculated using the number rating on the computer self-efficacy scale. The present study shows an average increase in strength of 20% over all six sections. Growth in sections 5 (33%) and 6 (38%) were significantly more than the other sections with increases of 3% (section 1), 17% (section 2), 12% (section 3), and 16% (section 4). This is an interesting finding since both sections 5 and 6 were in the same semester yet there were no major changes to the course or content.

Computer self-efficacy as a composite score was calculated from the levels indicated on all questions answered yes. The average growth over all six sections was 15%, this is less than the strength increase of 20%. Again, the highest increases are in sections 5 (26%) and 6 (27%) and smaller changes are in section 1 (1.1%), section 2 (14.9%), section 3 (6.5%), and section 4 (15.7%).

Results of the present study reported a 15% increase in computer self-efficacy composite and a 20% increase in strength. The first part of each scale question, where students indicated yes or no for the self-efficacy dimension of magnitude barely changed
The second part of the question where the respondent selected a specific strength rating to represent level of confidence increased more (20%) than the overall composite increase (15%). This demonstrates the students still indicated yes (magnitude) at the end of the semester posttest, but felt more strongly about the strength or “level of conviction about the judgment” (Compeau & Higgins, 1995b, p. 192). This finding provides evidence individual confidence developed more firmly throughout the semester and increased during graphic skills acquisition.

Conversely, the research of Lee and Bobko (1994) found the opposite of the present study, the self-efficacy composite increased more than the strength. The Lee and Bobko (1994) study used a different computer self-efficacy measurement from the present study. A higher increase in self-efficacy composite may be attributed to respondents who are quick to say yes to the first part (magnitude) when personal capabilities are in question regarding technology. This supports the high percentage of students who self-report above average in computer skills, however are “less skilled than they perceive” (Madigan, Goodfellow, & Stone, 2007, p. 413).

Magnitude, strength, and composite computer self-efficacy results also varied by question on the scale. There are minimal changes to magnitude and two questions show the highest amount of growth pretest to posttest. The questions with the largest increase asked if the respondent has used a similar package before (Q-10) or if someone showed the respondent how to do it first (Q-9). The question discussing previous use of similar packages (Q-2) minimally changed (-.03).

These results are consistent with experience as the strongest source of self-efficacy Bandura (1977; 1997). This also positively aligns with vicarious experience as essentially the second strongest source of self-efficacy and the power of behavior
modeling. Bandura (1977) reported subjects achieved higher skill development through modeling than other techniques. Gist, Rosen, and Schwoerer (1988) studied various training methods to assist users with learning to work with computers in the workplace. Modeling achieved the greatest results and allowed users to expand trust in personal potential.

Computer self-efficacy strength grows 20% from pretest to posttest with extremely high increases in two questions. The question with a 73% gain asks for a confidence rating if the respondent never used a package like it before (Q-2). After acquiring graphics instruction, the respondents are more confident with successfully using new and unfamiliar software in the future. This suggests the recent work in graphics raised computer self-efficacy and supports the work of Bandura (1986) stating new and intriguing tasks are the most influential on self-efficacy.

Respondents have higher computer self-efficacy for future tasks with new and unfamiliar software in part because of recent successes. Most of the students successfully completed a course in graphic software, after not knowing graphics software well. Users have low levels experience with graphics and the most knowledge about word processing, Internet, and computer games (Hasan 2003; Wilfong 2006).

The computer self-efficacy strength score with the second most significant increase 44% was (Q-1) if no one was around to tell respondent what to do along the way. This finding directly connects to social cognitive theory, supporting learners who aim to think individually, understand, and guide their educational experience (Bandura, 1986; 1991; 1993). This also relates to self-regulation, the process of empowerment through concentrating attention on efforts and directing efforts towards set goals.
Developing independent learners challenges traditional one-sided classroom environments and do not engage students or allow for unconventional thinking and therefore fail to maximize the educational experience. Freire (1970) described this as the “banking concept of education,” where students are empty accounts and simply receive what the teacher deposits (p. 72). Dewey (1933) indicated collecting facts and data alone does not develop learning habits, a deeper thirst for continued knowledge, or the motive to be an active participant in society. This finding is due in part to the participant-researcher advocating democratic classroom methods, fostering the growth of self-efficacy and empowering the student during graphic skills acquisition.

One computer self-efficacy strength question with a minimal percent of change (2%) asked if the subject had any prior experience with a similar package (Q-10). The average answer for this scale question was high at 8 or 9 out of 10, on both the pretest and posttest. Enactive experience is the primary source of self-efficacy and involves people learning through participation and doing. The minimal change on the question may be attributed to individuals already knowing experience strengthens belief in yourself. People, especially students understand that experience and doing something multiple times increases self-confidence in that activity. This applies to everything from piano practice and math homework, to riding a bicycle.

The second computer self-efficacy strength question with a very small percent of change (2%) inquired about if someone showed the subject how to do it first (Q-9). This connects to behavior modeling or vicarious experience, the second strongest source of self-efficacy. This scale question also had a high average answer at 8 or 9 out of 10, on both the pretest and posttest. This finding regarding the strong power of vicarious experience or modeling both before and after may be due to an individual’s long history.
with the concept. “After infants discover that they can exercise some control over aspects of their immediate environment, they draw on vicarious experiences to expand and verify their sense of personal efficacy” (Bandura, 1997, p. 167).

Throughout life, many life tasks and actions have no firm guidelines to measure success and people rely on comparisons to self-assess (Bandura, 1997). These personal evaluations will vary depending on the comparison group chosen, people who observe those who are more similar to themselves, see the ideal as more attractive and attainable (Bandura 1997; Wood, 1989). Same-age peers are crucially important in behavior modeling (Wood, 1989). The chief benefit of modeling is people gain new perspectives on personal capabilities which previously had no reference for comparison (Bandura, 1997; Bandura & Jourden, 1991; Wood, 1989).

The composite computer self-efficacy increased an average of 15% and the most significant increase (42%) is if the subject had never used a similar package before (Q-2). The second largest increase (33%) noted subjects rated higher computer self-efficacy if no one is around to assist (Q-1). These same two questions were also the most increased in computer self-efficacy strength however reversed, the question about no one around to assist (Q-1) had a stronger change than if the subject had never used a similar package before (Q-2).

**Implications**

The results of this study suggest graphic skills acquisition had a significant positive impact on the computer self-efficacy of the 120 student-participants.

**Independent Learning**

The data shows the most substantial factor from the environment was independent learning (Q-1). Working independently empowers the user to feel in control and provides
a sense of ownership about future direction. Collins (2009) says it is essential to support individual choice in how and what students learn. By enabling student-participants we encourage creating an individual approach and allow students to decide where to begin and what to give attention to, all based on individual and particular needs.

Individuals in my class sought activities to engage and empower; the students had an inherent need to feel in control and claim educational ownership (Baggetun & Wasson, 2006; Bandura 1986, 1991). Students shared the favorite projects were ones with more flexibility and freedom. One example is the self-portrait where students were encouraged to create personal images and connections. Students were excited to create unique pieces of art, original and personal. One student asked if the class could be allowed to do one project on anything selected with minimal direction. This is truly the foundation of self-efficacy, the human desire to control life situations through minimizing failure and constantly reaching for success, goals, and rewards (Bandura 1986; 1991; 1997).

**Access to Support Materials**

An important factor from the social cognitive theory determinant of environment is access to support materials (Q-8). Learners in my class benefited from comprehensive software assistance easily accessible from within the active and current program. Help areas were created by the software manufacture and provided accurate and updated information. The help was usually visible through a link or icon directly in the software, and were searchable, and extremely convenient for references and inquiries.

It took the student-participants some time to find the correct answer to my questions but patience and “persistency increase[s] the likelihood of success” (Bandura & Schunk, 1981, p.596). When a student-participant did not feel pressured by time s/he
felt free to experiment, make multiple attempts, and pause for reflection and modification (Dewey, 1933).

Engaging in Unfamiliar Tasks

Another strong factor from social cognitive theory contributing to increased computer self-efficacy is cognition when engaging in new and unfamiliar tasks (Q-2). These unprecedented actions called for additional thought, recall, and comparison to previous and comparable computer activity from the student-participants. Then the thought process transitioned to compositing knowledge to move the task forward. After acquiring graphics instruction, the respondents were confident with successfully using new and unfamiliar software in the future. This supports the work of Bandura (1986) stating new and intriguing tasks are the most influential on self-efficacy.

Behavior Modeling

Factors from behavior include vicarious experience or behavior modeling (Q-4). In this situation, student-participants had the opportunity to observe the participant-researcher demonstrate various techniques with the tools in the software. The students stayed protected through observation and did not have to prove their knowledge, demonstrate proficiency, and risk failing while trying the technique in front of the participant-researcher and other classmates. The students witnessed an ideal future situation in a tangible way and visualized personal success through the model. Behavior modeling greatly assisted people with phobias and anxieties in my class and some made remarkable progress with the aid of confident and relatable guides (Bandura, Blanchard, & Ritter, 1969). After overcoming a phobia, the student-participant displayed a reduction in general anxiety about other aspects of their life as well.
Although my students felt more efficacious through behavior modeling and the ability to see someone else using the software before trying it, my learners did not want me walking through the process step by step or assisting to complete the job. My learners shared a preference for support documents and time to approach the task in an individual way at a preferred personal pace. The students want examples and resources first followed by autonomy and time for independent learning. My data shows my student-participants felt most confident in completing future computer tasks if there was no prior use of a similar software and when I was not around to assist.

Summary

My findings of the present study show an interesting relationship between independent learning and behavior modeling. Student-participants wanted to have a visual confirmation or proof through behavior modeling to show the task was possible and could be accomplished. The student-participants felt confident after witnessing me or someone else showing the process and achieving the task.

Action Plan

The final step in the action research process is the reflection stage and the development of an action plan where knowledge gained is used to resolve the area of focus identified in step one. (Mertler, 2013). Once the plan is applied, it should be monitored and adjusted as needed to adapt individual environments, students, and teachers. Mertler (2013) states the plan may be a formal document or a set of guidelines for carrying out the recommendations. Table 5.1 is an action planning table outlining the results and future steps to action.
### Table 5.1

**Action Research Plan**

<table>
<thead>
<tr>
<th>Summary of Research Question and Findings</th>
<th>Recommended Actions</th>
<th>Who Will Collect Data?</th>
<th>Timeline</th>
<th>Resources Necessary</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. What factors from social cognitive theory (cognitive, environmental, behavior) influenced students’ self-efficacy with computer technology in an undergraduate graphic arts course?</td>
<td>1. Students are given more time to work alone</td>
<td>1. The participant-researcher</td>
<td>1. Over a semester long class</td>
<td>1. Additional time in the computer lab for the class.</td>
</tr>
<tr>
<td></td>
<td>2. Increased resources are available to students</td>
<td></td>
<td></td>
<td>2. Quick access to support documentation already professionally created (software company resource).</td>
</tr>
<tr>
<td></td>
<td>3. Students observe processes through behavior modeling and witness someone successfully completing a task or project</td>
<td></td>
<td></td>
<td>3. Resources to create additional documentation specific to the class projects.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>4. Resources to conduct demonstrations, computer and projector</td>
</tr>
</tbody>
</table>

The results of this study support graphic skills acquisition has the potential to influence computer self-efficacy in a positive away. The factors identified from Bandura’s social cognitive theory were:
1. Cognition: New and Unfamiliar Tasks

2. Environmental:
   a. Independent Learning
   b. Access to Support Materials
   c. No Time Constraints

3. Behavior: Behavior Modeling

Based on the present study, I will increase independent learning in the classroom and students will have more autonomous time to work with and to practice concepts. Students are often driven by deadlines and the creative process has a different timeline requiring space for some reflection and self-critique. I have often noticed when the class is over more than half of the students stay to continue to work on projects independent. While working, individuals get into a zone and can use this time to experiment. Incorporating work time during the class can help achieve this.

In supporting independent learning I must consider the resources students will need to be successful. Gaining access to support materials created by the publisher would be very helpful so the students could find answers quickly and directly from the source. This would minimize the time spent searching for an answer online through numerous search results claiming to have the answer. Contextual help could also streamline the process so students can get the help needed exactly where and when the question is directly in the program. In additional to software resources, I need to grow my resources specific to the course to provide more guidance for these independent learners.
Cognitively, computer self-efficacy increased when the task was new and unfamiliar, therefore I can incorporate many new techniques in the course. The student may be aware of one use for a specific tool but I can share multiple uses. I can also build lessons around the use of several tools coming together in creative ways to create a new effect.

Another factor I can increase is behavior modeling, the students reported high levels of feeling more efficacious when given the opportunity to see someone else using it before trying it themselves. I use behavior modeling when I show various techniques or processes in a live demonstration. This could also be created on a video so it could be watched when needed at a certain part of the project. A video would also assist those students who need different timing or perhaps have a language barrier. This active research study was made possible through the support of the education and art departments and the numerous participating students. This study increased my students’ computer self-efficacy and motivated me to improve my teaching in specific ways.

**Recommendations for Graphic Arts Faculty**

Based on the findings presented in this dissertation, the participant-researcher has the following recommendations for graphic arts faculty

1. Allow students to work independently, make independent aesthetic decisions, and develop a personalized path to completing the project objectives.
2. Challenge students with new and unfamiliar tasks by introducing advanced techniques and methods for experimentation.
3. Provide support and resources through materials students can explore alone, accessible both in and out of class.
4. Provide a lot of diverse examples, approach the material in various individual ways, and allow the students to find the approach best suited

5. Use behavior modeling to share your expectations and what can potentially be achieved in the project.

**Recommendations for Future Research**

The present study has several limitations and provides opportunities for future research. First, participants were derived from a convenience sample of students enrolled in Visual Arts Computing at the University of South Carolina. Secondly, the Compeau and Higgins (1995b) computer self-efficacy scale was the only instrument used to collect data. Third, due to the historical document data used, demographic information was not included in the research design.

The participant-researcher suggests future research on graphic arts and Adobe Photoshop classes at the same university with various instructors. This research could also be conducted at different universities and community colleges, where students often have less access to technology. An instrument to gain knowledge about technology access and ownership could also inform educators and administrators in higher education. Cassidy and Eachus (2002) present support for positive alignment between both computer ownership and total software programs with computer self-efficacy.

Future research could include other items of measurement in addition to computer self-efficacy and technology access. Measurements for computer attitudes and growth mindset could be used to understand connections between several concepts and can work together to improve computer self-efficacy. Demographic information on gender, race,
major, and age could provide additional information to help identify learners who need more attention.

**Conclusions**

The data presented supports graphic skills acquisition as a method for increasing computer self-efficacy in a graphics arts course. This increased self-efficacy helped develop more independent and confident computer users; scale results showed students were more efficacious when working on new programs with no assistance. Graphics experience has the ability to substantially shape computer self-efficacy and this signifies a need to expand opportunities for graphics interactions, especially in curriculum and training environments (Busch 1995; Hasan 2003). Educators and trainers should consider including graphics as a component of technology projects to help enhance computer self-efficacy.

The evidence shows learners who received graphics instruction are more efficacious about using new and unfamiliar software in the future. Original, unprecedented actions call for individuals to engage in additional thought, recall, and comparison to previous and comparable computer activity. Thoughts then transition to composite knowledge and work to move the task forward. Cognition, behavior, and environment function “interactively as determinants of each other” in a pattern of reciprocal determinism (Bandura, 1986, p. 23). Positive conditions and experiences connect and cycle to form a sustained sequence of healthy, hopeful general computer instincts and beliefs.
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APPENDIX A
COMPUTER SELF-EFFICACY SCALE

DEVELOPED BY D. COMPEAU AND C. HIGGINS (1995B)

Computer Self-Efficacy Measure

Often in our jobs we are told about software packages that are available to make work easier. For the following questions, imagine that you were given a new software package for some aspect of your work. It doesn't matter specifically what this software package does, only that it is intended to make your job easier and that you have never used it before.

The following questions ask you to indicate whether you could use this unfamiliar software package under a variety of conditions. For each of the conditions, please indicate whether you think you would be able to complete the job using the software package. Then, for each condition that you answered “yes,” please rate your confidence about your first judgment, by circling a number from 1 to 10, where 1 indicates “Not at all confident,” 5 indicates “Moderately confident,” and 10 indicates “Totally confident.”

For example, consider the following sample item:

I COULD COMPLETE THE JOB USING THE SOFTWARE PACKAGE...

<table>
<thead>
<tr>
<th>NOT AT ALL CONFIDENT</th>
<th>MODERATELY CONFIDENT</th>
<th>TOTALLY CONFIDENT</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

...if there was someone giving me step by step instructions.

YES ......1 2 3 4 5 6 7 8 9 10

NO

The sample response shows that the individual felt he or she could complete the job using the software with step by step instructions (YES is circled), and was moderately confident that he or she could do so (5 is circled).

I COULD COMPLETE THE JOB USING THE SOFTWARE PACKAGE...
<table>
<thead>
<tr>
<th>Q:1</th>
<th>...if there was no one around to tell me what to do as I go</th>
<th>YES</th>
<th>1 2 3 4 5 6 7 8 9 10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q:2</td>
<td>...if I had never used a software like it before</td>
<td>YES</td>
<td>1 2 3 4 5 6 7 8 9 10</td>
</tr>
<tr>
<td>Q:3</td>
<td>...if I had only the book or software manuals for reference</td>
<td>YES</td>
<td>1 2 3 4 5 6 7 8 9 10</td>
</tr>
<tr>
<td>Q:4</td>
<td>...if I had seen someone else using it before trying it myself</td>
<td>YES</td>
<td>1 2 3 4 5 6 7 8 9 10</td>
</tr>
<tr>
<td>Q:5</td>
<td>...if I could call someone for help if I got stuck</td>
<td>YES</td>
<td>1 2 3 4 5 6 7 8 9 10</td>
</tr>
<tr>
<td>Q:6</td>
<td>...if someone else had helped me get started</td>
<td>YES</td>
<td>1 2 3 4 5 6 7 8 9 10</td>
</tr>
<tr>
<td>Q:7</td>
<td>...if I had a lot of time to complete the job for which the software was provided</td>
<td>YES</td>
<td>1 2 3 4 5 6 7 8 9 10</td>
</tr>
<tr>
<td>Q:8</td>
<td>...if I had just the built-in help for assistance</td>
<td>YES</td>
<td>1 2 3 4 5 6 7 8 9 10</td>
</tr>
<tr>
<td>Q:9</td>
<td>...if someone showed me how to do it first</td>
<td>YES</td>
<td>1 2 3 4 5 6 7 8 9 10</td>
</tr>
<tr>
<td>Q:10</td>
<td>...if I had used a similar software before this one to do the same job</td>
<td>YES</td>
<td>1 2 3 4 5 6 7 8 9 10</td>
</tr>
</tbody>
</table>
APPENDIX B

INSTITUTIONAL REVIEW BOARD (IRB) APPROVAL

INSTITUTIONAL REVIEW BOARD FOR HUMAN RESEARCH
APPROVAL LETTER for EXEMPT REVIEW

This is to certify that the research proposal: Pro00053736
Entitled: Exploring Changes in Computer Self-Efficacy During Graphic Skills Acquisition (Revised)

Submitted by:
Principal Investigator: Michele Dames
College/Department: Education
Instruction & Teacher Education/Curriculum & Instruction
Wardlaw
Columbia, SC 29208

was reviewed in accordance with 45 CFR 46.101(b)(1), the referenced study received an exemption from Human Research Subject Regulations on 3/8/2016. No further action or Institutional Review Board (IRB) oversight is required, as long as the project remains the same. However, the Principal Investigator must inform the Office of Research Compliance of any changes in procedures involving human subjects. Changes to the current research protocol could result in a reclassification of the study and further review by the IRB.

Because this project was determined to be exempt from further IRB oversight, consent document(s), if applicable, are not stamped with an expiration date.

Research related records should be retained for a minimum of three (3) years after termination of the study.

The Office of Research Compliance is an administrative office that supports the University of South Carolina Institutional Review Board (USC IRB). If you have questions, contact Arlene McWhorter at arlenem@sc.edu or (803) 777-7025.

Sincerely,

Lisa M. Johnson
IRB Manager