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Self-direction and Technology Use Among New Workforce Entrants

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Self-direction and Technology Use Among New Workforce Entrants

A Dissertation Presented for the

Doctor of Philosophy

Degree

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Lila Louise Holt

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Dedication

This dissertation is dedicated to my grandchildren

Alyssa Holt,

Hunter and Xander Shewmake

I love you more than you will ever know!

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Abstract

With the knowledge age evolving, colleges and universities should be ever vigilant to assure that the pedagogies practiced are adequately preparing future workers with skills required to keep pace (Scardamalia & Bereiter, 2006). Business managers have identified self-direction and technology use as increasingly important in the 21st century (Partnership for 21st Century Skills, 2006), yet a gap in research of pedagogies that advance self-directedness and promote technology use has been found. To help identify new pedagogies, the purpose of this study was to identify the relationship between self-directed learning (SDL) and technology use of people entering the workplace. A sample of 572 recent university graduates represented the new workforce entrants.

Based on the Personal Responsibility Orientation (PRO)-Model of SDL (Brockett & Hiemstra, 1991), factors of self-direction were identified and measured by the Personal Responsibility Orientation -Self Directed Learning Scale (PRO-SDLS) (Stockdale, 2003). Attitudinal factors of technology use were measured by the Computer Technology Use Scale (CTUS) (Conrad & Munro, 2008).

Results of this study indicated that while significant relationships between SDL and technology use were found, the effect size of the model tested is low (less than .03). Hierarchical regression indicated the factors of SDL as predictors of computer self-efficacy, attitudes toward technology use and computer anxiety are significant in some cases but account for less than 7% of the variance for any one factor. Additionally, both instruments used in this study are relatively new. While reliability for the PRO-SDLS was found to be consistent with previous research, this study indicates that caution should be taken in using the CTUS. Based on these results, this study includes implications for practice as well as recommendations for future research.

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Chapter 1

Introduction

Over the past 50 years, the workplace has undergone a transformation from the industrial age, through the service age, to the knowledge age. Today, workers must learn to quickly adapt to changing technologies in a global and dynamic economy (Marquardt & Kearsley, 1999, p. 391). As this knowledge-creating culture evolves, coherent fundamental pedagogies allowing students to advance knowledge frontiers must be incorporated into the classroom (Scardamalia & Bereiter, 2006). Scholars have recognized the need to refashion education as "advanced technologies are revolutionizing our understanding of learning and how it is best facilitated" (Marsick, Watkins, & O'Connor, 2010, p. 26). But what might this refashioning of education encompass? How could the educational needs required by the knowledge age, that is, 21st century skills, be better understood? As the first step in that understanding, the existing frameworks' foundations, differing views among educators, current endeavors, and workplace perceptions of knowledge-age skills must be examined.

Various frameworks have defined the skill sets for tomorrow's workforce. For example, the Partnership for 21st Century Skills, noted as the predominant advocate for new skill sets in the United States (Johnson, 2009), was developed in 2002 through a joint effort between the United States Department of Education and several major corporations (Partnership for 21st Century Skills, 2006). The framework includes the traditional three R's— reading, writing and arithmetic— along with four C's—critical thinking/problem solving, communication, collaboration and creativity/innovation. From these four C’s, skill sets were identified and then categorized into three groups: a) learning and innovation skills; b) information, media and technology skills; and c) life and career skills.

Another framework is the Blueprint for Career Development. Similar to the Partnership for 21st Century Skills, this framework was developed by the Australian government in collaboration with area businesses as well as educational systems in Canada and United States. The Blueprint identified 11 competencies grouped into three categories: a) personal management, b) learning and work exploration, and c) career building ("Australian blueprint for career development," 2003).

Other frameworks include the Metri Group and North Central Regional Educational Laboratory (Lempke, Coughlin, Thadini, & Martin, 2003), the American Association of Colleges and Universities (2007), and the Organization for Economic Cooperation and Development (2005). In comparing these frameworks, Dede (2009) found them largely consistent, but with differing areas of emphasis. The required workforce skills include critical thinking and problem solving, teamwork and collaboration, technology use, and life skills such as self-directed and lifelong learning ("Australian blueprint for career development," 2003; Partnership for 21st Century Skills, 2006).

Even with all the efforts to capture the required “new” 21st century skills, some researchers question the need for and results of integrating these skills. According to Dede (2009), educators argue that these skills are not really new. Other investigations find these frameworks do not incorporate the subject matter as currently taught today; that is, too much emphasis is placed on learning how to learn without incorporating the necessary underlying concepts on which students can build (Sawchuk, 2009).

Despite differing views on the need for new skill sets, pursuit of 21st century skills continues. Governors and chief school officers in at least 10 states are in the process of rewriting standards and incorporating knowledge-age skills (Gewertz, 2008). Additionally, Iowa and Wisconsin are looking for models to help teachers integrate new skills in the classroom (Gewertz, 2008). Other efforts include various discussions on how to assess student accomplishment of these skills (Silva, 2009).

To obtain comprehensive insights, researchers have also examined employers' perceptions of new entrants into the workforce. In 2006, the Partnership for 21st Century Skills joined with three other organizations (The Conference Board, The Society for Human Resource Management, and Corporate Voices for Working Families) to determine business' perspectives of 21st century skills and preparation of people entering the workforce. Respondents to an in-depth survey included 431 human resource personnel and senior executives, representing over two million employees (Partnership for 21st Century Skills, 2006).

New entrants into the workforce were classified according to educational level: a high school diploma, a two-year college degree, or a four-year degree. The survey incorporated subject matter and other skills identified by the 21st century frameworks. Respondents identified which skills were important and which would be increasingly important over the next five years. For each educational level and skill, respondents categorized new entrants as a) deficient, b) adequate, or c) excellent.

As the survey results in Table 1 indicate, even workforce entrants graduating from four-year institutions did not excel in many areas employers deemed important

(Partnership for 21st Century Skills, 2006). Also, 64% of the respondents indicated that lifelong/self-directed learning would be increasingly important over the next five years. Although 78.3% of the employers rated lifelong/self-directed learning as very important, only 25.9% ranked four-year college graduates as excellent in this area. Additionally, less than half (46.2%) of the four-year college graduates were rated excellent in information-technology application, while 81% of respondents felt such application was very important. Although the survey results may not be generalized to business as a whole, they lend doubt to new graduates' readiness to enter the workforce.

In summary, educational frameworks have been developed and discussed, and in spite of some differing views, are being implemented. At the same time, employers recognize the new skill sets identified as necessary for the 21st century. Therefore, greater understanding of educational needs for the knowledge age is needed.

Table 1 Business Perception of 21st Century Skills

Skill	Very important	Increasingly important over the next 5 years	Four-year degree graduates are Excellent
Information Technology	81.0%	77.4%	46.2%
Diversity	71.8%	67.1%	28.3%
Critical Thinking/Problem Solving	92.1%	77.8%	27.6%
Lifelong/Self-Directed Learning	78.3%	64.0%	25.9%
Oral Communication	95.4%	65.9%	24.8%

Source: Partnership for 21st Century Skills (2006, pp. 21, 34, 49)

Statement of the Problem

This study's further investigation of how prepared graduates of four-year institutions are in self-direction and technology use as they enter the workforce revealed a gap in the current research. Pedagogies to further advance students' self-direction and to promote technology use are lacking (Dede, 2009).

While field- or institution-specific research in students' self-direction exists (Li, Favreau, & West, 2009; Shin, Haynes, & Johnston, 1993), there is a gap in research regarding preparedness for self-direction and technology use of recent four-year graduates entering the work arena. In addition, although much research on self-direction and technology use exists as a predictor of success in online classes (Eachus & Cassidy, 2006; Kerr, Rynearson, & Kerr, 2006; Pillay, Irving, & McCrindle, 2006), as well as assessments of influences on technology use (Moos & Azevedo, 2009), research is lacking concerning the relationship between self-directed learning and technology use in the workforce setting or, more specifically, among new entrants into the workforce. Therefore, the lack of research is the problem identified for this study.

Purpose of the Study

The purpose of this study is to identify the relationship between self-directed learning and technology use of people entering the workplace. More specifically, this study examines the extent to which recent four-year graduates' self-directed learning skills predict factors influencing their technology use. The goal of this investigation is to further the research effort regarding how to better prepare today's college students for the 21^{st} century workplace.

The interest in and need for the present study were confirmed by literature in which employers identified the skills of learning-to-learn and self-direction as increasingly important for employees (Guglielmino, 2008; Guglielmino, Long, & Hiemstra, 2004; Partnership for 21st Century Skills, 2006; Teo et al., 2010), as well as businesses' recognition of the need for employees to adapt to technology (Gross, 2005; Overby, 2002). The research also confirmed that new curriculum and competencies are required to keep pace with workplace changes (Dede, 2009; Gut, 2011; Voogt & Roblin, 2010).

Research Questions

Four questions were addressed in this study:

1. What is the relationship between self-directed learning and selected factors that influence technology use?
2. After control of the variance for age, gender, GPA, and major, what is the relationship between selected factors of self-directed learning and computer self-efficacy?
3. After control of the variance for age, gender, GPA, and major, what is the relationship between selected factors of self-directed learning and attitudes toward technology use?
4. After control of the variance for age, gender, GPA, and major, what is the relationship between selected factors of self-directed learning and computer anxiety?

Theoretical Framework for the Study

This study is based on research of both self-directed learning (SDL) and studies of individuals' technology use. The subsequent sections identify theoretical frameworks based in adult learning theories and the factors influencing technology use. These, frameworks, along with related research, are discussed further in Chapter 2.

Self-directed Learning Framework

Necessary to this study is an understanding of how self-directed learning is defined. Knowles (1975) published "*Self-Directed Learning*," which became a guide for much of the subsequent research and practice by providing foundational definitions and assumptions. Among those assumptions was that individuals continue to learn what is required to perform evolving life tasks (Knowles, 1975). Additionally, Brockett and Hiemstra (1991) emphasized taking personal responsibility for one's learning. Thus, self-directed learning for this study focuses on taking responsibility to learn what is required to perform evolving life tasks. Self-directed learning does not indicate learning in isolation, but rather the learner taking responsibility for and control of the subject matter and/or method to be learned (Brockett & Hiemstra, 1991).

Of the differing models of self-direction, one widely recognized— the Personal Responsibility Orientation (PRO) model was deemed appropriate for examining self-directed learning as a skill for the knowledge age. While the model includes the conceptualization of the personal responsibility of SDL equally important are distinctions between SDL encompassing personal or learner characteristics (LC) as well as a learning process, that is the teaching/learning (TL) transaction (Brockett & Hiemstra, 1991). In the PRO model, it is the learner's assuming personal responsibility that stimulates the learning process.

In an effort to validate ways of empirically examining self-direction, a recent scale was developed based on the PRO model of self-direction (Brockett & Hiemstra, 1991) titled the Personal Responsibility Orientation – Self-Directed Learning Scale (PRO-SDLS) (Stockdale, 2003; Stockdale & Brockett, 2010). The PRO model of self-direction, as captured in the PRO-SDLS, includes the following four factors:

- Control: Within the TL transaction of the PRO model, control is identified as a basic part of learning to be self-directed. According to Brockett & Hiemstra (1991), "[I]t is the ability and/or willingness of individuals to take control of their own learning that determines their potential for self-direction." (p .26) (The term control, as used in this study, means to direct one's learning.).
- Initiative: Based on the PRO model of self-directed learning, the learner is proactive by taking steps toward decisions and/or actions. Previous definitions have used the term initiative in a similar manner (Knowles, 1975).
- Motivation: Adult education scholars propose a theoretical relationship between self-direction and intrinsic motivation (Bitterman, 1989; Delahaye & Smith, 1995). Motivation is the desire to take action steps. This desire can be internal or external.
- Self-efficacy: The self-efficacy factor is based on writings regarding the learner's self-confidence (Brockett & Hiemstra, 1991). The concept of self-efficacy has

been derived from Social Learning Theory and refers to the belief in one's own capabilities required to produce a given outcome (Bandura, 1977, 1986, 1997).

The PRO Model along with the relationship to the PRO-SDLS is shown in Figure 1. Chapter 2 explores other models of self-direction and instruments as well as further discusses the PRO model and PRO-SDLS.

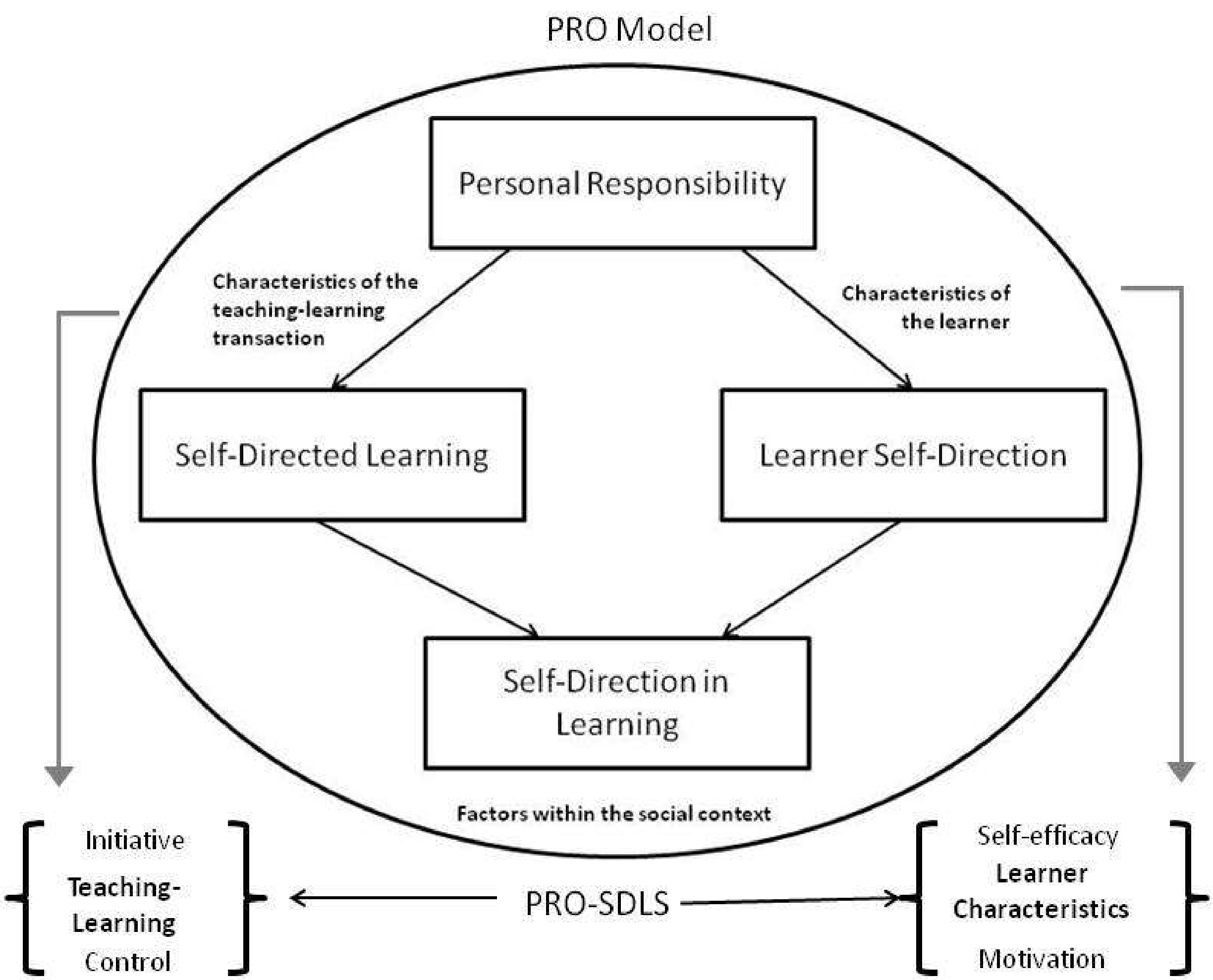

Figure 1. PRO model (Brockett & Hiemstra, 1991, p. 25). Reproduced with permission. PRO-SDLS (Stockdale, 2003)

Technology Use Framework

Just as with self-directed learning, individual use of an adaptation to technology has been the focus of much research. One literature review examined many variables influencing an individual's use of technology (Czaja et al., 2006). From attitudinal variables identified, computer self-efficacy, attitudes toward technology use, and computer anxiety were selected as appropriate for this study. These attitudinal variables found to influence technology use were derived from Social Learning Theory (SLT) (Bandura, 1977); the Theory of Reasoned Action (TRA) (Fishbein & Ajzen, 1975); and affective motivation, that is, the way in which individuals experience, process and behave based on emotions. For example, a negative experience correlates directly with a negative attitude (Bandura, 1986). The following is an overview of the three factors influencing technology use implemented in this study:

- Computer self-efficacy: Bandura (1997) suggested that measures of self-efficacy should be domain-specific to be effective. Due to the continuous change in technology, self-efficacy has been viewed as the most useful sphere in determining outcomes of technology influence (Beas & Salanova, 2006). Computer self-efficacy is the belief that one can successfully use computer technology to achieve a given outcome.
- Attitudes toward technology use: Research in the 1980's and 1990's determined that an individual's experience using computers was positively correlated with attitudes (Brown & Inouye, 1978; R. Torkzadeh, Pflughoeft, & Hall, 1999). Attitudes are the manner, feeling and/or position regarding a person, place or

thing (i. e., technology). Attitudes toward technology use can influence the way in which an individual interacts with technology (Conrad & Munro, 2008).

- Computer anxiety: Anxiety refers to feelings of apprehension, tension, nervousness and/or worry. Computer anxiety is a fear of using computers (Chua, Chen, & Wong, 1999).

The choice of these attitudinal variables was confirmed in part by the many scales designed to measure computer self-efficacy, attitudes toward technology, and computer anxiety that have been developed and used over the years. Although significant advances in technology have rendered many of the instruments dated or even obsolete (Christensen & Knezek, 2000; Eachus & Cassidy, 2006; Gressard & Loyd, 1985; Heinssen, Glass, & Knight, 1987; Loyd & Gressard, 1984; Marcoulides, 1989; Meier, 1988; Oetting, 1983) efforts to examine these variables continue. A more recent scale, the Computer Technology Use Scale (CTUS), encompasses the three factors identified above (Conrad & Munro, 2008). Because of the use of more current computer terminology, this study incorporated the CTUS for the technology instrumentation.

Research has also identified social/demographic and personal variables that may be correlated with technology use. Specific variables such as education and intelligence (Czaja et al., 2006), college major (Balcita, Carver, & Soffa, 2002), age (Moos & Azevedo, 2009; Salanova, Grau, Cifre, & Llorens, 2000; Scott & Walczak, 2009), and gender (Cassidy & Eachus, 2002; Durndell & Haag, 2002; Moos & Azevedo, 2009; Whitley, 1997) have been examined. In addition, significant differences have been noted in the teaching styles of the Science, Technology, Engineering, and Mathematics (STEM) fields (K. A. Smith, 2010). For example one style of teaching in STEM includes "grading on a curve." Research found 59% of engineering faculty reported "grading on the curve" as opposed to 22% of all faculty (Astin, 1993). These studies' mixed findings leave the tested relationships and impact on teaching styles unclear. Therefore, to obtain a clearer picture of the relationship between SDL and technology use, this study controlled for any variance due to age, gender, intelligence (as represented by GPA) and college major(referred to as a major in this study)as represented by those students in the STEM field versus students in other fields. In addition to self-directed learning frameworks, Chapter 2 will further discuss factors influencing technology use and the CTUS.

Significance of the Study

This study focused on the relationship between underlying factors of self-directed learning and technology use and examined both the interactions of the factors and newer instruments used for measurement. A deeper understanding of the underlying attitudinal variables affecting change with technology may be valuable in understanding unimaginable changes on the technological horizon. Discovering the relationships between self-direction and technology use may help further the knowledge base of theories and instrument development in these areas. Furthermore, in examining the relationship between self-direction and technology use, this study will hopefully advance practice in developing pedagogies for the dynamic 21st century workplace. That is, by developing learner self-direction it may be possible to promote use of technology, and thus better equip tomorrow's workforce for the technological changes that it will face.

Assumptions, Delimitations, Limitations and Definitions

This study assumes the following:

- Respondents to the PRO-SDLS, CTUS and demographic information provided accurate and honest information.
- The survey questions used in this study adequately reflected the identified variables associated with self-directed learning and technology use.

The following are the delimitations of this study:

- Only students who had applied to graduate from a major university were included in this study.
- The survey instrument was administered online.
- The survey instrument was the only method of collecting data.

This study is limited by the following:

- All survey items were subject to the respondents' interpretation.
- Because the survey population was limited to one institution, the results may not be generalizable to all other four-year institutions.
- The survey's population was delimited as described above. No attempt was made to control for quality of courses or classroom pedagogies.

In this study, the following terminology is used as defined below:

- *Knowledge age*: The current era in which knowledge is also recognized as an economic commodity. This era has also been referred to as the information age. The skills required for this era have been referred to as 21st century skills.

- *Self-directed learning*: Self-directed learning consists of "both the external characteristics of the instructional process and the internal characteristics of the learner, where the individual assumes primary responsibility for a learning experience" (Brockett & Hiemstra, 1991, p.24). Although *self-directed learning*, *self-direction in learning*, and *learner self-direction* are defined differently by Brockett and Hiemstra the terms are used interchangeably in this study.
- *Technology*: Hardware and software that can be used and/or manipulated to search, store, increase knowledge, or accomplish tasks. Applicable to this study are new technologies of the ever evolving knowledge tools that are rapidly being developed.

Other variables have been defined throughout this chapter.

Conclusion

Technology use is essential in the knowledge age, and technology changes are a continuous challenge. The skills required to keep pace with these changes need to be examined and incorporated into the education of new workforce entrants. This study explored the relationship between one such skill, self-directed learning, and technology use among recent college graduates. The goal was to further the body of knowledge of SDL and technology use as the first step in identifying ways to better prepare today's college students for the 21st century workplace.

Chapter 2 continues with a review of the literature of self-direction and technology. Included in this review is a discussion of the instruments used in this study. Chapter 3 discusses the research design and procedure. Chapter 4 presents the results.

Finally, Chapter 5 provides conclusions based on this research and offers recommendations for future research and practice.

Chapter 2

Review of the Literature

Chapter 1 identified a need to examine pedagogies in colleges and universities as they seek to educate 21st century workers. The problem, purpose and a theoretical framework for this study were presented. Chapter 2 is a review of the literature supporting that framework with the intent to create a basis for this study and other research opportunities. Discussed first is the literature of self-directed learning. Beginning with what might be considered the seminal works on self-direction, the review includes a survey of selected models and instruments used in self-directed learning research and concludes with a discussion of the PRO-Model (Brockett & Hiemstra, 1991) and the PRO-SDLS (Stockdale, 2003) chosen for this study. Following the review of self-directed learning literature is a review of selected theories and research on technology use. Since the literature surrounding the technology use is extensive, this review uses the theoretical framework presented in Chapter 1 as a lens to focus on attitudinal factors influencing technology use.

Self-Directed Learning

The review of self-directed learning literature begins with a brief consideration of history and previous research. Because an abundance of literature on self-directed learning exists, this section is limited to seminal works and models, along with research applicable to higher education.

Self-Directed Learning (SDL): Background and Models

Much of the work in self-direction today has its roots in the works of Houle, Tough, and Knowles. While it is unclear whether Houle's terminology included direct reference to self-direction, the argument has been made that Houle contributed to self-directed learning both in his writing and in the legacy of his students Tough and Knowles (Brockett & Donaghy, 2005). In his 1961 study of 22 adult learning participants, Houle identified three learning orientations: a) *learning oriented* where adults engage in education for the sake of learning itself, b) *activity oriented* where social interaction becomes the impetus for learning projects, and c) *goal oriented* where education is viewed as means to a larger end (Houle, 1988; originally published in 1961).

Tough (1966) focused on Houle's *learning orientation* for further quantification of adult learning. By examining "adult self-teachers," Tough (1979; originally published 1971) found that adults do engage in continued learning by undertaking an average of eight learning projects annually.

Knowles (1975) expanded the concept of self-direction to include adults in formal learning situations. Self-direction was further explained as "a process in which individuals take the initiative, with or without the help of others, in diagnosing their learning needs, formulating learning goals, identifying human and material resources for learning, choosing and implementing appropriate learning strategies, and evaluating learning outcomes" (p. 18).

Smith and Haverkamp (1977) noted that many educators such as Houle, Tough, and Knowles, among others, have emphasized *learning to learn* as a skill. For example, Smith and Havercamp (1977) found that Knowles identified the following skills for self-direction:

> The ability to develop and be in touch with curiosities (to engage in divergent thinking).
>
> The ability to formulate questions ... that are answerable through inquiry (to engage in convergent or inductive-deductive reasoning).
>
> The ability to identify the data required to answer the various kinds of questions.
>
> The ability to locate the most relevant and reliable sources of ... data
>
> The ability to select and use the most efficient means for collecting the required data from the appropriate sources.
>
> The ability to organize, analyze, and evaluate the data so as to get valid answers.
>
> The ability to generalize, apply, and communicate the answers to the questions raised. (Knowles, 1973, p. 163)

Subsequent works on SDL have encompassed a wide variety of terminology, categorizations, conceptualizations and models. Scholars have noted that other terms (e.g. self-planned learning, self-teaching and autonomous learning) are often interchanged with self-directed learning and each slightly shifts the emphasis (Brockett & Hiemstra, 1991). More recently, SDL has been categorized as having one of three goals depending on a person's philosophical view: a) personal responsibility, b) transformational learning, and c) social impact (Merriam, 2001). The goal of personal responsibility is for learners to take control by being personally accountable for their own learning (Brockett & Hiemstra, 1991; Garrison, 1997). The goal of transformational learning posits reflection and self-knowledge as necessary for autonomy that is an integral part of self-direction (Mezirow, 1985). Other goals of self-direction are social impact and emancipatory learning. For example, learners can use the Internet to mobilize and publicize to create social change (Meikle, 2002; Shirky, 2008). The following discussion expands on these three goals and conceptualizations.

Candy's conceptualization of SDL. In Candy's (1991) conceptualization, which is based on a constructivist view, learning occurs within each person's unique frame-of-reference. Underlying competencies are argued to form the basis for SDL and include the following: self-management skills; familiarity with subject matter; and the most difficult to define, the learner's quiet assurance of control. Developing the competencies is a continuous endeavor and should be built into educational criteria.

The Staged Self-directed Learning model. This model focuses on the teaching-learning setting. In this model, the teacher helps a learner progress through four stages from dependent to self-directed. Each stage includes techniques the teacher can use to aid the learner in moving to the next stage (Grow, 1991). The Staged Self-Directed Learning model however was criticized for categorizing of some teaching styles as being superior to others (Tennant, 1992). In a defense of the Staged SDL model, Grow (1994) responded by clarifying there was no intended ranking as to one teaching style being superior to the others.

Garrison's comprehensive model. The above conceptualization and models are from an approximately concurrent timeframe and set the stage for three closely interwoven dimensions that provide the basis for Garrison's model. According to

Garrison (1997), self-monitoring, self-management and motivation integrate in a collaborative constructivist view whereby meaning and knowledge are built both personally and socially. Self-monitoring ensures that new knowledge is integrated in a meaningful way and is synonymous with responsibility so that the learner commits to using pervious knowledge to make meaning of new concepts. Self-management is aligned with the learner's control of the learning environment. However, self-management does not equate to learning in isolation: instead, the learning processes are facilitated rather than dictated. Motivation includes both "entering" or initial motivation and continuing motivation to work on the task. Entering motivations are a combination of personal need, affective states, personal characteristics (such as competency) and contextual characteristics or contingencies. In turn, the persistence of these motivational factors, affects the task or continuing motivation.

Self-Directed Learning Process model. Pilling-Cormick (1997) proposed three components of this model: the control of the educational process, interaction between student and educator, and factors influencing the control and interaction. Control is the extent to which students can direct their learning. Pilling-Cormick identified four factors that affect student control: a) social constraints, b) environmental characteristics, c) student characteristics and, d) educator characteristics. Learning is an active process based on interaction between student and educator in which the student determines the information or skill needed.

Performance, Assessment and Selection (PAS) model. This recent model of self-directed learning was developed in conjunction with an effort to understand cognitive load and its effect on SDL (van Merriënboer & Sluijsmans, 2009). Critical reflection becomes the basis for individual assessment of performance and plays an integral role in the learner's selection of a subsequent learning task. In this model, cognitive load theory, as well as four-component instructional design theory (i.e. learning tasks, supportive information, procedural information and part-task practice) is applicable to the PAS model's scaffolding. That is, not only should cognitive load and four-component instructional design theory be considered in educational design (Performance), but also the scaffolding necessary to aid learners in evaluating what they have learned (Assessment) and identifying further learning needs (Selection). Thus this model enables the learner's self-direction skills.

In summary, many terms, conceptualizations and models are available for self-directed learning. Along with those specifically listed above, research includes development of models for specific educational areas such as online learning (Song & Hill, 2007), human-resource development (Ellinger, 2004), foreign education (Guoxue, 2005) and museums (Banz, 2008). Because this study focused on the general student population of a four-year university, more directed models of SDL have not been included for review.

This study concentrates on self-directed learning as a skill for the 21st century workplace. Thus, this section focuses on learners possessing the ability to take initiative and responsibility for their own learning, along with those characteristics measureable upon graduation from a four-year institution. While several of the models discussed implications applicable to instructional pedagogies (Candy's, PAS and Self-Directed

Learning Process model), which may later be applicable for actual design, this study concentrated on learners' skills that encompass both the characteristics possessed and the teaching-learning transaction. For this reason the Personal Responsibility Orientation (PRO) model (to be discussed later in this chapter) was selected as the basis for this study.

Measuring SDL: Instruments and Research

Just as many models of SDL exist for specific domains, so do specific scales. In her dissertation, Stockdale (2003) identified 16 scales measuring some aspect of self-directed learning. Since that writing, a multitude of scales have been developed for specific audiences (e g., Cheng, Kuo, Lin, & Lee-Hsieh, 2010; Teo et al., 2010). Two of the most prominent scales designed to measure self-direction are the Self-Directed Learning Readiness Scale (SDLRS) (Guglielmino, 1977) and the Oddi Continuing Learning Inventory (OCLI) (Oddi, 1984). Although a well known instrument for measuring self-direction, the OCLI measures personal characteristics (Oliveira, Silva, Guglielmino, & Guglielmino, 2010) only and thus, was not considered for this study. Because the SDRLS is the most widely used instrument in SDL research, studies implementing it are examined more fully.

The SDLRS. Translated into 14 languages, the SDLRS has had a wide acceptance among many scholars in the field of adult education (Caffarella & Caffarella, 1986). To date, the SDLRS has been used by over 300,000 individuals and 500 organizations (Guglielmino, 2010).

Developed through a three-round Delphi study of 14 SDL experts, the 58-item scale includes 33 desirable characteristics of self-directed learners (Guglielmino, 1977). Both the reliability and validity of the SDLRS have been challenge. In a summary of studies, Kok, Aris, and Tasir (2008) found reliability alpha's between .67 and .02. The SDLRS' internal consistency has been an ongoing debate (Bonham, 1991; Brockett, 1985; Field, 1989) that remains, for the most part, unresolved (Hoban, Lawson, Mazmanian, Best, & Seibel, 2005). Nevertheless support for using the instrument continues with recommendations to consider with whom and how it is used (Brockett & Hiemstra, 1991).

Research using the SDLRS. In a review of literature involving the SDLRS (Stockdale, 2003), different demographics of validity were examined. Of 16 studies reviewed, a positive correlation was noted between age and the SDLRS for undergraduate students. Likewise, the research's results regarding gender have been mixed. For example, Stockdale (2003) found that, while 11 studies showed no significant differences with the readiness scale, other studies revealed that either female or male respondents had significantly higher scores. The findings of other research using GPA and educational attainment were also mixed. Stockdale's conclusions noted that age and GPA were predictors of SDLRS scores, while gender and educational attainment were not.

Since Stockdale's (2003) review of the literature, results of studies using the SDLRS have been mixed. In the educational setting a variety of differences in SDL scores have been found. For example, there is strong evidence that SDL skills can be learned (Dynan, Cate, & Rhee, 2008; Jiusto & DiBiaso, 2006; Litzinger, Wise, & Lee, 2005; Malta, Dimeo, & Carey, 2010; Oskay, 2010; Rice-Spearman, 2010; Smedley, 2007; Zhou & Lee, 2009). Problem-based learning and learning environment affected SDL scores (Litzinger et al., 2005; Park, Zhang, Shin, & Cha, 2009; Zhou & Lee, 2009). However, students' epistemology (Hashim, Zainal, Zali, & Ibrahim, 2009) and delivery media (Strickland, 2010) did not.

Educational levels were also found to have a positive relationship with SDL scores (Amey, 2009; Litzinger et al., 2005; Oliveira et al., 2010; Zhou & Lee, 2009), as did GPA (Litzinger et al., 2005). Further differences in SDL scores were found across different college majors (Kok et al., 2008). For example, regarding cultural differences, students in the medical field were noted to have higher SDL scores across cultures (Fitzgerald & Findlay, 2006; Gyawali, Jauhari, Shankar, Saha, & Ahmad, 2011; Huynh et al., 2009; Klunklin, Viseskul, Sripusanapan, & Turale, 2010; Smedley, 2007). One study, however, noted a cultural difference in business majors (Beitler & Mitlacher, 2007). On the other hand, ethnicity in social work students revealed no difference in SDL scores (Amey, 2009). Finally, in the workplace, leadership skills were found to have a positive relationship with SDL scores (Liddell, 2008; Zsiga, Liddell, & Muller, 2009).

While the above findings are fairly consistent, the results of the demographics of age and gender in the SDRLS were mixed. Of four studies reporting SDL scores by age, two found no significant relationship between age and SDL scores (Amey, 2009; Oliveira et al., 2010), while two found a positive relationship to age (Litzinger et al., 2005; Reio &

Davis, 2005). Of five studies reporting relationships between gender and SDL scores, two found no significant relationship (Amey, 2009; Oliveira et al., 2010), while three did find a correlation (Kok et al., 2008; Litzinger et al., 2005; Reio & Davis, 2005).

In summary, as shown in Table 2, the reviewed literature indicates mixed results and/or correlations of age, gender, GPA and college major. Additionally, in terms of the college major a relationship was identified between SDL and the sciences (medicine) and engineering fields. As noted in Chapter 1 these majors are included in STEM. Drawing from this body of research, age, gender, GPA and college major (STEM) were chosen for further consideration in this study.

The PRO model and the PRO-SDLS

As described in the theoretical framework section of Chapter 1, the Personal Responsibility Orientation (PRO) model (Brockett & Hiemstra, 1991) is based primarily on the humanist philosophy with personal responsibility being a major component of this model. Self-directed learners are responsible for making personal choices and learning how to learn. As shown in Figure 1 in Chapter 1, stimulating the learning process is the learner's personal responsibility which integrates not only learner characteristics, but also learning as a skill. This skill encompasses the teaching-learning transaction. Brockett and Hiemstra (1991) stress that self-direction occurs within a larger social context. Building on previous research (Spear & Mocker, 1984), Brockett and Hiemstra (1991) examined the environment's impact on learning.

Table 2 Selected Research Using the SDRLS since 2003

	Sample																			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Age				N				N											Y	Y
Gender				N				N						Y					N	Y
GPA																			Y	
Major	Y	Y							Y					N	Y	Y		Y		
Improve			Y		Y	Y					Y	Y					Y			
LE					Y		N			Y			Y						Y	
EL			Y	Y				Y			Y								Y	

Improve – SDL scores improved over time
LE – Learning environment/Media
EL – Educational Level (Grade Level)

Y tested with significant findings
N tested with no significant findings

Sample:
1. First year medical students in India (*n* = 121) (Gyawali et al., 2011).
2. Nursing students in Thailand (Klunklin et al., 2010).
3. Occupational therapy and physical therapy students (*n* = 86) (Malta et al., 2010).
4. Individuals in Portuguese companies (*n* = 145) (Oliveira et al., 2010).
5. Pre-service teachers (*n* = 50) (Oskay, 2010).
6. Laboratory students (*n* = 50) (Rice-Spearman, 2010).
7. Undergraduate students (*n* = 68)(Strickland, 2010).
8. Social work students: Seniors (*n* = 115) Masters (n = 70) (Amey, 2009).
9. Pharmacy students (*n* = 150) (Huynh et al., 2009).
10. Cyber university students (*n* = 219)(Park et al., 2009).
11. Computer science students (*n* = 100) (Zhou & Lee, 2009).
12. Students (*n* = 185) (Dynan et al., 2008).
13. Nursing students (*n* = 369) (Huang, 2008).
14. Students (*n* = 266) (Kok et al., 2008).
15. United States and German business students (Beitler & Mitlacher, 2007).
16. Australian nursing students (Smedley, 2007).
17. Students (*n* = 107) (Jiusto & DiBiaso, 2006).
18. Third-year medical students (*n* = 873) (Fitzgerald & Findlay, 2006).
19. Engineering students (*n* = 330) (Litzinger et al., 2005).
20. Participants (*n* = 530) (Reio & Davis, 2005).

Criticism of the PRO model includes reference to the encompassing social context. Flannery (1993) argued that the social context of self-direction is minimized in the PRO model and that cultural issues and societal roles in learning are inadequately considered. Acknowledging Flannery's criticism, Brockett and Hiemstra (2010) proposed revising the PRO model.

As discussed in Chapter 1, the PRO-SDLS was developed based on the PRO model (Brockett & Hiemstra, 1991) with a focus on the higher education context (Stockdale, 2003; Stockdale & Brockett, 2010). Stockdale's (2003) scale was developed to examine both the teaching-learning transaction (TL) and learner characteristics (LC) as proposed in the PRO model. The scale's purpose was two-fold: (a) identifying items that reflect both the teaching-learning process and the learner's characteristics and (b) validating the instrument with other measures of self-directed learning. Six objectives guided the PRO-SDLS scale's construction:

1. Development of a reliable measure of self-directedness
2. Content validated by a panel of experts
3. Congruent validation with the SDLRS
4. Construct validation by comparing scores with related behaviors
5. Convergent validity by comparing with professors ratings of their students who participated in the study
6. Demonstration that PRO-SDLS scores added unique variance to the prediction of self-direction scores using the SDLRS (Stockdale, 2003)

In conjunction with the PRO model's use, Stockdale (2003) considered adult education literature, as well as literature from psychology and educational psychology to further determine learner characteristics of self-direction. From the questions originally developed for the PRO-SDLS, a panel of experts identified four factors contributing to the instrument (Stockdale & Brockett, 2010); two for the TL construct and two for the LC construct.

For the TL construct, two factors - learner control and initiative - were based on the PRO model and adult-education literature. For the first factor, learner control, Stockdale (2003) drew from the seminal works of Kasworm (1982), Fellenz (1985) and Long (1990). Stockdale (2003) referenced Long's (1990) assertion that learner control over the learning process is often overlooked in SDL. In addition, Stockdale (2003) noted Fellnez's (1985) indication that the outcome of self-directed learning may be influenced by the locus of control.

Initiative was the second factor in the PRO-SDLS's TL construct. In the PRO model, Brockett and Hiemstra (1991) referred to TL interactions as the "process in which a learner assumes primary responsibility…" (p. 24). Stockdale (2003) noted the relationship of Knowles' (1975) definition of SDL in which a learner takes initiative for learning. Noting these similarities, Stockdale (2003) selected the term *initiative* for the PRO-SDLS.

The PRO-SDLS's LC construct was composed of motivation and self-efficacy. Based on the literature of psychology and of educational psychology, Stockdale (2003) drew from Deci and Ryan's (1985, 2000) description of motivation types. These researchers suggested that when learners are freely motivated, whether intrinsically or extrinsically, self-direction in learning occurs. While some extrinsically experienced motivation might be perceived as other-directed, self-direction occurs when people believe they have chosen their own behavior.

Self-efficacy is defined according to Bandura (1977) and social learning theory. Stockdale (2003) noted that the term *self-efficacy* was used instead of *self-confidence* and was defined by Bandura (1977) as "people's judgments of their capacities to organize and execute courses of action required to attain designated types of performances" (p. 391).

In developing the PRO-SDLS, Stockdale (2003) conducted three pilot studies to obtain the research objectives previously described. The first two pilot studies tested the components of either TL or LC as they compared to the SDLRS (Guglielmino, 1977). The third study consisted of both the TL and LC components of the PRO model and was used to evaluate findings.

In evaluating the reliability of the PRO-SDLS, Stockdale (2003) noted, "The high coefficient alpha (.92) indicated that self-direction as measured here can be regarded as a unitary construct" (p. 114). Content validation was met by asking a panel of six experts to decide whether the PRO-SDLS's items appropriately related to the PRO-Model's TL or LC components. Although 100% agreement was not reached for most items, the panel strongly agreed that 31 of the 35 items were representative of one or more of the components.

The next objective investigated congruent validity by examining the relationship between scores of the PRO-SDLS and the SDRLS (Guglielmino, 1977). Comparison of each instruments scores yielded an alpha value of less than .70. Thus, Stockdale (2003) concluded that this objective had been met.

Stockdale (2003) also compared the scores on the PRO-SDLS to other demographics in the survey. Age, GPA, previously completed semester hours and course performance were used and a moderately significant relationship was demonstrated. Stockdale then concluded that "construct validity coefficients established significant relationships between PRO-SDLS scores and related behavioral criteria" (p. 126).

The objective of convergent validity was not met for the PRO-SDLS when student scores of the PRO-SDLS or SDLRS were compared to a professor's rankings of the same students in a graduate course. For the last objective, the PRO-SDLS showed improvement over the SDLRS on the prediction of GPA, age and course performance. Stockdale concluded that a link between self-direction and the PRO-SDLS existed. In addition, administering the instrument in different settings was recommended to further study the scale's reliability.

Four additional studies that have used the PRO-SDLS were identified (Boyer, Langevin, & Gaspar, 2008; Fogerson, 2005; Gaspar, Langevin, Boyer, & Armitage, 2009; Hall, 2011). Table 3 provides those studies' PRO-SDLS' scores. Fogerson (2005) used the PRO-SDLS to examine learner satisfaction with online courses in relation to self-direction. Online learners' overall score on the PRO-SDLS was 96.91, which was higher than Stockdale & Brockett's (2010) score of 80.05. The scale's internal consistency was .91, which was similar to Stockdale & Brockett's result.

Table 3 PRO-SDLS Study Scores

	n	Mean	STD
Stockdale & Brockett(2010)	195	80.05	12.47
Fogerson (2005)	217	96.91	11.82
Boyer, Langevin & Gaspar, (2008)	15	89.67	12.00
Gaspar, Langevin, Boyer, & Armitage (2009) Sample 1	14	90.64	12.30
Gaspar, Langevin, Boyer, & Armitage (2009) Sample 2 (pre-test)	5	91.60	13.35
Gaspar, Langevin, Boyer, & Armitage (2009) Sample 2 (post-test)	5	84.00	4.74
Hall (2011) (pre-test)	110	89.62	10.03
Hall (2011) (post-test)	110	91.17	10.92

While no significant correlations were revealed between the study's readiness and satisfaction factors, a positive correlation was found between self-direction and age.

Boyer, Langevin, and Gaspar (2008) investigated the relationship among self-direction, constructivist apprenticeship and programming skills in an effort to develop pedagogies for computer programming instruction. In a sample of 15 programming students, the PRO-SDLS yielded a score 89.62. Gasper, Langevin, Boyer & Armitage (2009) furthered this work by evaluating self-direction in programming instruction. An initial survey of 14 programming students resulted in a mean score of 90.64, while those with pre- and post-test scores resulted in 91.60 and 84.00 means respectively (n = 5). Although a small sample size, the large decrease in the PRO-SDLS score from pre- to post-test was recommended for further study. Additionally, while the PRO-SDLS was used to evaluate students' self-direction, no reliability data was noted.

Hall (2011) used the PRO-SDLS to examine the self-direction of first-year, first-generation students attending a summer program to prepare for college. The 110 students in a pre- and post-test design scored means of 89.62 and 91.17 respectively. The PRO-SDLS' reliability was confirmed with a Cronbach's alpha of .84 pre-test and .97 post-test. After one semester of college, a significant relationship was found between the scores of the PRO-SDLS and GPA, although no significant relationship between PRO-SDLS scores and age, gender or ethnicity was noted.

In summary, the PRO-SDLS's reliability has been consistent across studies. Additionally, the instrument was designed around the PRO model and encompasses practical teacher-learner transactions. The PRO-SDLS has also been used to investigate classroom pedagogies. For these reasons, the PRO-SDLS was selected as one of this study's instruments.

Factors of Technology Use

Use of technology can be examined from different perspectives, such as diffusion of innovation (Rogers, 1995) or the Technology Acceptance Model (TAM) (Davis, 1989). The diffusion of innovation's stages are knowledge of the innovation, persuasion by forces, decision, implementation and confirmation. While important in research, the diffusion of innovation theory incorporates external factors, such as social persuasion, as opposed to internal factors including personal characteristics or skills and may be examined as related to SDL. Likewise, another external factor based on technology's usefulness is integrated into the TAM. Because this study focuses on the internal characteristics and skills that may influence technology use, as opposed to external persuasion or perceived usefulness of technology tools, the TAM is not discussed further.

Theoretical Background

As noted in Chapter 1, theoretical framework is derived from Social Learning Theory (SLT) (Bandura, 1986), the Theory of Reasoned Action (TRA) (Fishbein & Ajzen, 1975), and the concept of affective motivation. While many variables influencing technology use have been investigated, the identified personal characteristics are attitudinal variables of computer self-efficacy, attitudes toward technology use and computer anxiety (Czaja et al., 2006). Other variables that may also influence technology use include social/demographic variables, personal variables (e.g. age, education) and intelligence (represented by GPA) (Czaja et al., 2006). A relationship between technology and college major choices has also been considered (Balcita et al., 2002). As with SDL, many of these other variables have shown to be inconclusive for predicting technology use. With this study's focus being on the relationship between SDL and factors of technology use, this portion of the literature review examines computer self-efficacy, attitudes toward technology use and computer anxiety in an effort to understand those factors' underlying constructs. Although each of these three factors may appear to be distinct research problems, any two or three of them may, in fact, be researched in any particular study. For that reason, this section briefly examines these three attitudinal factors, along with selected research.

Computer Self-Efficacy

This study's theoretical framework noted the development of computer self-efficacy (CSE) as domain specific to the more general self-efficacy as described by SLT. Self-efficacy is the ability to take a course of action based on skills, as opposed to the evaluation of individual component skills. Bandura (1984) described this distinction in his examination of driving self-efficacy:

> In measuring driving self-efficacy, people are not asked to judge whether they can turn the ignition key, shift the automatic transmission, steer, accelerate and stop an automobile, blow the horn, monitor signs, read the flow of traffic and change traffic lanes. Rather they judge whatever their subskills may be, the strength of their perceived efficaciousness to navigate through busy arterial roads, congested city traffic, onrushing freeway traffic, and twisting mountain roads. (p. 233)

Likewise, when examining computer self-efficacy, being able to use technology is more important than the general skills of turning on the computer or using a specific program, which may be considered underlying component skills. CSE is defined as an individual judgment of one's capability to use a computer (Compeau & Higgins, 1995). Computer self-efficacy has been viewed as multifaceted in that it can be considered general or specific (Marakas, Yi, & Johnson, 1998). This study did not concentrate on a specific technology tool; therefore, CSE refers to general CSE. Computer self-efficacy was found to be a key factor in adopting technology in the workplace (Thatcher, Gundlach, McKnight, & Srite, 2007) and a predictor of computer anxiety (Downey & McMurtrey, 2007).

Attitudes Toward Technology Use

Social psychology literature has regarded attitudes and beliefs as predictors of behavior. A theory of reasoned action postulates that beliefs and attitudes lead to behavioral intentions (Fishbein & Ajzen, 1975). Early in the history of home computer use, a number of studies investigated attitudes about computers in relationship to an individual's computer experience (Levine & Donitsa-Schmidt, 1998). These studies' results indicated a positive relationship between computer experience and attitudes about computers. Furthermore, attitudes were found to be predictors of computer use (Levine & Donitsa-Schmidt, 1998). In fact, a recent study of students using an e-portfolio indicated that attitude had the most significant effect on usage. In addition, adults' attitudes have been shown to be modifiable with increased computer experience (Jay & Willis, 1992). Thus, as demonstrated in Table 4, while experience affects attitudes and attitudes have been found to affect further usage, gender, age and other factors were not as clear.

Computer Anxiety

Research has commonly recognized computer anxiety as a factor in technology use (Cambre & Cook, 1985; G. Torkzadeh & Angulo, 1992). Computer anxiety has been defined as a negative emotional state occurring when using technology (Bozionelos, 2001) and has been shown to affect technology use (Heinssen et al., 1987; Mahar, Henderson, & Deane, 1997; Rosen & Weil, 1995) and overall performance with technology (Mahar et al., 1997). It has also been shown to be cross-cultural (Arigbabu, 2009). A meta-analysis (Chua et al., 1999) drew four conclusions about computer anxiety: a) is a fear when computers are to be used, b) can be changed, c) can be measured in multiple dimensions, and d) can cause avoidance of computer use.

Table 4 Selected Research on Technology Use

	Sample						
	1	2	3	4	5	6	7
Age	Y		N				
Gender	N	Y		Y			Y
Anxiety	Y	Y			Y		
Attitudes			Y				
CSE						Y	

Anxiety – lower = more technology use or better attitude
Attitudes – better = more technology use or better with experience
Computer Self-efficacy (CSE) – higher = more technology use
Y tested with significant findings
N tested with no significant findings

Sample

1. English as a foreign language teachers in Iran (*n* = 254) (Rahimi & Yadollahi, 2011).
   Scale Used: Computer Anxiety Rating Scale (Rosen & Weil, 1995)
2. Secondary school students in India (Khatoon & Mahmood, 2011).
   Scale Used: Computer Attitude Scale (Khatoon & Sharma, 2009).
3. University students in Greece. (Korobili, Togia, & Malliari, 2010).
   Scale Used: The CAS, developed by Liaw (2002)
4. Turkish elementary teachers (Ursava & Teo, 2010).
   Scale Used: Computer Anxiety Rating Scale (Rosen & Weil, 1995)
5. Novice users (Cowan & Jack, 2010).
   Scale Used: Computer Anxiety Scale (BSCAS) (Beckers, Wicherts, & Schmidt, 2007)
6. Respondents (Hasan, 2008).
   Scale Used: Not specified
7. Undergraduates (*n* = 193) (McIlroy, Bunting, Tierney, & Gordon, 2001).
   Scale Used: Computer Anxiety Rating Scale (Rosen & Weil, 1995)

The meta-analysis also included various correlates of computer anxiety. Among these were gender, age and computer experience. The correlation between gender and computer anxiety was inconclusive. The correlation between age and computer anxiety was also primarily inconclusive, with no consistent or significant results for narrow bands of age. However, one notable exception is in Dyck and Smither's (1994) study that found a significant difference in computer anxiety between senior citizens, who are more anxious, and undergraduates. Finally, the meta-analysis confirmed an inverse relationship between computer experience and computer anxiety, thus providing the basis for treating computer anxiety by providing computer experience (Bozionelos, 2001).

Just as Bandura (1977, 1997) proposed a relationship between anxiety and self-efficacy, where a reduction in anxiety increases self-efficacy, research also examines the relationships among computer self-efficacy, attitudes about using technology, and computer anxiety. For example, attitudes toward using computers were shown to have a main effect on computer self-efficacy (Beas & Salanova, 2006) and research suggests negative attitudes toward computers may result from computer anxiety (Wilder, Mackie, & Cooper, 1985).

In summary, computer self-efficacy, attitudes toward technology use and computer anxiety have been identified as foundational factors for technology use. For this reason these factors were further examined in this study.

Measures of Technology Use: Selected Research

Since the advent of the personal computer, numerous scales have been designed to measure computer self-efficacy, attitudes toward technology use, and computer anxiety. In 2004, over 31 scales measuring computer attitudes alone were identified (Shaft, Sharfman, & Wu, 2004). A more recent study (Garland & Noyes, 2008) evaluating the relevance of four frequently used scales revealed that their relevance had diminished slightly over time. As a result, effort has been made to create more current scales, as well as to update others (Morris, Gullekson, Morse, & Popovich, 2009). In addition, the scales have been modified for language and culture (ay Çelik, 2010), as well as made more specific for such formats as blogs and wikis (Cowan & Jack, 2010; Shahsavar, Tan, & Aryadoust, 2010). Because of the extensive literature in this area, only more recent literature representing the scales' varied findings were included in Table 4.

CTUS

In the research outlined in Table 4, separate scales for computer self-efficacy, attitudes toward technology use and computer anxiety were identified. The Computer Technology Use Scale (CTUS), a more recent scale, is based on all three of these desired factors. The CTUS's construction included theoretical underpinnings from social psychology and applied theories to technology use. The first factor of the CTUS, computer self-efficacy, was developed around the four mediators of self-efficacy. The first three—persistence, goal setting and attribution— were examined through a high performance cycle model (Locke & Latham, 1990), while the fourth mediator—coping—was based on a twofold approach of problem-based and emotion-based coping (Folkman & Lazarus, 1980). In the high performance cycle model higher persistence and stronger goal setting indicated higher self-efficacy. Additionally, individuals who attributed failure to lack of ability versus the lack of effort tended to have a lower self-efficacy (Locke & Latham, 1990). From a coping perspective, problem-focused solutions may be found more quickly than emotional-based ones (Folkman & Lazarus, 1980).

The questions from the CTUS's attitude section were based on Eagly and Chaiken's (1993) research in which psychological tendency in demonstrating favor and disfavor may be regarded as a biased response to a stimulus. Conrad and Munro (2008) noted that the CTUS's computer-anxiety questions are based on Reber's (1985) definition and applied to technology. Questions referring to anxiety tapped into the unpleasant/pleasant emotions as they relate to technology use.

Development of the CTUS consisted of a preliminary study of 479 volunteer participants from an Australian university. A follow-up study with confirmatory factor analysis was performed using a sample of 352 volunteers. The resulting 36-item instrument demonstrated that higher levels of computer self-efficacy indicated a more positive attitude with less anxiety. While several studies referenced results from the original instrument development study, review of literature identified no other studies using the CTUS as a scale.

In summary, the CTUS incorporates the three factors of technology use of computer self-efficacy, attitudes toward computer use, and computer anxiety as identified above. Additionally, the CTUS is one of the newer scales, so as a more recent instrument; further testing is required to assess its reliability. For these reasons, the CTUS was selected for use in this study.

Conclusion

The goal of this literature review was to investigate self-directed learning and technology use and identify implications in developing pedagogies for preparing new workplace entrants with 21st century skills. From the self-directed learning literature, the PRO model (Brockett & Hiemstra, 1991) was selected for this study, as it embodies both the learner characteristics and the teaching-learning process that encompass SDL. As a measurement instrument, the PRO-SDLS (Stockdale, 2003) was selected as it has shown limited but steady reliability and is designed for application in an educational setting.

An abundance of literature concerning technology use exists. This review focused on identifying the personal, intrinsic factors that indicate future technology use as a 21st century skill. The reviewed literature identified and focused on attitudinal variables of computer self-efficacy, attitudes toward technology use and computer anxiety (Czaja et al., 2006). Numerous scales were identified to measure these variables, yet many measured only one variable and/or used outdated terminology. The CTUS (Conrad & Munro, 2008) was identified as a relatively new scale measuring all three factors, and thus was selected for this study.

Chapter 3

Method

The purpose of this study was to identify the relationship between self-directed learning and technology use of people entering the workplace. The following research questions explored that relationship as well as the predictability of factors of self-direction to factors of technology use:

1. What is the relationship between self-directed learning and selected factors that influence technology use?
2. After control of the variance for age, gender, GPA, and major, what is the relationship between selected factors of self-directed learning and computer self-efficacy?
3. After control of the variance for age, gender, GPA, and major, what is the relationship between selected factors of self-directed learning and attitudes toward technology use?
4. After control of the variance for age, gender, GPA, and major, what is the relationship between selected factors of self-directed learning and computer anxiety?

Population and Sample

The population for this study was more than 3,000 undergraduate students who had applied for graduation from a four-year university in the Southeastern United States during the spring and summer semesters of 2011. All students, regardless of age or previous employment, were considered part of this population. Based on the 11 variables defined, the sample size must be sufficient for the number of variables in the study. Scholars suggest a minimum of 15 respondents for each variable (Gall, Gall, & Borg, 2003). Therefore, the required number of respondents for this study was a minimum of 165.

Because the university requires all students to regularly check their official university email, the survey instrument was administered via university email. The university provided a listserv of the anticipated graduates and estimated it contained approximately 3000 students. The researcher did not have access to individual email addresses; thus, all participants were contacted through the university blind list. An email was sent to the listserv with an invitation to participate in the study with one reminder sent approximately five days later. As an incentive, one tablet computer was given away from a drawing among participants. The survey was available online for three weeks. A total of 572 students responded to the survey, well above the 165 required for regression analysis. Because an exact population number is not available, the actual response rate could not be determined.

Variables and Instrumentation

For this study, the dependent variables were technology use, computer self-efficacy, attitudes toward technology use, and computer anxiety and the independent variables of self-direction were control, initiative, motivation, and self-efficacy. Control variables were age, gender, GPA, and college major.

As previously discussed in Chapters 1 and 2, two scales were used for this study: the Personal Responsibility Orientation – Self-Directed Learning Scale (PRO-SDLS)

(Stockdale, 2003; Stockdale & Brockett, 2010) and the Computer Technology Use Scale (CTUS) (Conrad & Munro, 2008). Permission was obtained from each of the instruments' authors prior to administering the survey; documentation of that permission is included in Appendix A.

PRO-SDLS

The PRO-SDLS (Stockdale, 2003) is a 25-item Likert scale designed for use in an educational setting. The overall calculated reliability coefficient (alpha) is .91. Cronbach's alpha for the factors are the following:

- Control .78
- Initiative .81
- Motivation .82
- Self-efficacy .78

All coefficients are greater than .70, which is considered acceptable (Gall et al., 2003). Several studies (e g. Boyer et al., 2008; Fogerson, 2005; Gaspar et al., 2009) were identified in Chapter 2 as using the PRO-SDLS; however, further research and validation are still underway.

CTUS

The CTUS (Conrad & Munro, 2008) is a recently developed instrument designed to measure the three attitudinal factors of computer self-efficacy, attitude toward computers, and computer anxiety. The instrument was chosen for this study because it is a more recent measure of the variables investigated in this study. However, because CTUS is relatively untested, further testing for reliability is important in this study.

Cronbach's alpha for the factors from the original creation of the instrument are the following:

- Computer self-efficacy .76
- Attitudes – complexity .73
- Attitudes – positive .51
- Attitudes – negative .57
- Computer related anxiety .71

While computer self-efficacy, the attitudes of technology complexity, and computer related anxiety are above the accepted .70 for reliability, the attitudes of positive and negative are not. The authors suggest that the low alpha may be because of the small number of questions for those subscales (Conrad & Munro, 2008).

In addition to the two scales, the survey contained a demographic section to gain information about the control variables of age, gender, GPA and major. The survey was administered online using a university supported online survey tool. The opening and demographics questions can be found in Appendix B while the PRO-SDLS (Stockdale, 2003) and the CTUS (Conrad & Munro, 2008) are available via research publications.

Data Collection

An IRB Form A was submitted to the University of Tennessee - Knoxville review board before sampling the student population. A copy of the IRB approval is included in Appendix C. After IRB approval was obtained, the university provided a blind email listserv. The email sent to the listserv recipients included a request for participation and a link to the online survey. Because of the survey's length and the recipients' possible lack of interest in the subject matter, participation in a drawing for one tablet computer was offered as an incentive. One reminder email was sent approximately five days after the initial email. To assure only one response per student, the university provided a login. However, to maintain the students' anonymity during the collection process, no identifying login information accompanied the survey results. After agreeing to participate, a respondent also had a "no answer" option to each question. Upon completing the survey, participants could provide their university email address for the drawing for a tablet computer.

The email addresses for the drawing were collected separately from the survey responses. Participation in the survey and/or drawing was completely voluntary. The survey remained open for three weeks. Immediately following the survey period, the random drawing for the tablet computer was held, the recipient was notified, and the tablet (iPad) was delivered to the student. A copy of the acknowledgement of receiving the tablet is found in Appendix D; however, the recipient's name was deleted to protect anonymity.

Research Design and Data Analysis

A correlational design was used in this study to investigate the relationship between SDL and technology use. Descriptive statistics were used to provide a profile of the survey sample. Pearson correlations were used to examine the relationship between SDL and technology use while hierarchical multiple regression was used to evaluate the relationship between a set of independent variables and the dependent variable, controlling for and/or taking into account a different set of independent variables' impact on the dependent variable (Bordens & Abbott, 2005). Because the role of gender, age, GPA and major have the potential to influence technology use, these variables were measured as control variables and used in stage one of the hierarchical regression. After accounting for the change in variance for control variables, the second stage of the hierarchical regression examined the relationship between self-directed learning factors and factors influencing technology use.

Prior to examination of the sample using multiple hierarchical regressions, the data were examined for normality, linearity and homogeneity of variance using Q-Q and scatter plots, which were then evaluated. SPSS was used to perform all calculations.

Two stages were implemented in the hierarchical regression. Stage one involved an evaluation of the variance attributed to the control variables. In the second stage, the independent variables of the factors of self-directed learning were examined. A confirmation analysis using 50% of the data was then performed.

Conclusion

The goal of this chapter was to describe the procedure used in this study. A population of recent graduates from a four-year institution was identified as the new workplace entrants of the 21st century. The PRO-SDLS (Stockdale, 2003), based on the PRO model of SDL (Brockett & Hiemstra, 1991), was combined with the CTUS (Conrad & Munro, 2008), along with demographic control variables, in an attempt to evaluate the new entrants attitudes. In an effort to predict technology use from the self-directed learning factors, hierarchical multiple regression was the statistical method selected. In Chapter 4, an analysis of the data will be presented.

Chapter 4

Results

The purpose of this study was to identify the relationship between self-directed learning and technology use of people entering the workplace. This study is a small first step in identifying change needed in higher-education pedagogies to meet the 21st century workplace's needs. A sample of new workforce entrants was obtained from the anticipated college graduates in the spring and summer semesters of 2011 at a major Southeastern university.

From over 3000 email invitations sent, 572 students responded. A preliminary examination of the data sample revealed that a very limited number (less than 1%) of responses were questioned for deletion. While some answers to questions were missing, it was possible to calculate each factor of self-direction and each attitudinal factor of technology use for every respondent. Therefore, no responses were eliminated from the study. Because an exact number for the population could not be ascertained, no response rate could be calculated.

Incorporated in this chapter are the results found from examining the relationships between self-direction and the attitudinal factors of technology use. Included in the results are (1) a breakdown of the respondents' demographics, (2) an analysis of the instrumentation consisting of the PRO-SDLS (Stockdale, 2003) and the CTUS (Conrad & Munro, 2008), and (3) the findings for each of the four research questions.

Demographics

This study was narrowed to four demographic characteristics: gender, age, GPA and college major. As discussed in Chapters 1 and 2, college major was categorized as Science, Technology, Engineering, or Mathematics (STEM) or non-STEM college majors. Approximately 43.5% (n = 249) of the respondents were male and 56.3% (n = 322) were female. Respondents ranged from 21 to 54 years old with a mean age of 23.9 years (SD = 4.15, n = 572). The mean GPA of the graduating students was approximately 3.3 on a 4.0 scale (SD = .42, n = 567). Those in the STEM majors represented 44% (n =252) of the sample while 56% (n = 320) were other majors.

Instrumentation

This study's instrumentation included the PRO-SDLS (Stockdale, 2003) and the CTUS (Conrad & Munro, 2008). Because these are more recent instruments, this study hopefully will contribute to the knowledge base by further examining their results and reliability. Reliability is concerned with the measures' repeatability or, more specifically, with the random error in study results (Trochim & Donnelly, 2001). Cronbach's alpha was used to determine the instruments' reliability for this study's sample.

PRO-SDLS

The 25-item PRO-SDLS's calculated reliability coefficient (alpha) for this study was .88, which was close to Stockdale's (2003) original finding of .91. Table 5 provides comparisons of Cronbach's Alphas for the PRO-SDLS with previous research as well as this current dataset.

Table 5 Cronbach's Alphas for the PRO-SDLS

	2003*	2005*	2011a*	2011b*	Current
N	195	217	110	110	572
Control	.78	na	.78	.83	.72
Initiative	.81	na	.76	.72	.73
Motivation	.82	na	.41	.67	.79
Self-efficacy	.78	na	.79	.79	.79
Overall	.91	.92	.84	.87	.88

*2003- Stockdale
2005 – Fogerson
2011a-Hall Pre-test
2011b-Hall Post-test

Total scores for the PRO-SDLS identified from previous studies are presented in Table 3, Chapter 2. As previously noted, the total possible PRO-SDLS score falls between 25 and 125 (25 questions with a five-point Likert scale) with the scores ranging from 80.05 to 96.21, as noted in Chapter 2. The PRO-SDLS's mean for new entrants into the workplace for this sample is 89.13 ($n = 519$). The means for the factors of self-direction encompassed in the PRO-SDLS, along with comparison scores from Stockdale and Brockett (2010), are provided in Table 6.

In summary, the PRO-SDLS's reliability and results for this study's sample are consistent with previous research. While slightly lower than the original reliability (Stockdale, 2003), the Cronbach's Alphas for this study are still above an acceptable level. Additionally, while this study's scores are higher than those reported in Stockdale and Brockett (2010), the relationships among the individual factor scores are proportional.

Table 6 Score Comparisons for the PRO-SDLS

	Stockdale & Brockett (2010)			Current		
	Mean	SD	*n*	Mean	SD	*n*
SDL – Total	80.05	12.47	195	89.13	11.54	519
Self-Efficacy	22.09	3.48	199	24.25	3.50	548
Initiative	17.70	3.89	199	19.41	3.72	565
Motivation	20.17	4.16	197	22.88	4.67	548
Control	20.24	3.66	197	22.48	3.43	554

For example, initiative received the lowest score of the four factors in both studies while self-efficacy received the highest.

CTUS

As mentioned previously, the CTUS is a new scale; thus, data for the scale are limited. In fact, the only reliability scores discovered for the 36-item CTUS (Conrad & Munro, 2008) were from the scale's original development. Because the CTUS does not yield a total score, only the Cronbach's Alphas for the individual factors are presented in Table 7.

Two results should be noted from examining the CTUS's reliability. First, further review of correlations between individual items in the computer self-efficacy subscale revealed a negative correlation between item one and over half of the other subscale items, while all other correlations were positive. The analysis also revealed a slightly higher reliability without item one. With the negative correlation of item one to other items, the Cronbach's Alpha for computer self-efficacy was a low .65 (without this one item, the reliability alpha was only raised to .67). The implications and recommendations for the CTUS and computer self-efficacy will be further discussed in Chapter 5.

Table 7 CTUS Cronbach's Alphas

	2008	Current
Computer Self-efficacy	.76	.65
Attitudes – complexity	.73	.76
Attitudes – positive	.51	.67
Attitudes - negative	.57	.64
Computer Anxiety	.71	.90

2008 - Conrad & Munro

Second, also noted in Table 7 is that the CTUS' reliability included subscales of attitudes (i.e. complexity, negative, and positive). These subscales demonstrated low reliability scores for both the original study as well as this sample. Conrad and Munro (2008) suggested these low scores may be due to the few number of questions for each subscale. As this research did not seek to further subscale the attitudes toward technology use, all attitude subscales were collapsed in one scale of attitudes toward technology use, thus providing a Cronbach's Alpha of .79. The CTUS's calculated reliability with this sample is presented in Table 8.

The CTUS scores for the factors of computer self-efficacy, attitude toward use of technology and computer anxiety are based on a 7-point Likert scale. Table 9 provides the means for the factors along with the comparative means from Conrad and Munro (2008). Again, the CTUS does not provide an overall score.

Table 8 CTUS Reliability for Attitude Subscales Collapsed

	Current
Computer Self-efficacy	0.65
Attitudes	0.79
Computer Anxiety	0.90

Table 9 CTUS Results: Score Comparisons

	2008			Current		
	Mean	*SD*	*n*	Mean	*SD*	*n*
Computer Self-Efficacy	4.41	.89	352	4.82	.73	572
Attitude						
Complexity	3.72	1.14	352			
Positive	5.27	1.09	352			
Negative	4.24	1.09	352			
Attitudes Collapsed				4.75	.88	572
Anxiety	2.79	.92	352	1.07	.89	572

2008- Conrad and Munro

Research Questions

This section presents the results for the four research questions addressed in this study. It should be noted that before evaluating these research questions, the data were inspected for normality, linearity, and homogeneity of variance using Q-Q and scatter plots. In examining the data, two precautions were noted:

1. A correlation between the independent variables of self-efficacy and control indicated a need to watch for multicollinearity in the analysis.
2. Computer anxiety was found to be slightly skewed in examining the data's normality.

These precautions will be discussed further in examining the research questions.

Question 1

What is the relationship between self-directed learning and selected factors that influence technology use?

The first step in examining this relationship is to investigate the correlations between the demographics and each of the variables of self-direction and technology use in this study. The relationships with the demographics along with the independent and dependent variables were evaluated.

Gender. Table 10 presents means by gender. Results indicated males ($M = 3.35$, $SD = .66$) had higher initiative than females ($M = 3.15$, $SD = .57$) for this sample. This difference was significant, $t(488.975) = 3.671$, $p<.001$, $d=.33$. In addition, females ($M = 1.20$, $SD = .87$) had higher computer anxiety than males did ($M = .90$, $SD =.89$). Again, statistical analysis revealed this difference to be significant $t(569) = 3.96$, $p < .001$, $d = .33$. In both cases, the analysis revealed a medium effect size.

Table 10 Gender

	Gender	*n*	Mean	*SD*	
SDL Total	Male	225	89.51	12.29	
	Female	293	88.82	10.95	
SE[a]	Male	249	4.02	.61	
	Female	322	4.06	.56	
Initiative	Male	249	3.35	.66	**
	Female	322	3.15	.57	
Motivation	Male	249	3.26	.70	
	Female	322	3.29	.65	
Control	Male	249	3.73	.62	
	Female	322	3.75	.55	
CSE[b]	Male	249	4.87	.78	
	Female	322	4.79	.69	
Attitude	Male	249	4.78	.92	
	Female	322	4.74	.85	
Anxiety	Male	249	.90	.89	**
	Female	322	1.20	.87	

a – Self-efficacy
b – Computer self-efficacy
** $p<.001$

Major. The relationship of college major (STEM, non-STEM) to factors of self-direction and of technology use is presented in Table 11. Results indicated that the SDL total was higher for students majoring in science, technology, engineering and mathematics fields (M = 90.36, SD = 11.97) than those majoring in other fields (M = 88.15, SD = 11.10). Statistical analysis revealed a significant difference with a low effect size, $t(517) = -2.18$, $p < .05$, $d = .19$. For the selected factors of self-direction, both initiative and control were found to be significant. Initiative was higher for those in the STEM majors (M = 3.30, SD = .62) versus other majors (M = 3.20, SD = .62) with $t(570) = 1.98$, $p < .05$, $d = .17$.

Table 11 Major (STEM, other)

	Major (STEM)	*n*	Mean	*SD*	
SDL Total	Other	289	88.15	11.10	*
	STEM	230	90.36	11.97	
SE[a]	Other	320	4.01	.57	
	STEM	252	4.08	.59	
Initiative	Other	320	3.20	.62	*
	STEM	252	3.30	.62	
Motivation	Other	320	3.27	.64	
	STEM	252	3.28	.71	
Control	Other	320	3.67	.57	**
	STEM	252	3.83	.59	
CSE[b]	Other	320	4.72	.74	**
	STEM	252	4.94	.71	
Attitude	Other	320	4.72	.90	
	STEM	252	4.80	.84	
Anxiety	Other	320	1.19	.92	**
	STEM	252	.92	.83	

a – Self-efficacy
b – Computer self-efficacy
*$p < .05$
**$p < .01$

Likewise, control was higher for STEM majors (*M* = 3.83, *SD* = .59) versus other majors (*M* = 3.67, *SD* = .57) with $t(570) = 3.17$, $p < .01$, $d = .267$.

For the attitudinal variables of technology use, both computer self-efficacy and computer anxiety were found to be significant. Computer self-efficacy, STEM (*M* = 4.94, *SD* = .71) as compared to other majors (*M* = 4.72, *SD* = .74) revealed that computer self-efficacy was higher for STEM majors, $t(570) = 3.61$, $p < .001$, d=.30, while for computer anxiety, STEM majors (*M* = .92, *SD* =.83) were lower than other majors (*M* = 1.19, *SD* = . 92), where $t(570) = 3.68$, $p < .001$, $d = .31$. As with self-direction, the effect size of these results was moderate to low.

Age. Pearson's *r* was used to examine relationships among factors of self-direction and use of technology. Age was found to have a positive correlation with overall self-direction ($r = .087$, $p < .05$) although initiative was the only SDL factor indicating a significant relationship ($r = .150$, $p < .01$). Results demonstrate that as age increases self-direction and initiative increase.

Significant correlations were also found between age and attitudinal variables of technology use. As a person ages, computer self-efficacy increases ($r = .146$, $p < .01$) while computer anxiety decreases ($r = -.091$, $p < .05$). Although the results for these variables are significant, the coefficient of determination is low (< .03, or 3%) for all variables as designated in Table 12.

GPA. Further examination of demographics' relationship to other variables in this study revealed a positive correlation between GPA and self-directed learning

($r = .219$, $p < .01$). That is, as GPA increases so does self-direction. Three of the factors of self-direction also revealed a positive correlation to GPA. Self-efficacy ($r = .234$, $p < .01$), motivation ($r = .096$, $p < .05$), and control ($r = .274$, $p < .01$) increase as GPA increases. As with age, the coefficient of determination is low (< .08 or 8%) as shown by r^2 in Table 12.

Hence, age and major have a moderate-to-low effect size when compared to the factors of self-direction or technology use. Age and GPA also have significant correlations with factors of self-direction and technology use; however, the r^2 values indicate approximately 8% of the variability can be determined from the relationship.

Table 12 Correlations for Age and GPA with Self-direction and Technology Use

		Age	r^2	GPA	r^2
SDL Total		.087*	.008	.219**	.048
	n	519		517	
SE		.029		.234**	.055
	n	572		567	
Initiative		.150**	.023	.036	
	n	572		567	
Motivation		.063		.096*	.009
	n	572		567	
Control		.012		.274**	.075
	n	572		567	
CSE		.146**	.021	-.042	
	n	572		567	
Attitude		.025		-.011	
	n	572		567	
Anxiety		-.091*	.008	.147**	.022
	n	572		567	

**Correlation is significant at the 0.01 level (2-tailed).
*Correlation is significant at the 0.05 level (2-tailed).

Further evaluation of the dataset included the relationship of the factors of self-direction and the factors of technology use, as provided in Table 13. Of the three attitudinal variables, computer self-efficacy was found to have a significant correlation with the self-direction factors of initiative $r = .254$, $p < .01$), motivation ($r = .085$, $p < .05$), and control ($r = .109$, $p < .01$). For all three relationships, a positive correlation was found, indicating that as computer self-efficacy increases so do initiative, motivation, and control. Attitude toward technology was found to be significantly correlated with both self-efficacy ($r = .187$, $p < .01$) and control ($r = .172$, $p < .01$), indicating that as self-efficacy and control increase so does attitude toward technology. Computer anxiety was found to be significant with both self-efficacy ($r = -.092$, $p < .05$) and initiative ($r = -.174$, $p < .01$), demonstrating a decrease in anxiety as self-efficacy and initiative increase.

Table 13 Pearson Correlations for Independent and Dependent Variables

	Independent Variables				Dependent Variables		
	SE[a]	Initiative	Motivation	Control	CSE[b]	Attitude	Anxiety
SE[a]	1						
Initiative	.352**	1					
Motivation	.402**	.444**	1				
Control	.687**	.335**	.311**	1			
CSE[b]	.034	.254**	.085*	.109**	1		
Attitude	.187**	-.012	.011	.172**	.063	1	
Anxiety	-.092*	-.174**	.000	-.077	-.361**	-.435**	1

a – Self-efficacy
b – Computer Self-Efficacy
** Correlation is significant at the 0.01 level (2-tailed).
* Correlation is significant at the 0.05 level (2-tailed).

Although all these relationships were found to be significant, further examination of the coefficient of determination (r^2) indicates a low to very low proportion of variability in one variable that can be determined from the relationship. The largest value for r^2 for any of the attitudinal variables is the relationship between computer self-efficacy and initiative (r^2 =.065).

Table 14 shows the correlations between the self-directed learning total score and the attitudinal factors of technology use. An initial examination of Pearson's *r* indicated a significant relationship between the SDL total score and each of the attitudinal factors. Results indicate that as computer self-efficacy increases so does the SDL Total score ($r = .174$, $p < .01$). In addition, as the attitude becomes more positive, self-direction increases ($r = .118$, $p <. 01$). Results also indicate that computer anxiety decreases as self-direction increases.

To examine this significance further, the coefficients of determination were calculated. The values for r^2 for computer self-efficacy, attitudes toward technology use, and computer anxiety in relationship to self-direction are very low values of .030, .014, and .011, respectively, thus indicating that while statistically significant, these correlations are very weak.

In summary, for Question 1 the relationships between self-direction and attitudinal factors of technology use were examined. The results indicate that although relationships between both demographics and other factors under investigation are significant, the strength of those relationships is weak. Further discussion and implications of these results are in Chapter 5.

Table 14 Correlations between Self-directed Learning and Technology Use

	Computer Self-Efficacy	Attitude	Anxiety
Self-Directed Learning Total	.174**	.118**	-.103*

**Correlation is significant at the 0.01 level (2-tailed).
*Correlation is significant at the 0.05 level (2-tailed).

Questions 2 - 4 are examined through the lens of hierarchical regression with the results for each regression presented here. As with Question 1, Chapter 5 includes further discussion and implications of Questions 2-4.

Question 2

After control of the variance for age, gender, GPA, and major*, what is the relationship between selected factors of self-directed learning and computer self-efficacy?*

The result of the regression analysis model showed the self-direction factors to be predictors of computer self-efficacy. As can be seen in Table 15, the control factors of age, gender, GPA, and major account for 4.5% of the variability. The self-direction factors of self-efficacy, initiative, motivation and control predict an additional 6.5%. In a further examination of self-direction's four factors, self-efficacy and initiative are significant predictors of computer self-efficacy as seen in Table 16. Initiative is a factor of the PRO Model's Teaching Learning (TL) construct (Stockdale & Brockett, 2010).

Table 15 Computer Self-Efficacy Model (n = 572)

Model	R Square	Adjusted R Square	R Square Change
1	.045	.038	
2	.110	.097	.065**

a. Predictors: (Constant), Age, Major, GPA, Gender
b. Predictors: (Constant), Age, Major, GPA, Gender, Motivation, Control, Initiative, Self-Efficacy
** $p < .01$

Table 16 Computer Self-Efficacy (CSE) Predictors (n = 572)

Model		Unstandardized Coefficients		Standardized Coefficients	
		B	Std. Error	Beta	
1	(Constant)	4.216	.347		
	GPA	-.037	.074	-.021	
	Gender	.025	.066	.017	
	Major	.234	.066	.159	**
	Age	.025	.007	.140	**
2	(Constant)	3.614	.372		
	GPA	-.061	.075	-.034	
	Gender	.080	.065	.054	
	Major	.218	.064	.148	**
	Age	.019	.007	.106	*
	Self-Efficacy	-.155	.073	-.123	*
	Initiative	.311	.056	.263	**
	Motivation	-.029	.051	-.027	
	Control	.123	.072	.098	

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

Question 3

After control of the variance for age, gender, GPA, and major, what is the relationship between the selected factors of self-directed learning and attitudes toward technology?

The regression model's results showed the self-direction factors to be predictors of attitude toward technology use. Table 17 indicates that the control factors of age, gender, GPA, and major were not significant as predictors. In contrast, the model showed that the self-direction factors of self-efficacy, initiative, motivation and control were significant in predicting attitudes toward computers with an adjusted R squared change of .053.

As shown in Table 18, further examination of the four factors of self-direction revealed that self-efficacy and initiative were significant in predicting attitudes toward technology. While the correlation between self-efficacy and control was .687, as a precaution the regression was confirmed in a model without the SDL factor of control. The model was significant for self-efficacy and provided an adjusted R squared change of .05. Self-efficacy is in the Learner Characteristic (LC) construct while initiative is in the Teaching Learning (TL) construct of the PRO Model (Stockdale & Brockett, 2010).

Table 17 Attitude Toward Technology Model (n = 572)

Model	R Square	Adjusted R Square	R Square Change
1a	.003	-.004	
2b	056	.042	.053 **

a. Predictors: (Constant), Age, Major, GPA, Gender
b. Predictors: (Constant), Age, Major, GPA, Gender, Motivation, Control, Initiative, Self-Efficacy
** p<.01

Table 18 Attitude Toward Technology Predictors (n = 572)

		Unstandardized Coefficients		Standardized Coefficients	
Model		B	Std. Error	Beta	
1	(Constant)	4.661	.424		
	GPA	-.017	.091	-.008	
	Gender	.001	.081	.001	
	Major	.090	.081	.051	
	Age	.005	.009	.023	
2	(Constant)	4.149	.459		
	GPA	-.145	.093	-.069	
	Gender	-.046	.081	-.026	
	Major	.045	.079	.026	
	Age	.004	.009	.021	
	Self-Efficacy	.269	.090	.177	**
	Initiative	-.136	.069	-.096	*
	Motivation	-.070	.063	-.054	
	Control	.167	.088	.111	

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

Question 4

After control of the variance for age, gender, GPA, and major, what is the relationship between the selected factors of self-directed learning and anxiety with technology?

As noted earlier in this chapter, when examining computer anxiety for normality, the data were skewed. The skew of 1.031 was only slightly over the acceptable 1.0 for normality. To account for this skewness, a transformation of computer anxiety was performed, and the result confirmed the baseline results. To better interpret these results, the original baseline regression is presented here.

The regression model's results showed the self-direction factors to be predictors of computer anxiety. Table 19 indicates that the control factors of age, gender, GPA, and major account for 6% of the variability in the regression, thus the self-direction factors of self-efficacy, initiative, motivation and control predicted an additional 3.7% of the variability. As shown in Table 20, further examination of the four factors of self-direction revealed that initiative and motivation were significant factors of self-direction in predicting computer anxiety. The predictors are a combination of the learner characteristic of motivation and the teaching learning construct of initiative in the PRO Model (Stockdale & Brockett, 2010).

Table 19 Computer Anxiety Model (n = 572)

Model	R Square	Adjusted R Square	R Square Change	
1	.060	.053		
2	.097	.084	.037	**

a. Predictors: (Constant), Age, Major, GPA, Gender
b. Predictors: (Constant), Age, Major, GPA, Gender, Motivation, Control, Initiative, Self-Efficacy
** p < .01

Table 20 Computer Anxiety Predictors (n = 572)

Model		Unstandardized Coefficients		Standardized Coefficients	
		B	Std. Error	Beta	
1	(Constant)	6.826	.417		
	GPA	.285	.089	.133	**
	Gender	.190	.080	.106	*
	Major	-.209	.079	-.117	**
	Age	-.011	.009	-.051	
2	(Constant)	6.074	.455		
	GPA	.351	.092	.164	**
	Gender	.158	.080	.088	*
	Major	-.187	.079	-.104	*
	Age	-.006	.009	-.027	
	Self-Efficacy	-.154	.089	-.100	
	Initiative	-.228	.068	-.160	**
	Motivation	.134	.062	.101	*
	Control	-.034	.087	-.022	

*p < .05
**p < .01

Conclusion

This study investigated the relationship between self-directed learning and technology use among students entering the workforce after graduation from a 4-year institution. While significant relationships between SDL and technology use have been found, the model's effect size is low. In addition, the SDL's factors as predictors of computer self-efficacy, attitudes toward technology and computer anxiety are significant in some cases but account for less than 7% of the variance for any one factor.

Chapter 5

Discussion and Recommendations

The knowledge age is evolving. With the changes accompanying knowledge creation, colleges and universities should be ever vigilant to assure that pedagogies keep pace. The workplace has identified self-direction and technology use as increasingly important skills in the 21st century, yet a gap in current research of pedagogies that advance self-directedness and promote technology use has been noted. The purpose of this study was to identify the relationship between self-directed learning and technology use of people entering the workplace. Demographics of age, gender, GPA, and college majors—classified as either Science, Technology, Engineering and Mathematics (STEM) majors or other—were investigated in conjunction with self-direction factors in the PRO-SDLS (Stockdale, 2003) and attitudinal factors of technology use in the CTUS (Conrad & Munro, 2008). Graduating seniors from a four-year university provided a sample (n = 572) representing those people entering the workforce.

An examination of the sample data set included the differences, relationships and predictive capabilities of the demographic variables (gender, age, GPA, and college major); the independent variables (factors of SDL); and the dependent variables (attitudinal variables of technology use). The investigation's results found statistically significant but weak relationships for the model studied. While the total SDL scores as measured by the PRO-SDLS were found to have significant relationships with technology use's attitudinal factors as measured by the CTUS, the resulting coefficients of determination were very low (less than .03). The purpose of this chapter is to discuss the results and offer recommendations for practice and future research.

Discussion

Included in this discussion is the demographics' impact as related to the research questions. The relationship of SDL to technology use's attitudinal variables, and SDL as a predictor of technology use follow the demographics discussion.

Demographics

As shown in the literature reviewed in Tables 2 and 4 in Chapter 2, the results of relating the demographics to other factors studied were mixed. Some studies identified significant relationships while others did not. This study identified a few significant results among the demographic factors and the SDL factors and technology use's attitudinal factors.

In particular, the literature review in Chapter 2 indicated inconclusive results among the demographic variables in relationship to technology use's attitudinal variables (Balcita et al., 2002; Cassidy & Eachus, 2002; Czaja et al., 2006; Moos & Azevedo, 2009; Salanova et al., 2000; Scott & Walczak, 2009). The results of this study indicated that while no significant relationship existed between the demographic variables and attitude toward the use of technology, all four of the demographic variables had a significant but weak relationship with computer anxiety.

Likewise, an examination of the demographics in relationship to self-direction resulted in significant correlations between self-direction and age, GPA, and major respectively. However, when the individual factors identified in the PRO-SDLS were examined, the results varied for each factor. Self-efficacy had a positive relationship with GPA as did motivation and control. GPA was not found to have a significant relationship with initiative (see Table 12, Chapter 4). Likewise, even though gender was not found to be significantly related to the overall self-direction scores of the PRO-SDLS, a significant difference was found in that females had a lower score on initiative than did males. As with the attitudinal variables, the effect size was not strong.

These mixed and weak results have two indications for future research. In all cases, the significant relationships' effect size was very low. These results might indicate caution in future research. With such a low effect, variances among the different samples, even though statistically significant, should be viewed with caution. The effect size must also be considered in future research.

Also, because of varied results by of SDL factors demonstrated in this study, studying SDL as a whole may not be sufficient. Rather, by isolating specific factors, future research may further refine instruments to focus on more specific aspects of SDL.

Instrumentation

This study examined both the PRO-SDLS (Stockdale, 2003) and the CTUS (Conrad & Munro, 2008). In an effort to further the knowledge base of theory, the resulting scores and reliability were presented and compared previous research's results.

The PRO-SDLS. With a Cronbach's Alpha for this study of .88, well above the acceptable .70 as shown in Table 5 in Chapter 4, the reliability of the PRO-SDLS (Stockdale, 2003) confirmed that of previous studies (Boyer et al., 2008; Fogerson, 2005; Hall, 2011; Stockdale, 2003). Thus, this instrument continues to perform reliably.

Additionally, this study furthered the knowledge base of scores from the PRO-SDLS. As presented in Table 3 in Chapter 2, scores ranged from a low of 84 (*n* = 5) (Gaspar et al., 2009) to a high of 96.91 (*n* = 217) (Fogerson, 2005). This study included the largest sample to date used in examining the PRO-SDLS. The broad base of graduating seniors repeated an overall mean score of 89.12 (*n* = 572). However, few pre-test/post-test studies are identified. Therefore, further testing of this instrument with that format is deemed warranted.

The CTUS. With no previous reliability other than the CTUS's original development (Conrad & Munro, 2008) identified, this study found the computer self-efficacy factor's reliability to be .65, which is below the recommended minimum of .70. In addition, since this reliability is less than the original study's .76 (Conrad & Munro, 2008), caution should be used when interpreting the results of this study, where the dependent variable of computer self-efficacy is evaluated. One possible explanation for the variance may be the difference in culture. While this instrument was developed in English, it was developed for the Australian culture. Although no specific terminology is noted, further testing of the CTUS is deemed warranted as well as being cautious in interpreting the results.

Also, as noted in the literature review, many of the instruments used to measure technology use's attitudinal variables are now dated (Garland & Noyes, 2008). The CTUS was chosen because of the more updated terminology and the inclusion of three chosen attitudinal factors influencing technology use. Despite the use of a newer instrument, however, the computer anxiety factor's results are skewed as found in research Question 3's results. The skew demonstrated that today's college graduates showed little anxiety with technology.

Based on lack of anxiety found in this study, the argument might be made (while beyond the scope of this research) that because today's younger generation is growing up with technology, the need for research of technology use and adoption may no longer be necessary. However, this researcher believes that argument is not the case. First, as included in this study, other factors have been shown to affect technology use. Just because anxiety is missing interest in learning and using technology is increased. Second, rapid changes in technology have only just begun. Today's technology that no longer presents as much anxiety will become outdated. Today's younger generation will be required to adapt to new technologies to which they are not accustomed and which we cannot even envision. Therefore, continued development and testing of instruments measuring factors that influence technology use are deemed necessary. Continued development of the CTUS or even the development of a new instrument that includes computer self-efficacy, attitude toward technology, and computer anxiety seems warranted. These instruments will need to be created with rapid change in mind to keep pace with evolving technologies.

The Research Questions

This study's second broad goal was to move toward identifying appropriate pedagogies to support 21st century skills. As a first step toward this goal, this study's research questions examined the relationship among factors of self-direction and technology use's attitudinal variables. One broad conclusion from this study would be that while significant relationships exist between self-direction and technology use's attitudinal factors, the relationships are weak; thus, based on the model tested, there is little indication that an effort to develop pedagogies for further developing SDL skills will create major progress in an individual's technology use. This is not to say an increase in self-direction skills would not help promote increased technology use, but rather one would not expect to see giant strides. Additionally, the weak relationship found between SDL and technology use does not reduce the importance of each as a skill in the 21st century workplace. Instead, this weak relationship indicates that additional research designed to examine each skill needs to be identified. With that overarching result in mind, some specific results from each of the research questions should be considered.

The first question examined the relationship between the total self-directed learning score from the PRO-SDLS and each of the attitudinal factors the CTUS measured. The model demonstrates significant correlations between self-direction and computer self-efficacy, attitude toward technology use, and computer anxiety, respectively. At the same time, each of these relationships demonstrates a low coefficient of determination. In a linear environment, the effect size is small. However, this study does not indicate that the combination each dependent variable's significance would be linear or exponential. If each attitudinal factor of technology use would multiply rather than simply add to the indication of technology use, then these relationships might be worth reexamining.

In examining results for questions 2-4, the factors of self-direction as measured by the PRO-SDLS were presented in the lens of the PRO-Model (Brockett & Hiemstra, 1991) of self-directed learning. More specifically, the results were viewed through the lens of the Learner Characteristic (LC) and the Teaching/Learning (TL) constructs.

The second question examined the relationship between the factors of self-direction and computer self-efficacy. The results showed that as self-direction increased so did computer self-efficacy. The factors of self-direction accounted for 6.5% additional variance over the demographic variables' control. Within this model, however, the LC and TL constructs were conflicted. For the LC construct, self-efficacy was found to be significant, showing that as self-efficacy increased, computer self-efficacy decreased. In the TL construct, as initiative increased so did computer self-efficacy. In the TL construct, initiative was more powerful than self-efficacy, thus resulting in the overall positive relationship.

The considerations here must be qualified by reliability of the CTUS's computer self-efficacy factor. However, previous research has also indicated a drop in SDL scores with a limited sample (n = 5) in pre- and post-test studies of programming students (Gaspar et al., 2009). This drop might indicate that as computer self-efficacy increased, SDL scores decreased, providing the same negative relationship demonstrated in this study. Future research on SDL should be aware of this conflict and identify the relationships between the PRO-Model's LC and TL constructs.

The results for the third question, examining the relationship of self-direction and attitude toward technology use, found an additional 5.2% variance over the demographic variables and indicated that as self-direction increased, the attitude toward technology became more positive. Interestingly, in the relationship between self-direction and attitude toward technology, the LC and TL factors were reversed. As self-efficacy (LC) increased, attitude toward technology use also increased, that is, became more positive. However, as initiative (TL) increased, attitude toward technology use decreased, or became more negative. For this question, self-efficacy in the LC construct was more powerful, and the increased attitude toward technology use was greater than the decrease found in relationship with initiative, thus creating an overall positive relationship of SDL with attitude toward technology use.

Question 4 examined the relationship of self-direction and computer anxiety. The resulting model indicated that self-direction accounted for 3.7% additional variance over the demographics and that as self-direction increased, computer anxiety decreased. The LC construct, motivation, demonstrated that as motivation increased, so did computer anxiety, while in the TL construct as initiative increased, computer anxiety decreased. As with Question 2, initiative is the more powerful factor, thus dominating the model. Therefore, both the LC and TL constructs have implications in predicting the technology use's attitudinal factors. Again, because of the CTUS's possible limitations and the low effect size, an actual conflict between the LC and TL constructions cannot be determined. However, future researchers should watch for additional conflicts; and, thus, because of the limitations presented by the CTUS, confirmatory experimental studies measuring attitudinal variables should be conducted while implementing a treatment of SDL pedagogies.

In summary, the results of this study indicated a significant but weak model of SDL prediction of technology use. Because of the limitations of the instrumentation used in this study, actual results cannot be reliably determined. However, the internal trends of the conflicts between the LC and TL constructs provide implications for practice and further research.

Implications for Practice

With the weak relationship between SDL and technology use, recommendations for practice need to include previously identified pedagogies of each. Pedagogies for SDL can be drawn from the PRO-Model (Brockett & Hiemstra, 1991). For example, the LC construct is "the characteristic of an individual that predispose one toward taking primary responsibility for personal learning endeavors" (p. 29). Brockett and Hiemstra propose three strategies facilitators might use for promoting learner characteristics: encouraging reflection, which might be facilitated by reading and writing (e.g. journaling); helping the learner by being supportive and being "for" the learner; and promoting rational thinking. In addition, the PRO-Model also includes suggestions for practice of the TL construct. Nine variables were identified that are within the learners' control:

1. Identification of learning needs
2. Learning goals
3. Expected outcomes
4. Evaluation/validation methods
5. Documentation methods

6. Appropriate learning experiences
7. Variety of learning resources
8. Optimal learning environment
9. Learning pace. (Brockett & Hiemstra, 1991, pp. 118-119)

Pedagogies for improving technology use's attitudinal factors have been related most specifically to the time an individual spends with technology (Levine & Donitsa-Schmidt, 1998). The time spent with computers was shown to improve attitudes and ease anxiety; thus, pedagogies should be developed with time of use in mind.

Although the effect size between SDL and technology use has been found to be minimal in this study, a significant relationship does exist. Thus, there may be connections different research methods may reveal. Additionally, a combination of pedagogies which promote time spent with technology and SDL may help improve technology use. For example, while facilitators promote SDL, they might help a learner identify technology needs or provide documentation which could be used with technology, such as online articles. Other pedagogies may include either using technology to record reflections of learning or creating learning contracts including a variety of technologies used for learning resources. Still additional pedagogies may include research that is reported using new technologies (ex. new forms of presentations) as opposed to traditional paper reports. These pedagogies' goals would be two-fold: to provide technology time with current learning needs and to encourage the learner to include technological advancements on their own in future learning.

To examine these pedagogies, further experimental research is recommended. By performing a pre-test/post-test study of SDL and technology-use factors while implementing the above and similar strategies, a clearer picture of the relationships may be discovered.

Recommendations for Further Study

Recommendations for further study drawn from the preceding discussion include the following:

Continued monitoring of the demographics of age, gender, GPA, and college majors not only for significance but also for effect size. Based on the discussion above, this study demonstrated significant but low effect sizes. As previously noted, the low effect size may account for the variability in various samples' results. By monitoring these factors in future research, demographics' impact on technology use maybe clarified.

Further investigation of the PRO-SDLS can add to the body of knowledge of scores and reliability. With businesses identifying the need for the upcoming workforce to be self-directed, further evaluation of students' self-direction skills in preparation to enter the workplace as well as pedagogies to further those skills are relevant to today's universities. The PRO-SDLS has shown continued reliability and consistent results in the educational setting for which it was designed. Continued use of this instrument, especially in large-scale studies, will help provide results to draw more in-depth conclusions by maintaining the common denominator for measurement. Additionally, developing a PRO-SDLS for domains other than education may be useful for evaluating self-direction in other environments.

Caution should be taken when using the CTUS in future studies. With only the original and the current studies employing the CTUS, too few results are available for making broad judgments. Furthermore, the low reliability score for computer self-efficacy and the slight skew associated with computer anxiety indicate that caution should be taken in further using this instrument.

To keep pace with ever-changing technologies, updates and re-evaluation of instruments used to measure influences on technology use should be continued. Just as technology use in business and education evolve rapidly, so must the research instruments used to evaluate the use and change. The myriad of instruments available for examining technology use's attitudinal variables include older technology terminology and have not kept pace with the knowledge age. Of particular interest may be an instrument developed to test over time technology use's attitudinal variables. This instrument might be developed to identify key technological terms specified to be replaced with references to the most current technologies at the time the instrument is administered.

A further examination of the conflict between the constructs of the PRO-Model identified in this study is recommended. The results of the individual factors of self-direction identified in relationship to the attitudinal variables provided conflicting results. Even though caution is warranted with the instrumentation, as noted in the discussion, other mixed results were identified on a small scale. Therefore, further study of the relationships between technology and SDL factors is deemed warranted.

Experimental research investigating different pedagogies' effects on both self-direction and/or technology use is also recommended. These studies would help examine the conflicts noted in the previous recommendation. Furthermore, experimental research can help identify not only if adjusting teaching methods and pedagogies are worthwhile, but also which pedagogies are more effective. Again, while the relationship and individual effect sizes noted in this study are minimal, future studies could examine the overall relationships of both SDL and technology use's attitudinal variables.

Conclusion

The knowledge age will continue to demand the 21st-century workforce's growth in self-direction and technology use. To keep pace with this demand, pedagogies to advance 21st-century skills have been identified as crucial. This study was designed to further the knowledge base by examining the relationship between selected SDL factors of SDL and technology use's attitudinal factors. While examining whether SDL skills predict the use of today's technologies, this study was also designed with a vision for the future. Self-direction as a skill and attitude, as well as the three attitudinal variables of technology use explored here should be applicable to the technological changes to come. While the exact knowledge-creating tools themselves will evolve, the general self-efficacy, control, initiative, and motivation of self-direction, along with domain-specific self-efficacy (in this study, computer self-efficacy), the attitude toward technology use along with the anxiety that learning new technologies brings will be present with future advances. Thus, an eye to future generations' learning new skills and tools and adapting to them was the impetus for this study.

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Appendix A

Instrument Permission

PRO-SDLS – Susan Stockdale, PhD

Dear Susan,

I hope this email is not redundant but I have been trying to reach you concerning the PRO-SDLS. I am working on my dissertation and would like permission to use your instrument in my research. I'm on a tight timeframe to finish so am trying from this email address in case the other email was filtered etc. Thanks so very much.

Lila Holt

from Susan Stockdale [redacted]
to Lila Holt
date Tue, Apr 26, 2011 at 8:35 AM
subject Re: PRO-SDLS
[redacted]

You certainly may. Let me know if you need a copy.

Susan Stockdale, Ph.D.
Chair of the Secondary and Middle Grades Department
Associate Professor of Educational Psychology and Middle Grades Education
Kennesaw State University

CTUS – Agatha Conrad

Agatha Conrad [redacted]

Monday, January 31, 2011 7:43 PM
Dear Lila,

At this stage there are no further updates on the instrument, but you welcome to use it as it stands. I will be happy to hear about the results of your study

Best wishes
Agatha

Holt, Lila Louise

To:
Agatha.Conrad[redacted]
Wednesday, January 26, 2011 4:19 PM
Dear Agatha,

My name is Lila Holt and I am a PhD Candidate at the University of Tennessee in the US. I've recently read the article from the Journal of Education computer Research (2008) about the development of the CTUS . I'm working on my dissertation proposal and find that this scale may be useful in exploring the relationships of technology use and self-directed leering. If I am able to use the scale you have developed and further research on this as well that would be great.

Do you have any further updates on this scale or thought of my use? I appreciate your time and consideration and wish you all the best at Newcastle.

Thanks so very much.

Lila
PhD candidate and GTA
University of TN - Knoxville

Appendix B

Instrumentation

Welcome
As a soon to be graduate, feedback on your learning methods for classes and what you think of using technology is very important. This survey is part of my PhD dissertation project and your participation is strictly voluntary. Please plan to spend approximately 15 minutes to respond to the questions.

Please be assured that your answers are confidential and you may choose no response to any question. No individual's answers will ever be identified in any report. Should you have any questions about the project or my interest in using the results, I encourage you to contact me, Lila Holt, at lholt@utk.edu or (865) 974-0497 or my advisor, Jay Pfaffman at pfaffman@utk.edu or (865) 974-0497. If you have any questions about your rights as a research participant, you may contact Ms. Brenda Lawson at the UT Office of Research at blawson@utk.edu or at (865) 974-3466.

If you agree to participate, upon exiting the survey you will be given an opportunity to submit your university email address to be entered in a drawing for an iPad as well as request results from this survey.

Your email address is completely separate from your survey answers and there will be no way to identify participants in the actual survey answers. Nor will your email address be used for any other purpose. The odds of being selected will depend on the number of respondents to this survey. Only undergraduate students who are anticipated to graduate in 2011 are being asked to participate.

If you agree to participate in the survey click on the I AGREE below.

Thanks so much!

- I agree to participate
- No Thank you

What year will you graduate?

Which semester will you graduate?

- Spring
- Summer
- Fall

Is this your first four year degree?

- Yes
- No

What is your GPA?

What year were you born?

Your Gender?

- Male
- Female

What is your major?

- Business
- Engineering
- Math/Science
- Computer Science/Technology
- English/Humanities
- Education
- Health/Health Related
- Music
- Other

Section 1 (Learning): Please Indicate one answer for each statement. There are no "right" answers to these statements which pertain to your recent learning experiences in college.

This section contains the questions from the PRO-SDLS (Stockdale, 2003).

Section 2 (Technology): Please indicate one answer for each question. There are no "right" answers to these statements

Section 3 (Technology Comfort): In this section rate your response to each of the following items. How comfortable does each of the statements make you feel at this point in your life? Don't spend too long on each item.

Sections 2 and 3 are taken from the CTUS (Conrad & Munro, 2008).

Thank you for participating. When you click NEXT you will see an end of survey page then be redirected to a site where you may enter the drawing for the iPad and/or request results for this survey.

The END OF SURVEY PAGE may take 1 MINUTE and will look like the survey is over! Please wait and do NOT close your browser. This is done to keep your information separate from your survey answers.

Appendix C

IRB Approval

Lawson, Brenda S

To:
Holt, Lila Louise; Pfaffman, Jay Alton
Cc:
Woodside, Marianne R
Wednesday, April 06, 2011 11:43 AM

Lila:
I have reviewed your proposed Form A human subjects' research protocol entitled "Self-directedness and technology use among undergraduate students graduating from a 4-year university", and I will certify it to be exempt from IRB review. You may proceed with your research.
……….

Best,
Brenda

Brenda Lawson
Compliance Officer and IRB Administrator
Office of Research

Appendix D

Acknowledgement of Table Computer

To:
Holt, Lila Louise

Saturday, May 21, 2011 4:03 PM
Lila

Thank you very much; I'm setting it up as I type.

Good luck with your dissertation!

[redacted]

On Sat, May 21, 2011 at 12:20 PM, Holt, Lila Louise <lholt@utk.edu> wrote:
Hi,

This is the official email letting you know you were the winner of the drawing for participating in my survey for my dissertation. Thank you so much for filling out the survey.

Congratulations on your graduation!

Lila Holt

Vita

Lila Holt was born in Des Moines, Iowa and grew up in Swedeborg, Missouri where her parents worked civil service. Lila attended the University of Missouri – Rolla where she met her husband and subsequently moved to Tennessee, She and her husband, Dirk, currently live in Knoxville and spend many hours with their children and grandchildren. Lila received her Bachelor of Arts degree from the University of Tennessee – Knoxville, in 1981 in Computer Science following which she taught at a junior college for six years. In 1992 she received her Master of Science degree in Computer Science from the University of Tennessee following which she entered the corporate world and managed information systems for a manufacturing company in both the United States and Mexico. She has most currently been a graduate research assistant as well as lecturer at the University of Tennessee while pursuing her doctorate. During this time she has been actively involved in the Self-Directed Learning Research Group conducting research and developing a database for citation analysis. She has presented at various professional conferences, participated in technology panels, and has collaborated on publications. Her PhD in Education with a concentration in Instructional Technology in 2011 is her most recent publication.