ATTITUDES AND GENDER DIFFERENCES OF HIGH SCHOOL SENIORS WITHIN ONE-TO-ONE COMPUTING ENVIRONMENTS IN SOUTH DAKOTA

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ABSTRACT

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Attitudes and Gender Differences of High School Seniors Within One-to-One Computing Environments in South Dakota

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In today's age of exponential change and technological advancement, awareness of any gender gap in technology and computer science-related fields is crucial, but further research must be done in an effort to better understand the complex interacting factors contributing to the gender gap. This study utilized a survey to investigate specific gender differences relating to computing self-efficacy, computer usage, and environmental factors of exposure, personal interests, and parental influence that impact gender differences of high school students within a one-to-one computing environment in South Dakota. The population who completed the One-to-One High School Computing Survey for this study consisted of South Dakota high school seniors who had been involved in a one-to-one computing environment for two or more years. The data from the survey were analyzed using descriptive and inferential statistics for the determined variables.

From the review of literature and data analysis several conclusions were drawn from the findings. Among them are that overall, there was very little difference in perceived computing self-efficacy and computing anxiety between male and female students within the one-to-one computing initiative. The study supported the current research that males and females utilized computers similarly, but males spent more time using their computers to play online games. Early exposure to computers, or the age at which the student was first exposed to a computer, and the number of computers present in the home (computer ownership) impacted computing self-efficacy. The results also indicated parental encouragement to work with computers also contributed positively to both male and female students' computing self-efficacy. Finally the study also found that both mothers and fathers encouraged their male children more than their female children to work with computing and pursue careers in computing science fields.

This abstract of approximately 200 words is approved as to form and content. I recommend its publication.

Signed Mark Baron

Professor Directing Dissertation

DOCTORAL COMMITTEE

The members of the committee appointed to examine the dissertation of Mathew B. Nelson find it satisfactory and recommend it to be approved.

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Mathew Nelson, June 2011

TABLE OF CONTENTS

Table of Contents

LIST OF TABLES

CHAPTER 1

Introduction

A man and his son are in a fatal car accident in which both the boy and his father died immediately at the scene of the accident. The police decided to consult an expert computer-based physicist to perform a computer simulation analysis of the accident in an effort to provide a more thorough understanding of the accident. The computer physicist arrived at the scene of the accident and stated: "I'm sorry; I can't investigate this scene because it's too difficult for me. The boy who died in the crash was my son." How is this possible if the father died in the crash? Most peoples' initial response is that the computer physicist is the boy's stepfather or something similar, but only a minority of people even consider the possibility of the computer physicist being the boy's mother.

The gender gap in technology and computing science, along with math and science has been well documented throughout the past 10 years. Previous research has identified a number of complex, interacting factors potentially contributing to the gender gap in the areas of science, math, technology, and engineering, including effects of environment (family influence, neighborhood, peers, and educational influences/policy), cultural context, and experiences or training (Halpern, Benbow, Geary, Gur, Hyde, & Gernsbachers, 2007). This study explored topics related to the computing gender divide including the current state of the computing gender divide, ubiquitous natured one-to-one computing technologies, computer anxiety, computing self-efficacy, computer usage, and environmental factors of exposure, personal interests, and parental influence.

One-to-one computing initiatives continue to grow at a rapidly advancing rate throughout the United States as there have been numerous programs in recent years. The popularity of one-to-one initiatives is evident in statewide initiatives in Maine (37,000 students), Virginia (23,000 students), and Michigan (80,000 students and teachers); and Texas, New Hampshire, and Vermont are currently developing plans for wide-scale one-to-one computing initiatives (Gulek & Demirtas, 2005; Van ‘t Hooft & Swan, 2007; Zucker, 2004). Previous research on successful one-to-one laptop programs have identified the following positive outcomes: independent learning, responsible ownership, a sense of pride, better organization skills, increased self-efficacy, in-depth learning, more student interest, and increased technological proficiency (Blumenfeld, Kempler, & Krajcik, 2006; Heynderickx, 2005; Mouza, 2006; Rockman, 2004; Warschauer, 2006; Windschitl & Sahl, 2002). The proliferation of computing tools for students requires a deeper understanding about gender differentials in computing.

Based on the previous research on the impact of computer anxiety and social facilitation, Cooper and Weaver (2003) predicted that anxiety can interact with the presence of others in a classroom and may be a factor influencing girls to perform more poorly on computer-based tasks around other individuals. Research has indicated that motivation and self-efficacy influence performance, preference, and choices within various situations, or in other words, high personal academic expectations predict subsequent performance, course enrollment, and occupational choice (Bandura, 1997; Pajares, 1996; Schunk & Pajares, 2002). Previous research has indicated that boys and girls use computers differently and have very different attitudes and interest levels toward the technology (American Association of University Women, 2000; Comber, Colley, Hargreaves, & Dorn, 1997; Margolis & Fisher, 2002). Research on early exposure has indicated that early play and other childhood experiences influence brain development, social interests, and the progression through developmental stages (Gurian & Stevens, 2004; Margolis & Fisher, 2002), and if the individual has a high level of early exposure to computers, this can have an impact on their motivation toward computers (Papastergiou, 2008). Various stereotypes seem to play a role in the digital gender divide as parental influence and social context also impact an individual's attitude and opportunity for success with the computer. Spencer, Steele, and Quinn (1999) found that under the proper circumstances the mere existence and knowledge of a negative stereotype causes anxiety, pressure, and negative feelings among members of a stereotyped group such as females.

Statement of the Problem

Overall employment within the computer science and informational technology fields is projected to increase by 30% with 286,000 new jobs created from 2008 to 2018 (United States Bureau of Labor Statistics, 2010). According to the United States Bureau of Labor Statistics (2010), females account for 48% of the total work force and the female work force is projected to grow by over 9% from 2008 to 2018. A report to the nation from the National Commission on Mathematics and Science Teaching for the 21st Century (2000) outlined the 10 fastest growing occupations, eight of which were math, science, or technology-related. A survey conducted by The National Council for Research on Women (2001) indicated that women constituted 45% of the workforce in the U.S., but held just 12% of science and technology-based jobs in business and industry. In the National Education Technology Plan (2004), President George W. Bush described the need to ensure that no child is left behind in regard to technology,

> We cannot assume that our schools will naturally drift toward using technology effectively. We must commit ourselves to staying the course and making the changes necessary to reach our goals of educating every child. These are ambitious goals, but they are goals worthy of a great nation such as ours. Together, we can use technology to ensure that no child is left behind. (n.p.)

Awareness of this gender gap is crucial, but many have argued that understanding the complex interacting factors contributing to the gap should be the focal point of efforts to further eliminate the gap (Cooper & Weaver, 2003). As with any multifaceted issue of complexity, the current status can be identified as one of both significant progress and serious inadequacies (National Commission on Mathematics and Science Teaching for the 21st Century, 2000). In their synthesis of research regarding the gender digital divide, Cooper and Weaver (2003) reported that women were unrepresented in their use and ownership of computers, took fewer technology classes, were far less likely to graduate from college with degrees in computer science or informational technology fields, and were less likely to enroll in postgraduate technology fields. Females continue to be under-represented in the informational technology workforce (Cohoon, 2003; Etzkowitz, Kemelgor, & Uzzi, 2000; Roberts, Kassianidou, & Irani, 2002; Teague, 2002). This digital divide between males and females has not only been damaging for women, but also for society because half of the potential workforce may struggle to contribute to the informational technology field (Cooper & Weaver, 2003). “Forecasts are that by the year 2010, 25% of all new jobs created in the private and public sectors will be ‘technologically orientated’” (American Association of University Women, Educational Foundation Commission on Technology, Gender and Teacher Education, 2000, p. 4). In today's age of exponential change and progress, it is essential for educators to be aware of any gender gaps and differences in critical content areas of math, science, and technology.

Statement of Purpose

This study investigated specific gender differences relating to computing self-efficacy, computer usage, and selected environmental factors that influence gender differences of high school students within a one-to-one computing environment in South Dakota. The primary purpose of this study was to examine self-efficacy regarding computers and computing science, and identify any potential differences in self-efficacy between male and female students within a one-to-one computing environment. This study analyzed high school seniors in a ubiquitous classroom environment where each student has 24-hour access to personal tablet computers. This study is an effort to encourage equity among students concerning technology and potentially close the digital divide, which as defined by Roblyer (2006) refers to a discrepancy in access to an interest level in technology resources. The study also analyzed self-efficacy, which is an individual's belief about his or her capacity to organize and execute the actions required to produce a given level of attainment (Bandura, 1997). The scope of this study focused on investigating specific gender differences related to computing self-efficacy, computer usage, and selected environmental factors influencing gender differences within high school seniors within a one-to-one computing environment in South Dakota.

Research Questions

The following research questions are framed to guide this study:

1. What differences in self-efficacy toward computers and interest in computer

science are there between females and males within a one-to-one computing environment in South Dakota?

2. What differences are there between female and male students' use of computers in a one-to-one computing environment?

3. What differences in perceived computer anxiety are there between female and male students within a one-to-one computing environment?

4. To what extent does age of first exposure to computers impact the attitudes of the male and female students toward computing self-efficacy?

5. To what extent does the number of computers (other than the one-to-one initiative issued computer) already present in the home make a difference in the attitudes of the male and female students toward computing self-efficacy?

6. What is the relationship between parental encouragement to work with computers and the students' overall computer self-efficacy?

7. What differences are there between male and female students' parental encouragement for the student to work with computers and pursue careers in computing science?

Significance of the Study

In today's age of exponential change and technological advancement, awareness of the gender gap in technology and computer science-related fields is crucial, but further research must be done in an effort to better understand the complex interacting factors contributing to the gender gap. The significance of the study is clear when one considers the documented gender gap in computing science career pursuit along with the high costs associated with schools and states investing resources into one-to-one laptop initiatives.

Results of this study may be useful for policy makers who are considering one-to-one computing and the various components associated with the initiative. The results could help to provide a better understanding of computing self-efficacy differences based on gender and environmental factors that could potentially contribute to the gender computing divide. This study also could provide useful information for educators who seek to better understand the needs of female and male students engaged within a one-to-one computing environment. The popularity of one-to-one computing initiatives is rapidly growing in K-12 education, and although school boards and policy makers may believe that one-to-one computing initiatives hold the potential to bridge any potential digital divide or existing gender divide between students, there remains a lack of comprehensive research investigation of computer self-efficacy of students with two or more years of experience within a one-to-one computing environment.

Definition of Terms

In an effort to maintain uniformity and increase understanding of the study the following terms are defined. All definitions without citations were developed by the researcher.

Classroom Connections: The one-to-one initiative started by the State of South Dakota in 2006 where schools purchased computers for all high school students. In this program the state contributed one-third of the cost of the computers, and the district involved contributed the other two-thirds of the cost (South Dakota Department of Education, 2009).

Gender digital divide: The gap between males and females within computer science related employment, computer science skill levels, and general interest/

motivation in computing science.

One-to-one computing environment: A high school classroom environment where an individual laptop computer is assigned to each student. In this study, each high school student within the one-to-one environment was assigned a laptop computer at the beginning of the school year and is responsible for the computer until the end of the school year.

One-to-one laptop initiative: A school environment in which each student has a laptop or tablet computer that can be utilized 24 hours a day, seven days a week. In this school the ratio of computers per student is one-to-one.

Tablet PC: A personal computer given to the high school students involved in the Classroom Connections initiative. A Tablet PC has a stylus that can be used to write or "ink" on various documents and notes.

Technology integration: The process of actively incorporating technology into classroom lessons in an effort to enhance student learning outcomes

Ubiquitous computing: The computer or laptop is available to the student at all times (24 hours a day, seven days a week), anywhere. In a ubiquitous computing environment the technology has been integrated into daily life and activities.

Limitations and Delimitations of the Study

1. This study was delimited to a sample of South Dakota high school seniors who have engaged in a one-to-one computing environment throughout their high school careers (two or more years). As a result of the focused sample of students within the one-to-one computing initiative in South Dakota, the results of this study are not able to be generalized to other populations of students in different educational settings and states.

2. This study also was delimited by the focused investigation of the specific environmental factors of computer access, exposure, and parental encouragement to work with computers. The researcher recognizes the complex nature of the computing gender gap and numerous complex, interacting factors potentially contributing to the computing gender gap and differences that may not have all been addressed in the scope of this study.

3. This study may be limited by the number of responses received from the sample group surveyed.

4. This study was delimited by the fact that different forms of test administration (paper and pencil computerized) can impact test results. The study focuses more on perceived attitudes and gender differences of students using computers for academic purposes and does not fully take into account or analyze the dramatic changes in computer usage and social networking applications.

5. Dramatic changes in technology are taking place and the way students use various forms of technologies is rapidly changing. This study focused on attitude and usage differences and is delimited by the fact that it does not directly investigate the potential impact social networking has on computer usage and attitudes. The researcher recognizes this as a recommendation for future research.

Assumptions

It is assumed that all respondents answered all survey questions honestly and to the best of their abilities.

Organization of the Study

The focus of Chapter 1 of this dissertation is to provide an introduction to the study of selected gender differences relating to computing self-efficacy, computer usage, and selected environment factors influencing gender differences of high schools students within a one-to-one computing environment in South Dakota. A statement of the study's purpose, the seven research questions guiding the study, the significance of the study, a definition of terms, and limitations, delimitations, and assumptions of the study also are included within Chapter 1.

Chapter 2 describes the need for research on gender differences within ubiquitous (one-to-one) computing environments, along with a brief history of computing technology, one-to-one computing initiatives, and an analysis of the current state of the computing gender divide. In an attempt to synthesize the review of background information pertinent to the specific research questions guiding this study, Chapter 2 also includes a summary of previous research related to self-efficacy, computer usage, and environmental factors of computer access, exposure, and parental encouragement to work with computers

Chapter 3 describes the methodology that was utilized to conduct this comparative, non-experimental study. In this chapter the methodology and procedures used to gather data for the study are presented. The methodology includes an explanation of the population sample, pertinent instrumentation information, and the general data collection and analysis procedures. Chapter 4 includes the results of analyses from the data collection and the findings of the study. Chapter 5 contains a summary of the study, findings, conclusions, discussion, and recommendations for further research.

CHAPTER 2

Review of Related Literature

Chapter 2 provides a comprehensive review of the literature and research associated with specific factors contributing to gender differences in one-to-one computing environments. A comprehensive review of literature following Maxwell's (2005) guide to relevancy was followed for this literature review. This chapter is divided into the following sections, which are directly related to the research questions guiding the study: (a) Brief Historical Background of Computing, (b) Current State of the Computing Gender Divide, (c) Ubiquitous Technologies, (d) One-to-one Computing Initiatives, (e) Computer Anxiety, (f) Computing Self-efficacy, (g) Motivation and Self-Efficacy, (h) Computer Usage, (i) Early Exposure and Personal Interests, and (j) Parental Influence and Encouragement. Previous research has identified a number of complex, interacting factors potentially contributing to the gender gap in the areas of science, math, technology, and engineering including effects of environment (family influence, neighborhood, peers, and educational influences/policy), cultural context, and experiences or training (Halpern et al., 2007). This study focused on investigating specific gender differences related to computing self-efficacy, computer usage, and selected environmental factors influencing gender differences within high schools seniors in a one-to-one computing environment in South Dakota. The review of literature provides a context to understand the gender digital computing divide, one-to-one computing, and also identifies a potential gap in research related to gender differences in a one-to-one high school computing environment.

Brief Historical Background of Computing

During World War II, the first known computers were a group of 80 women calculating ballistics trajectories by hand for the war effort and the women's job title actually was "computer" (Women in Technology International, 1997). According to the Women in Technology International (1997) when the first computer, the Electronic Numerical Integrator And Computer (ENIAC), was built for the calculation purposes, six of the women with the original job title of "computer" in World War II were selected to become the first computer programmers. Throughout the years, after early computing technologies were developed, schools rapidly integrated computers into the classroom as learning tools. In fact, in 1981 fewer than 20% of school classrooms in the United States had computers, but by 1990 more than 95% of all classrooms had at least one computer and in 2000 over 98% all schools owned computers and were connected to the Internet (Cooper & Weaver, 2003).

In 1991, U.S. spending for Industrial Age capital goods such as engines, electrical distribution, metal working and materials handling machinery, industrial equipment, and agriculture and construction equipment was exceeded for the first time in United States history by the spending for information technology, which included computers and telecommunications hardware and software (Trilling & Fadel, 2009). Trilling and Fadel (2009) described this as the official mark of the information technology age as spending emphasis shifted from machines that perform similar operations on the atoms and molecules of the physical world toward equipment that makes, manipulates, manages, and moves the bits and bytes of information. According to the United States Department of Education (2006), "almost 100% of public schools in the United States had access to the Internet, compared with the 35% that had access in 1994. The rate at which schools have been purchasing computer has been climbing at greater than 10% per year, with purchases running at approximately $1 billion annually" (Cooper &Weaver, 2003, pp. 1-2).

Current State of the Computing Gender Divide

Cooper and Weaver (2003) referred to the digital divide as a term, "…used to refer to the gap between those who have access to technology and those who do not, between those who have the expertise and training to utilize technology and those who do not" (p. 3). In their synthesis of research regarding the gender digital divide, Cooper and Weaver (2003) reported that women were underrepresented in their use and ownership of computers, took fewer technology classes, were far less likely to graduate college with degrees in informational technology fields, and were less likely to enroll in postgraduate technology fields. Females have continued to be under-represented in the informational technology and computer science workforce (Cohoon, 2003; Etzkowitz, Kemelgor & Uzzi, 2000; Roberts, Kassianidou, & Irani, 2002; Teague, 2002). This digital divide between males and females is not only damaging for women, but also for society because half of the potential workforce may struggle to contribute to the informational technology field (Cooper & Weaver, 2003).

In 2001, women comprised over 50% of all high school students, but only 17% of the students taking the Advanced Placement Computer Science A test in high school and less than 11% taking the more sophisticated Advanced Placement Computer Science B test (College Board, 2001). According to analysts, the number of women entering the information technology profession was continuing to decline (Panteli, Stack, & Ramsay, 2001). Forecasts were that by the year 2010, 25% of all new jobs created in the private and public sectors would be “technologically orientated” (American Association of University Women, Educational Foundation Commission on Technology, Gender and Teacher Education, 2000). Regardless of the economic situation, McClelland (2001) argued that access to jobs will require training and competency in computing technologies, which makes it ever more important to understand potential reasons why women are not seeking and obtaining advanced training in computing technology. In today's technologically rich world there is no doubt that computers and technology are not only infused into daily life, but also in today’s workplace with the top three occupations with the fastest employment growth are computer science, computer engineering, and system analysts (Lanius, 2006).

Statistics indicated that more than 75% of tomorrow’s jobs will require strong computer skills in a rapidly advancing, technologically rich society (United States Bureau of Labor Statistics, 2000). According to the American Association of University Women Educational Foundation (2000), the nature of the problem potentially begins earlier in an individual’s life, but the gender gap in computer science is evident and alarming when one considers the fact that girls represent 17% of the high school Computer Science "AP" test takers, and less than one in 10 of the higher-level Computer Science "AB" test takers. The United States Bureau of Labor Statistics (2000) reported “nearly 75% of tomorrow's jobs will require use of computers, while fewer than 33% of participants in computer courses and related activities are girls” (p. 1). The American Association of University Women Educational Foundation (2000) found that women make up roughly 20% of informational technology professionals and that computer science is the only field in which women's participation has actually decreased historically over time with females earning less than 28% of the computer science bachelor's degrees, down from a high of 37% in 1984.

In today's age of exponential change and progress, it is essential for educators to be aware of any gender gaps and differences in critical content areas of math, science, and technology. A report to the nation from the National Commission on Mathematics and Science Teaching for the 21st Century (2000) outlined the 10 fastest growing occupations, eight of which were math, science, or technology related. A survey conducted by The National Council for Research on Women (2001) indicated women constitute 45% of the workforce in the U.S., but held just 12% of science and technology-based jobs in business and industry. As with any multifaceted issue of complexity, the current status can be identified as one of both significant progress and serious inadequacies (National Commission on Mathematics and Science Teaching for the 21st Century, 2000). Awareness of this gender gap is crucial, but many argue that understanding the complex interacting factors contributing to the gap should be the focal point of efforts to further eliminate the gap.

Ubiquitous Technologies

Mark Weiser, who served as a scientist at the Xerox Palo Alto Research Center (PARC), was credited for first defining ubiquitous computing, being able to use computers anytime and anywhere, as follows:

> Ubiquitous computing names the third wave in computing, just now beginning. First were mainframes, each shared by lots of people. Now we are in the personal computing era, person and machine staring uneasily at each other across the

> desktop. Next comes ubiquitous computing, or the age of calm technology, when technology recedes into the background of our lives. (Van't Hooft & Swan, 2007, p. ix)

The Research Center for Educational Technology (2007) defined ubiquitous computing very similarly as learning environments in which all students have access to a variety of digital devices and services, including computers connected to the Internet and mobile computing devices, whenever and wherever they need them. Their definition focused on the active nature of the teaching and learning process as students and teachers aim to "… critically analyze information, create new knowledge in a variety of ways (both collaboratively and individually), communicate what they have learned, and choose which tools are appropriate for a particular task" (Research Center for Educational Technology, 2007, p. 1).

Twenty-four hour access also encourages equity among students concerning technology that closes the digital divide, which is a discrepancy in access to technology resources (Roblyer, 2006). With the ubiquitous technology the students have access to information and various tools 24 hours a day, seven days a week. "Today's students consider this type of access akin to being always on in constant contact with their friends via texting, instant messaging, mobile phones, and Internet connections" (Ito et al., 2008, p. 1). Gulek and Demirtas (2005) described the responsibilities of any successful laptop program as creating equal access to the laptop computing technologies, remediating students who lack experience with technology, and developing specific student standards for technology proficiency. The ubiquitous nature of the one-to-one computing initiative aims to prepare students for tomorrow's technologically rich world and focus on the 21st century skills of problem solving, critical thinking, communication, presentation, research, and collaboration. Several studies found that laptops can enhance 21st century skills such as improved technology literacy, communication, writing, and research skills (Zucker, 2005). Having ubiquitous access to computers 24 hours a day allows for students to access more resources and become accustomed to 21st century lifelong learning (Penuel, 2006).

One-to-one Computing Initiatives

Windschitl and Sahl (2002) described the movement toward one-to-one computing, one of the fastest spreading initiatives in American education today, "Laptop computer programs introduce a host of complex issues into a school community, the least of which is how teachers will adapt to classroom settings in which every student owns a mobile suite of powerful technological tools" (p. 27). There have been numerous laptop initiatives throughout the United States in recent years, including initiatives in Maine (over 37,000 students), Virginia (over 23,000 students), and Michigan (over 80,000 students and teachers); Texas, New Hampshire, and Vermont are currently developing plans for many more (Zucker, 2004). Bausell (2008) reported that the state of South Dakota had an average of two students per computer, which is tied with Maine for having the best student per computer ratio in the United States.

Zucker's (2004) analysis of the available research on the impacts of one-to-one computing concluded that,

> although research on one-to-one computing in a limited number of schools is about a decade old, there has not yet been enough research to keep pace with policymakers and practitioners' calls for guidance and for reliable information

about what happens when every student has a computer. (p. 5)

The number of schools engaging in one-to-one initiatives has been growing, but to date a significant number of studies have not been conducted. Apple Computer (2005) found that the research regarding one-to-one learning programs has not kept up with the rapid expansion of the initiatives and "more and better-designed studies must be conducted to quantify the benefits of the initiatives and the impact they have on student achievement and state test scores" (p. 15). In the scope of his research synthesis, Livingston (2006) summarized the potential impact this trend may have, "Nearly every study . . . showed that laptops can increase student motivation and engagement, and when motivation to learn increases, so does the retention of that learning" (p. 4). The growing number of students impacted by one-to-one computing initiatives and potential positive implications of the integration warrants the need for further research regarding gender differences in attitudes and computing self-efficacy within the one-to-one computing environment.

The concept of constructing knowledge utilizing technology as a tool was suggested by Papert in the 1980s and focused on the concept of using computers in an effort to help the students construct and manipulate knowledge to "form more robust internal knowledge structures" (Van't Hooft & Swan, 2007, p. 5). One of the most significant findings on the benefits to laptops was the Rockman (2004) study, which analyzed 29 school sites across the U.S. and reported conclusions about the benefits to students using laptop technology and their impact on teaching and learning:

1. Laptop students spend more time using computers.
2. Laptops appear to extend the school day.
3. Laptops are frequently used in core subject area classes.

4. Students choose tools appropriate to the task.

5. More computer use results in more proficient students. (p. 28)

The general consensus from recent reviews of the research was that additional detailed information is needed to assess the impact of one-to-one laptops on teaching, learning, motivation, and interest in computing technologies (Lemke & Martin, 2003; Penuel, 2006; Russell, Bebell & Higgins, 2004; Zucker, 2004). Cooper and Weaver (2003) described the role of computers in education and the underlying goals of the integration:

> Children are being introduced to computers at earlier ages with the twin goals of motivating them to learn and to get them ready to take their place in an increasingly technologically oriented society. An unwritten premise of today's educational mission is that our instruction should motivate and inform all children as equally as possible, without regard to gender, race, or income. (p. ix.)

Penuel (2006) studied various one-to-one initiatives and identified three common features of the initiatives:

> 1. providing students with use of portable laptop computers loaded with contemporary productivity software (e.g., word processing tools, spreadsheet tools, etc.), 2. enabling student to access the Internet through schools' wireless networks, and 3. a focus on using laptops to help complete academic tasks such as homework assignments, tests, and presentations. (p. 331)

Previous research on successful one-to-one laptop programs identified the following positive outcomes: independent learning, responsible ownership, a sense of pride, better organization skills, increased self-efficacy, in-depth learning, more student interest, and increased technological proficiency (Blumenfeld, Kempler, & Krajcik, 2006;

Heynderickx, 2005; Mouza, 2006; Rockman, 2004; Warschauer, 2006; Windschitl & Sahl, 2002).

South Dakota's Classroom Connections 1 to 1 Computing Initiative

In 2003, South Dakota Governor Mike Rounds organized a long-term educational plan aimed to enhance high school students' technology literacy skills in 2003. The plan, commonly referred to as the 2010 Education Initiative, included the following objectives: (1) to provide students with the educational tools that will be used in their post secondary institutions or the world of work, (2) to close the digital divide between students who have access to technology and those who did not, (3) to create a more relevant learning environment for high school students, and (4) to teach 21st Century skills to all high school students (Melmer, 2007). In January of 2006, Governor Mike Rounds announced the South Dakota Classroom Connections program. The Classroom Connections program, which was designed to be an incentive program to encourage schools to adopt laptops as ubiquitous technology, provided financial assistant for the schools to purchase a laptop computer for each high school student (South Dakota Department of Education, 2006). According to the South Dakota Department of Education (2010), in the fall of 2010 the Classroom Connections project had 72 districts involved (11,000 high school students), 41 of which had been involved for at least two years and met the criteria to participate in this study.

Computer Anxiety

Anxiety of any sort can have a profound impact on performance, and as indicated by Bozionelos (2001), computer anxiety can greatly impact computing self-efficacy, interest, usage, and overall performance. In the 1980s social scientists found evidence for the presence of computer anxiety in the population of students of all ages (Gressard & Loyd, 1986; Weil, Rosen, & Sears, 1987; Wilder, Mackie & Cooper, 1985) and research in the late 1990s indicated that computer anxiety continues to impact people's attitudes toward computing technologies (Brosnan, 1998; Chua, Chen & Wong, 1999). Bozionelos (2001) characterized computer anxiety as negative emotions and cognitions induced in actual or imaginary interaction with computing technologies. Along with experiencing computer anxiety, females often conclude that they do not have the competencies to use computers and acquire a diminished sense of computing self-efficacy (Cooper & Weaver, 2003). Based on the previous research on the impact of social facilitation, Cooper and Weaver (2003) predicted that anxiety can interact with the presence of others in a classroom and may be a factor influencing girls to perform less well on computer based tasks around other individuals.

> The social context of computing affects what people think as well as what they feel. Anxiety and stress dominate the performances of girls when they use IT programs in public, whereas boys seem to become more enthused, eager, and productive while computing in the public arena. (Cooper & Weaver, 2003, p. 60)

As Cooper and Weaver (2003) stated, "The research we have examined thus far suggest that the seeds of computer anxiety are sown early in the school years but continue to have consequences as children develop" (p. 27). This computer anxiety can lead to an overall decreased computing self-efficacy in an individual.

Attitudes and Computing Self-Efficacy

Central topics investigated in this study are attitudes and self-efficacy as they relate to computing technologies. As young girls grow and develop, there are many factors that account for and help shape interest and attitudes toward a particular field. Bandura (1977, 1997) defined self-efficacy as individuals' confidence in their ability to organize and execute a given course of action to solve a problem or accomplish a task in which an emphasis is placed on human agency and self-efficacy perceptions as major influences on individuals' achievement strivings, including performance, choice, and persistence. Bandura (1997) proposed that individuals' efficacy expectations rather than outcome expectancies are the major determinant of goal setting, activity choice, willingness to expend effort, and persistence. Self-efficacy, a critical component of motivation, is an individual's belief about her or his capacity to organize and execute the actions required to produce a given level of attainment (Bandura, 1997). Bandura (1997) also proposed that individuals' perceived self-efficacy is determined primarily by four things: previous performance, vicarious learning, verbal encouragement, and physiological reactions. Researchers have found positive correlations between student achievement and self-efficacy beliefs of students (Bandura, 1997; Pajares, 1996). Self-efficacy is multidimensional in nature, can be positive or negative, and vary greatly from task to task depending on perceived level of difficulty. Research supports the theory that self-efficacy influences performance and choices within various situations or, in other words, high personal academic expectations predict subsequent performance, course enrollment, and occupational choice (Bandura, 1997; Pajares, 1996; Schunk & Pajares, 2002).

Hawkes and Brockmueller's (2004) review of previous research of female attitudes toward informational technology fields indicated that girls and women tend to hold more negative attitudes toward informational technology and their own perceived computer use capabilities. “These beliefs, combined with media influences predominantly portraying men in technology roles, often persuade women to choose non-technology related careers” (p. 4).

Research has suggested that females demonstrate less favorable attitudes toward computers (Karsten & Schmidt, 2008; Young, 2000) and less confidence and higher levels of anxiety when working with computers (Beyer, 2008; Thatcher & Perrewe, 2002). Individual and behavioral factors have large influences on computing technology adoption as Compeau and Higgins (1995) argued that that computer or technology behaviors are largely influenced by the individual’s perception of their computer self-efficacy and computer anxiety. Computer anxiety refers to a feeling of apprehension or anxiety toward using computers and, as indicated by previous studies, the relationship between computer anxiety and computer science aptitude is negative and strong (Compeau, Higgins, & Huff, 1999; Thatcher & Perrewe, 2002.) Because computing has developed a masculine image similar to the traditionally masculinized subjects such as science and mathematics, females tend to feel less comfortable than males with computers (Beyer, 2008; Karsten & Schmidt, 2008). Being generally uncomfortable with computers may lead females to develop negative attitudes toward computers as females typically display lower computer aptitude (Beyer, 2008; Young, 2000) when compared to males.

Motivation and Self-Efficacy

Classical research by Piaget (1970) indicated that most young children show great interest and enthusiasm for learning and that interest propels their intellectual development. Corbin (2008) argued that motivation is a vital component of the teaching and learning process and stated that motivation is "largely an emotional reaction in which the learner sees benefit and reward in attending to the learning task or activity or anticipates some positive result or sense of emotional well being" (p. 74). Several studies have indicated that attitude was shown to improve when students had access to a computer at home (Cuban, 2001), were given a laptop computer for use during the school year (Efaw, Hampton, Martinez, & Smith, 2004), or were taught with computer-based learning materials (Dewhurst, MacLeod, & Norris, 2000). Cooper and Weaver (2003) suggested that a combination of individual expectancies and group stereotypes operate in the home and the classroom to produce a self-fulfilling prophecy that leads females to experience computer anxiety and lower overall computing self-efficacy. Motivation to learn refers to the desire of the trainee to learn the content of a training program (Klein, Noe, & Wang, 2006). Motivation to learn is a major predictor of learning outcomes and is influenced by both individual and situational characteristics (Colquitt, 2000; Klein, Noe, & Wang, 2006). In order to understand motivation one must understand the nature of the individual as teenage girls tend to have larger and more diverse social groups than teenage boys and are more expressive, compassionate, cooperative, and open to the company of others (Polimeni, Hardie, & Buzwell, 2002). As Papastergiou (2008) stated, girls in high school tend to study computer science for extrinsic factors, such as money, potential jobs, or good grades, whereas high school boys tend to study computer science for both intrinsic and extrinsic factors, which may contribute to the digital divide. One factor related to motivation to utilize computers is computer usage levels and types of activities for which the computer is utilized.

Computer Usage

Previous studies have defined computer use in numerous ways including general access to computers (Solvberg, 2002; Young, 2000), general use at home (Solvberg, 2002, Volman, Eck, Heemskerk, & Kuiper, 2005), playing games (Colley & Comber, 2003; Miller, Schweingruber, & Brandenburg, 2001; Volman et al., 2005), using the Internet and e-mail (Jackson, Ervin, Gardner, & Schmitt, 2001; Miller, Schweingruber, & Brandenburg, 2001), and using a variety of application software (Colley & Comber, 2003; Volman et al., 2005). Research has indicated that as boys grow older, they tend to use computers they have at home more frequently whereas girls use their home computers less as they grow older (Comber et al., 1997). Evidence has suggested that although females and males are equally inclined to surf the Web, fewer females are involved in the research, design, implementation of new computer technologies, and other more sophisticated computing-based tasks (Margolis & Fisher, 2002). The American Association of University Women (2000) found that women and men are using computers as a tool for accessing the Internet, using email, and using word processing programs at equal rates, but it is alarming to consider that men more than women are participating in the technological revolution and doing so at a more sophisticated level in classrooms and workplaces.

Shashaani (1997) surveyed over 1,700 secondary school students and found that a large majority (70%) indicated that males are the primary users of computers in the home. Not only has the use of computers by males been more frequent at home, but their use of the technology tends to be for playing games and programming (Funk & Buchman, 2006). McCormick and McCormick (1991) found that girls' interest in computer games was lacking and they felt a vast majority of games were typically designed for males. Funk and Buchman (2006) also found that boys were more interested in playing computing-based video games and in the primary and middle school grade levels it was more socially acceptable for boys to play computer games, as those boys who play computer games are viewed to be more popular than girls who play video games. The American Association of University Women (2000) concluded that females tend to view computer use as tedious, sedentary, and antisocial, and although females were not computer-phobic, they often positioned themselves as morally or socially more evolved than boys who enjoyed interacting with machines. The study also found that females tended to demonstrate reluctance to engage in technologies that seem to them largely devoted to the interests of boys (American Association of University Women, 2000).

Previous research has found that video games can be an avenue towards computer access and may lead individuals to develop a comfort level working with computers, but at the same time video games and software programs made for the home market often reinforce gender bias and stereotypical gender roles with very few powerful, active female roles (American Association of University Women, 1998). Cooper and Weaver (2003) alluded to the potential discrepency in computer-based learning experiences which may impact learning, attitudes, and self-efficacy towards computers, "If it is true that girls are uncomfortable engaging in computer based learning games and similar activities, and if it is true that learning on the computer can be a productive and positive experiences, then the girls are not receiving the benefit" (p. 12). According to Prescod and Dong (2006) "an individual's learning style is an indication of the person's needs, motivations, attitudes, expectations, and emotions when in a learning environment" (p. 2). Computer usage levels, along with attitudes, motivation, and expectations of students toward technology, should be considered in any technology integrated learning environment as previous research has indicated that the learning environment should match an individual's learning style to enhance student learning outcomes (Baldwin & Sabry, 2003; Crawford, 2008; Leigle & Janicki, 2006).

Early Exposure and Personal Interests

Previous research on early exposure has indicated that early play and other childhood experiences influence brain development, social interests, and the progression through developmental stages (Gurian & Stevens, 2004; Margolis & Fisher, 2002). Papastergiou (2008) found that early familiarization with computing at home has a profound impact on a student's motivation toward studying computer science and using computers for academic and pleasureable purposes. Margolis and Fisher (2002) found some differences in male and female access to computers at home and school as frequently the computer was located in the son's room at home and the girls were forced to work with the threat of anxiety as they were surrounded by boys at school. Research has indicated that girls are not as interested in computers, and their computer interests, skills, and abilities are generally lower (Rowell et al., 2003). The importance of girls' attitudes toward computers has been supported by previous research in which middle school girls reported perceiving computer careers and the entire computer culture (including software, games, and the Internet) as not only "male" but also as "antisocial" and "geeky" (American Association of University Women Educational Foundation, 2000).

According to the research of Rosenbloom, Ash, Dupont, and Coder (2008), although many young women may possess the qualifications and skill to pursue a career in a technology-related field, they simply chose to do something better correlated to their interest based on personal choice. The fact is that women could potentially pursue a career that they are interested in based on their personality, but personal choice is an often overlooked explanation for the gender gap computing science-related fields. The results of Rosenbloom's et al. (2008) study indicated that men and women "differ systematically in their interests, and that these differences can account for an economically and statistically large fraction of the occupational gender gap" (p. 543), which includes the fields of computing science, physics, math, and other similar fields. The Committee on Maximizing the Potential of Women in Academic Science and Engineering and the National Academy of Sciences (2007) indicated the representation of women in the fields of math, science, and technology is low relative to the number of women qualified to work in the field. The Committee (2007) concluded, "It is not lack of talent, but unintentional biases and outmoded institutional structures that are hindering the access and advancement of women" (p. 1). The study performed by Rosenbloom et al. (2008) used a standard personality-inventory test to measure people's preferences for different kinds of work and found personal preference to be the single largest determinative factor in whether women went into information technology. Often, the women are qualified to work within the science and technology field, but they would prefer to do something else (Rosenbloom et al., 2008; Committee on Maximizing the Potential of Women in Academic Science and Engineering and the National Academy of Sciences, 2007).

Impact of Parental Influence and Encouragement of Self-Efficacy

Many individuals tend to dismiss the fact that there is bias and that a gender gap exists in computer science, but one of the first steps toward combating any negative environmental influences is to recognize and address the issue (Leedy, LaLonde, & Runk, 2003). Previous research has indicated that social context plays a very crucial role in encouraging or discouraging an individual's success with the computer and under the proper circumstances, the mere existence and knowledge of a negative stereotype causes anxiety and pressure in members of the stereotyped group (Spencer, Steele, & Quinn, 1999). Women performing computing-based tasks must face the "threat in the air" – the potential negative evaluation caused by the stereotype (Steele, Spencer, & Aronson, 2002).

Cooper and Weaver (2003) concluded that the lessons learned through a century of psychological research indicated that people's behavior, attitudes, and thoughts are impacted dramatically by the social context. Not only does the social context influence attitude and behavior, but Cooper and Weaver (2003) found that the social context has a large impact on how successful students will perform computer tasks in the classroom. The research of Littleton, Light, Joiner, Messer, and Barnes (1998) found that parents indicate a greater willingness to spend more money for computers for their sons than for their daughters and focus on computer purchases more for their sons. "Because parents' and teachers' attitudes and opinions directly influence the performance expectations and attitudes their children and students develop for themselves, it is essential that parents and teachers examine their own assumptions about the role that gender takes in technology" (Cooper & Weaver, 2003, p. 9). Shashaani (1994) found that parents' computer stereotypes in favor of males encouraged their sons' computer involvement and discouraged their daughters, and his later study found that girls who perceived their parents as believing computers were more appropriate for males were in fact less interested in computers (Shashaani, 1997). Kekelis, Ancheta, Wepsic, and Countryman (2004) found that parents gave less computer-related support to their female children than to their male children.

A study conducted by Fouad (2008) at the University of Wisconsin-Milwaukee indicated that the self-confidence instilled by parents and teachers profoundly impacts interests and it seems as if the girls' long-term interests are shaped largely by environmental factors, including the influence of parents and teachers in the self-confidence building process. Leedy, LaLonde and Runk (2003) discovered that even girls who are particularly motivated and talented in technology and math fields are not immune to the ill effects of gender bias, "This is a clear indication that our efforts to rid our society of this stereotype [have] not been successful" (Leedy, LaLonde, & Runk, 2003, p. 290). If a student (male or female) believes they have the capacity to perform well in a particular content area or field, they are likely to be successful in the field. If a female student believes she has the capacity to perform well working with a computer within the general technology field, she will be more likely to be motivated to succeed in that corresponding field.

The findings of a long-term study at the University of Michigan Institute for Social Research led by Davis-Kean (2007) produced similar results and found that fathers have a major impact on their daughter's academic interest. The Davis-Kean (2007) study analyzed the impact of parental values and attitudes on children's academic interest and found that parents, specifically fathers, provided more math-supportive environments for their sons than for their daughters, including buying more math and technologically rich toys for the boys. Davis-Kean (2007) found that fathers spent more time on math and technology activities with their sons than with their daughters and that girls' interest in math decreases as their fathers' gender stereotypes increase, whereas boys' interest in math increases as their fathers' gender stereotypes increase.

Parental encouragement and factors such as intentional and unintentional gender stereotypes or bias may lead some stakeholders in the child’s life to believe at times that there is nothing they can do to change or shape the attitudes of school-aged girls towards science, math, or technology. Despite the beliefs by these individuals, which include parents and many teachers, many believe there is nothing they can do to positively change or shape the attitudes of school-aged girls towards technology, math, and science. An empirically based tracking study conducted by Fouad (2008) at the University of Wisconsin-Milwaukee indicated that the self-confidence instilled by parents and teachers is more important for young girls learning in the content areas of technology, math, and science than their initial interest. Fouad (2008) concluded that overall interest level of any individual (male or female) in the content areas of math, science, and technology has the potential to increase if the environmental factors provide opportunities to build confidence in math, science, and technology-related skills. Overcoming pro-male bias in math, science, and technology requires individuals to confront it and for educators it often involves various methods of professional development regarding training aimed to help give girls equal opportunity to succeed (Berube & Glanz, 2008).

Summary

In today's world there is no doubt that computers and technology are not only infused into daily life, but in their synthesis of research regarding the gender digital divide, Cooper and Weaver (2003) reported that women were unrepresented in their use and ownership of computers, took fewer technology classes, were far less likely to graduate from college with degrees in informational technology fields, and were less likely to enroll in postgraduate technology fields.

One-to-one computing initiatives have continued to grow at a rapidly advancing rate throughout the United States, as there have been numerous programs in recent years. Previous research on successful one-to-one laptop programs have identified the following positive outcomes: independent learning, responsible ownership, a sense of pride, better organization skills, increased self-efficacy, in-depth learning, more student interest, and increased technological proficiency (Blumenfeld, Kempler, & Krajcik, 2006; Heynderickx, 2005; Mouza, 2006; Rockman, 2004; Warschauer, 2006; Windschitl & Sahl, 2002). Research has indicated that males and females use computers in different ways at different levels of sophistication including general access to computers (Solvberg, 2002; Young, 2000), general use at home (Solvberg, 2002, Volman, Eck, Heemskerk, & Kuiper, 2005), playing games (Colley & Comber, 2003; Miller, Schweingruber, & Brandenburg, 2001; Volman et al., 2005), using the Internet and e-mail (Jackson, Ervin, Gardner, & Schmitt, 2001; Miller, Schweingruber & Brandenburg., 2001) and using a variety of application software (Colley & Comber, 2003; Volman et al., 2005). Research has indicated that motivation and self-efficacy influences performance and choices within various situations or, in other words, high personal academic expectations predict subsequent performance, course enrollment, and occupational choice (Bandura, 1997; Pajares, 1996; Schunk & Pajares, 2002). Computer anxiety can impact an individual's overall attitude towards computing technologies (Brosnan, 1998; Chua, Chen & Wong, 1999) and as a result of the anxiety females often acquire a diminished sense of computing self-efficacy (Cooper & Weaver, 2003).

CHAPTER 3

Methodology

Chapter 3 describes the methods and procedures that guided this research study. The primary purpose of this study was to examine self-efficacy toward computers and computing science, and identify any potential differences in self-efficacy between male and female students within a one-to-one computing environment. This study also investigated specific gender differences relating to computer usage within a one-to-one computing environment and analyzed the selected environmental factors of computer access, exposure, and parental encouragement to work with computers. This chapter presents the research design, methodology, and procedures related to data collection and instrumentation, as well as population selection. The chapter ends with proposed data analysis procedures.

The following research questions guided this study regarding the gender digital divide and computing self-efficacy of high school students attending school within a one-to-one computing environment.

1. What differences in self-efficacy toward computers and interest in computer science are there between females and males within a one-to-one computing environment in South Dakota?

2. What differences are there between female and male students' use of computers in a one-to-one computing environment?

3. What differences in perceived computer anxiety are there between female and male students within a one-to-one computing environment?

4. To what extent does age of first exposure to computers impact the attitudes of

the male and female students toward computing self-efficacy?

5. To what extent does the number of computers (other than the one-to-one initiative issued computer) already present in the home make a difference in the attitudes of the male and female students toward computing self-efficacy?

6. What is the relationship between parental encouragement to work with computers and the students' overall computer self-efficacy?

7. What differences are there between male and female students' parental encouragement for the student to work with computers and pursue careers in computing science?

Review of Selected Literature

Prior to research design, an extensive review of the literature and research associated with the specific factors addressed by the research questions regarding gender differences within one-to-one computing environments was undertaken. A comprehensive review of literature following Maxwell's (2005) guide to relevancy was followed for this literature review. Specific attention was given to research which addressed computing self-efficacy, parental involvement efforts, and studies that focused on students in the middle- and secondary-grade levels. Previous research articles and information was retrieved from numerous sources including Educational Resources Information Center (ERIC), *Resources in Education (RIE), Proquest* database, and *Dissertation Abstracts International (DAI)* obtained from the Karl E. Mundt Library on the campus of Dakota State University in Madison, South Dakota and the I. D. Weeks Library on the campus of the University of South Dakota in Vermillion. The style and formatting of this dissertation follow the *Publication Manual of the American*

Psychological Association (2001), fifth edition.

Population

The population for this study consisted of South Dakota high school seniors who have been involved in a one-to-one computing environment for two or more years. In this non-experimental survey the researcher utilized a purposeful sampling strategy to gain a representational sample of South Dakota high school students involved in the one-to-one computing initiative with two or more years of experience with ubiquitous computer technologies infused into their classroom environment. An invitation to participate in the survey was sent to all high schools in South Dakota who have been involved with the one-to-one computing initiative for more than two years. The sample population included students in small, medium, and large school districts throughout the State of South Dakota as classified by the number of students using the South Dakota Athletic Association's classification formula. In the South Dakota Athletic Association's classification formula a large school or AA has more than 450 students, a medium school or A school has 90 to 449 students, and a small school or B school has less than 89 students in grades 9 through 12. Specific breakdown of the size classification of the schools who participated in the survey will be included in Chapter 4.

Instrumentation

The instrument utilized in this study was adapted with permission (Appendix A) from dissertation instruments utilized in the studies of Boitnott (2007) and Drobnis (2010). Questions from an instrument developed by Murphy, Coover, and Owen (1989), which aimed to measure perceptions on capability regarding specific computer-related knowledge and skills, also were utilized in the researcher's instrument to better measure computing self-efficacy.Each of the instruments adapted and utilized in this study were piloted and found to be appropriate for the intended purposes. In an effort to ensure validity, all three of the survey instruments were reviewed by an expert panel consisting of university research faculty and high school computer science teachers. Drobnis's (2007) instrument, the main instrument adapted in this study, was pilot tested with a class of 50 students and was found to report student sentiments accurately.

In an effort to measure any potential differences in self-efficacy toward computers and interest in computer science between the females and males within a one-to-one computing environment in South Dakota, questions were adapted with permission from Drobnis's (2010) Attitudes about Computers and Computer Science instrument. The researcher also utilized questions adapted with permission from Drobnis's (2010) instrument in an attempt to measure the extent to which the participation in the one-to-one computing initiative (ubiquitous natured technology) impacted students' attitudes and perceptions of computer anxiety experienced. Computer exposure and ownership were measured using questions adapted with permission from the Boitnott (2007) Attitudes about Computers and Computer Science instrument. The specific environmental factor of parental encouragement to work with computers was measured via questions adapted from Drobnis's (2010) Attitudes about Computers and Computer Science instrument.

The researcher-adapted instrument utilized in this study, the One-to-One Computing Survey (Appendix B), is comprised of five parts. Part I consists of basic demographic questions that define the proposed independent variables of the study including gender, ethnicity, age, and school size. Part II categorizes laptop computer usage in terms of hours spent per week performing various computing tasks. In Part III, respondents were asked to indicate the degree to which they believe a statement to be true using a four-point Likert type differential scale with 4 indicating strong agreement, 3, agreement, 2, disagreement, and 1, strong disagreement. The researcher intentionally chose a four-point scale given that the survey is relatively innocuous and is not likely to stimulate complex, emotional responses. In his research on improving survey research, Mangione (1995) found that if given a choice, many respondents will choose the middle. By eliminating the natural middle point, respondents are forced to make a definitive, reflective choice. Part IV focuses on the environmental factor of encouragement to work with computers. In part V the respondents are asked to input their answers to the questions. The last question provides an opportunity for the high school students to share additional information in their own words regarding their overall experiences within the one-to-one computing environment.

The survey questions aimed to collect information related to five identified categories directly related to the research questions guiding the study. On the One-to-one Computing Survey (Appendix B) questions five through 10 and 28 were utilized to answer research questions pertaining to computer usage; questions 11 through 14 and 16, 18, 19, 20, 21, and 22 measure computing self-efficacy; computing anxiety was addressed by question 14; questions 29 and 30 focus on early exposure and computers at home; questions 23 through 27 focus on the environmental factor of encouragement to work with computers; and questions 17 and 18 aimed to answer questions relating to computer science as a future career plan. Following committee approval and prior to data collection, an application to conduct the survey was submitted to and approved by the University of South Dakota Institutional Review Board (IRB).

Data Collection

The surveys were administered to high school seniors during home room, study hall, or prep time so that the survey will not impact the students' classroom instruction time or time outside of school. Participation in the survey was voluntary and the students had an unlimited amount of time to complete the survey. *Survey Monkey* ® was utilized to provide the students with a link to take the survey using their laptop computers. Anonymity was maintained as the students were not required to identify their name on the survey. The students who did not have the signed parental consent and/or student assent forms were asked to read or work on homework quietly while the other students completed the survey. The following materials were distributed to each of the individual schools who have participated in the one-to-one computing initiative for more than two years via email and postal mail; an introductory cover letter (Appendix B), parental consent form and student assent form (Appendix D), survey administration instructions (Appendix E), and copies of the survey instrument (Appendix C) in case the school chooses to administer the survey via paper and pencil instead of online at the provided *Survey Monkey* link. If the school wanted to do the survey using paper and pencil, they were instructed to contact the researcher to receive a self-addressed stamped envelope for the school to return the completed surveys.

The survey was sent to all South Dakota high schools who had participated in the one-to-one computing initiative for more than two years. The list of the 41 schools participating in the one-to-one computing initiative for more than two years and their corresponding contact information was obtained from the *Classroom Connections Directory* (as accessed via the South Dakota Department of Education website).

Data Analysis

The data from the survey was analyzed using descriptive and inferential statistics for the determined variables. The researcher organized the data from the surveys into five identified categories directly related to the research questions guiding the study: (1) Computing Self-Efficacy, (2) Computer Usage/Interest, (3) Perceived Computer Anxiety, (4) Computer Exposure/Ownership, and (5) Parental Encouragement. Each research question was addressed using defined statistical measures. Statistical analysis were performed to determine if differences exist in self-efficacy, interest, usage, perceived computer anxiety, exposure to computers, and parental encouragement between male and female high school students within a one-to-one computing environment. Composite means and standard deviation were computed for each of the five categories. The specific demographic data was grouped for statistical purposes and reported as frequencies and percentages to provide a general representation of the data. Gender was classified as male or female. The size of school was categorized by number of students in the school using the South Dakota Athletic Association's classification formula for major sports: AA - 450 or more students, A- 449 to 90 students or B - 89 students and below.

Mean scores in the areas of computing self-efficacy (research question one) computer usage (research question two), and perceived computer anxiety (research question two) of males and females were analyzed using *t* tests for independent means to determine if any statistical differences exist between male and female students. To answer research question one means for survey items 11 through 14 and 16, 18, 19, 20, 21, and 22 that relate to computer self-efficacy were compared by gender using a series of *t* tests for independent means. Means for survey items pertaining to computer usage (questions five through 10 and 28) were compared by gender using a series of *t* tests for independent means to answer research question two. To address and answer research question three means for survey item 15 relating to perceived computer anxiety were compared by gender using a series of *t* tests for independent means.

To answer research question four the researcher analyzed differences in self-efficacy (items 11 through 14 and 16, 18, 19, 20, 21, and 22) based on age of first computer exposure (item 29) for each gender using one-way analysis of variance (ANOVAs) for males and a different set of one-way ANOVAs for females. To analyze the impact of computer ownership and answer research question five the researcher investigated differences in self-efficacy (items 11 through 14 and 16, 18, 19, 20, 21, and 22) based on computer ownership (item 30) for each gender using a one-way ANOVAs for males and a different set of one-way ANOVAs for females.

The relationship between the specific environmental factor of encouragement for the students to work with computers (items 23 through 27) and the self-efficacy mean scores (items 11 through 14 and 16, 18, 19, 20, 21, and 22) was determined by computing Pearson product moment correlations to determine if a relationship exists and answer research question six. To answer research question seven means for survey items 25 and 26 were compared by gender using a series of *t* tests for independent means to determine if any differences exist between males and females. The .05 level of significance was used for all inferential statistics. The Statistical Package for the Social Sciences (SPSS, Version 19.0) was utilized for all data analyses and results will be presented in graph format.

CHAPTER 4

Findings

Chapter 4 provides results of data analyses and findings of this study. This study investigated specific gender differences related to computing self-efficacy, computer usage, and selected environmental factors influencing gender differences within high school seniors in a one-to-one computing environment in South Dakota. The primary purpose of the study was to examine self-efficacy regarding computers and computing science, and identify any potential differences in self-efficacy between male and female students who have participated in an ubiquitous classroom environment where each student had 24-hour access to personal tablet computers. Chapter 4 begins with information regarding the response rate and respondent demographics, followed by the results of data analysis for each specific research question. The following research questions were framed to guide this study and the data analysis:

1. What differences in self-efficacy toward computers and interest in computer science are there between females and males within a one-to-one computing environment in South Dakota?

2. What differences are there between female and male students' use of computers in a one-to-one computing environment?

3. What differences in perceived computer anxiety are there between female and male students within a one-to-one computing environment?

4. To what extent does age of first exposure to computers impact the attitudes of the male and female students toward computing self-efficacy?

5. To what extent does the number of computers (other than the one-to-one

initiative issued computer) already present in the home make a difference in the attitudes of the male and female students toward computing self-efficacy?

6. What is the relationship between parental encouragement to work with computers and the students' overall computer self-efficacy?

7. What differences are there between male and female students' parental encouragement for the student to work with computers and pursue careers in computing science?

Response Rate

An invitation to participate in the survey was sent to the 41 South Dakota high schools who have participated in the one-to-one computing initiative for more than two years. The population that the survey was sent to includes 20 small or B, 16 medium or A, and 5 large or AA school districts throughout the state of South Dakota as classified by the number of students using the South Dakota Athletic Association's classification formula. In the South Dakota Athletic Association's classification formula a large school (AA) has more than 450 students, a medium sized school (A) school has 90 to 449 students, and a small school or B school has fewer than 89 students in grades 9 through 12. The schools who participated in the survey included five B schools (25.0%), six A schools (37.5%), and one AA school (20.0%) for a total population of 267 students.

Demographic Data

Data regarding respondent gender are included in Table 1. Numbers of male and female students were very similar with female comprising slightly greater than half (50.2%) of the respondents.

Table 1

Gender Comparison of the Sample – High School Seniors

Gender	Frequency	Response Percentage
Male	133	49.8
Female	134	50.2
Total	267	100.0

Data regarding ethnic information of the respondents are included in Table 2. A vast majority of the respondents were White (91.4%) while Non-White respondents comprised 8.6% of the sample.

Table 2

Ethnic Comparison of the Sample – High School Seniors

Ethnicity	Frequency	Response Percentage
White	244	91.4
Non-White	23	8.6
Total	267	100.0

Student-reported grade point average data are displayed in Table 3. Of the student respondents surveyed 27.0% reported their grade point average to be between 3.00-3.49, while 25.5% reported 2.50 or below, 21.0% between 3.50-3.74, 19.1% between 2.50-2.99, and only 6.7% reported 3.75 or above.

Table 3

Grade Point Average Comparison of the Sample – High School Seniors

Grade Point Average	Frequency	Response Percentage
3.75+	18	6.7
3.50-3.74	56	21.6
3.00-3.49	74	27.7
2.50-2.99	51	19.1
2.50/-	68	25.5
Total	267	100.0

The size of the school of the student respondents is compared in Table 4. Over half (61.4%) of the respondents attended school in an A school, while 24.7% attended smaller B schools, and only 13.9% attended larger AA schools.

Table 4

School Size Comparison of the Sample – High School Seniors.

School Size	Frequency	Response Percentage
B	65	24.7
A	164	61.4
AA	37	13.9
Total	266	100.0

Findings

This section summarizes the findings and results of the data analysis for each specific research question.

Differences in Computing Self-Efficacy based on Gender

Results of data analysis regarding differences in self-efficacy toward computers and interest in computer science based on gender (research question one) are summarized in Table 5. Both males (M = 3.12) and females (M = 2.97) agreed that they felt they are good at using computers. The results indicated both males (M = 3.01) and females (M = 3.11) have similar comfort levels working with computers in their future career. Males (M = 3.07) and females (M = 3.18) responded similarly to their level of confidence using computers to organize information. Both males (M = 2.38) and females (M = 2.22) indicated similar, but slightly lower ratings regarding the understanding of the stages of data processing.

Table 5 also summarizes results of the independent *t* tests related to differences based on gender. From the results it appears that there were four significant differences based on gender. Males ($M = 3.08$) indicated significantly higher levels of enjoyment working with computers than the female ($M = 2.85$) group, $t(254) = 2.26$, $p = .024$. The males ($M = 2.03$) indicated significantly higher enjoyment levels in the area of programming than their females ($M = 1.61$) counterparts, $t(252) = 4.04$, $p = .000$. Males ($M = 2.53$) indicated significantly higher confidence levels troubleshooting computer problems than the female ($M = 2.20$) group, $t(253) = 2.98$, $p = .003$. Along similar lines, the males ($M = 2.28$) rated themselves much stronger in explaining why a program will or will not run on a computer than their female ($M = 2.22$) counterparts, $t(252) = 2.75$, $p = .006$.

Table 5

Differences in Computing Self-Efficacy based on Gender

	Means		*t*		
	Male	Female	value	*df*	*p*
I enjoy working with computers	3.08	2.85	2.26	254	.024*
I am good at using computers	3.12	2.97	1.80	254	.072
I often help my friends or family	2.85	2.93	-.85	252	.394
I enjoy programming	2.03	1.61	4.04	252	.000*
I help others with programming	1.90	1.72	1.61	253	.107
I am comfortable using computers in my future career	3.01	3.11	-1.05	252	.292
I troubleshoot computer problems	2.53	2.20	2.98	253	.003*
I feel confident using computers to organize information	3.07	3.18	-1.32	252	.187
I can explain why a program will or will not run on a computer	2.28	1.96	2.75	252	.006*
I understand the stages of data processing	2.38	2.22	1.38	253	.168

*significant difference at .05.

Differences in Computer Usage based on Student Gender

Table 6 summarizes the results of data analysis regarding differences in computer usage based on gender (research question two). The survey items aimed to quantify computer usage differences between male and female students specific to the number of hours spent using the laptop each week for the tasks of completing school work, entertainment purposes, playing computer games, social networking, surfing the Internet, creating products, and total amount of time spent using the computer outside of school. Females ($M = 2.41$) indicated they spend slightly more time using their computers for completing homework than the males ($M = 2.36$). The data indicated males ($M = 2.26$) utilized their computer slightly more for entertainment purposes than females ($M = 2.16$). Both males ($M = 1.98$) and females ($M = 1.98$) spent a similar amount of time using their computers to create things and for social networking applications (males $M = 2.02$; females $M = 2.07$).

From the results summarized in Table 6 it appears that there were two areas of significant differences in computer usage based on gender. Males ($M = 1.98$) indicated significantly higher usage of the computer for playing online games than their female ($M = 1.47$) counterparts, $t(264) = 5.33$, $p = .000$. The other significant difference was in the amount of time spent surfing the Internet with males ($M = 2.50$) indicating higher usage levels than the female ($M = 2.26$) group, $t(262) = 2.48$, $p = .014$.

Table 6

Differences in Computer Usage (hours spent) based on Student Gender

	Means		*t*		
	Male	Female	value	*df*	*p*
Completing homework	2.36	2.41	-.56	263	.574
Entertainment Purposes	2.26	2.16	.97	264	.331
Playing Online Games	1.98	1.47	5.33	264	.000*
Social Networking	2.02	2.07	-.50	264	.611
Suring the Internet	2.50	2.26	2.48	262	.014*
Creating things (products)	1.67	1.64	.35	264	.726
Total hours spent on computer outside of school	4.01	3.13	1.58	246	.115

*significant difference at .05.

Differences in Perceived Computer Anxiety based on Student Gender

The data analysis regarding perceived computer anxiety (research question three), which are summarized in Table 7, indicated that there was no significant difference between the perceived computer anxiety of the male and female respondents. The results showed males reported slightly higher levels of computer anxiety ($M = 1.60$) compared to their females ($M = 1.47$) counterparts, $t(254) = 1.34$, $p = .179$.

Table 7

Differences in Perceived Computer Anxiety based on Student Gender

	Means		*t*		
	Male	Female	value	*df*	*p*
I get nervous or experience computer anxiety	1.60	1.47	1.34	254	.179

*significant difference at .05.

Differences in Computing Self-Efficacy based on Age of First Exposure to Computers

Results of data analysis regarding differences in computing self-efficacy based on age of first exposure to computers (research question four) are summarized in Table 8 for the male respondents and Table 9 for the female respondents. Both the male ($M = 3.11$) and female ($M = 2.92$) groups who were first exposed to computers between the ages of one to six indicated they enjoyed working with computers. The results of the groups who were first exposed to computers between the ages of one to six indicated both males ($M = 3.21$) and females ($M = 3.11$) agreed that they are good at using computers. Males ($M = 3.26$) and females ($M = 3.30$) also responded similarly to their level of confidence using computers to organize information. Females ($M = 3.26$) indicated similar, but slightly higher comfort levels using computers in their future career than the males (*M* = 3.16).

One-way ANOVAs for males and a different set of one-way ANOVAs for females were utilized to analyze differences in computing self-efficacy based on age of first exposure to computers. Results of the one-way ANOVAs for the male respondent group, which are summarized in Table 8, indicated three significant differences in self-efficacy based on age of first computer exposure. Students first exposed to computers between the ages of one to six (*M* = 2.22) enjoyed computer programming significantly more than those exposed between the ages of seven to nine (*M* = 2.18) and age 10 or above (*M* = 1.77), $F(2, 121) = 3.37$, $p = .038$. Those first exposed to computers between the ages of one to six (*M* = 2.84) also indicated more confidence troubleshooting computer problems than the age seven to nine (*M* = 2.59) and age 10 or above (*M* = 2.27) groups, $F(2, 121) = 4.67$, $p = .011$. The final significant difference in the male respondent groups related to explaining why a program will or will not run a computer with the group who were first exposed to computers between the ages of one to six (*M* = 2.58) indicating higher levels of self-efficacy than the age seven to nine (*M* = 2.33) and 10 and above (*M* = 2.02) groups, $F(2, 122) = 3.76$, $p = .026$.

Results of the one-way ANOVAs for the female respondent group summarized in Table 9 indicated four significant differences in self-efficacy based on age of first computer exposure. Female students first exposed to computers between the ages of one to six (*M* = 3.11) felt they were good at using computers significantly more than those exposed between the ages of seven to nine (*M* = 3.06) and age 10 or above (*M* = 2.77), $F(2, 122) = 3.15$, $p = .046$. There was a significant difference in the comfort level using computers in future careers with the female students first exposed to computers between the ages of one to six ($M = 3.26$) indicating they are more comfortable than those exposed between the ages of seven to nine ($M = 3.27$) and age 10 or above ($M = 2.74$), $F(2, 122) = 7.21$, $p = .001$. The students first exposes between the ages of one to six ($M = 2.37$) felt more confident troubleshooting computers than the ages seven to nine ($M = 2.31$) and 10 or above ($M = 1.87$) groups, $F(2, 122) = 3.91$, $p = .022$. The final significant difference in the female respondents was in confidence using a computer to organize information with the students first exposed to computers between the ages one to six ($M = 3.30$) indicating higher confidence levels than the ages seven to nine ($M = 3.29$) and 10 or above ($M = 2.97$) groups, $F(2, 121) = 3.70$, $p = .027$.

Table 8

Differences in the Male Respondent's Computing Self-Efficacy based on Age of First Exposure to Computers

	Means				
	Age 1-6	Age 7-9	Age 10+	*F*	*p*
I enjoy working with computers	3.11	3.28	2.90	2.60	.078
I am good at using computers	3.21	3.23	2.96	2.34	.100
I often help my friends or family	3.00	2.84	2.73	1.08	.340
I enjoy programming	2.22	2.18	1.77	3.37	.038*
I help others with programming	2.13	1.85	1.73	1.90	.153
I am comfortable using computers in my future career	3.16	3.10	2.83	2.21	.113
I troubleshoot computer problems	2.84	2.59	2.27	4.67	.011*
I feel confident using computers to organize information	3.26	3.05	2.94	2.38	.096
I can explain why a program will or will not run on a computer	2.58	2.33	2.02	3.76	.026*
I understand the stages of data processing	2.61	2.38	2.21	1.99	.141

*significant difference at .05.

Table 9

Differences in the Female Respondent's Computing Self-Efficacy based on Age of First Exposure to Computers

	Means				
	Age 1-6	Age 7-9	Age 10+	*F*	*p*
I enjoy working with computers	2.92	2.98	2.67	1.81	.166
I am good at using computers	3.11	3.06	2.77	3.15	.046*
I often help my friends or family	3.13	2.90	2.79	2.37	.097
I enjoy programming	1.74	1.62	1.46	1.26	.285
I help others with programming	1.74	1.79	1.63	.42	.654
I am comfortable using computers in my future career	3.26	3.27	2.74	7.21	.001*
I troubleshoot computer problems	2.37	2.31	1.87	3.91	.022*
I feel confident using computers to organize information	3.30	3.29	2.97	3.70	.027*
I can explain why a program will or will not run on a computer	2.13	1.96	1.82	1.10	.333
I understand the stages of data processing	2.37	2.31	1.97	2.15	.121

*significant difference at .05.

Differences in Computing Self-Efficacy based on Computer Ownership

Results of the analysis regarding differences in computing self-efficacy based on the number of computers present in the home of the students (research question five) are summarized in Table 10 for the male respondent group and Table 11 for the female respondent group. The male (M = 3.37) group with three or more computers in their home indicated higher levels of enjoyment working with computers than the male (M = 2.84) group with zero to one computer and the male (M = 2.97) group with two computers. The data also indicated the male (M = 3.24) group with three or more computers in their home felt more comfortable using computers in their future careers than the male (M = 2.63) group with zero to one computer and the male (M = 3.17) group with two computers. The female groups with zero to one, two, and more than three computers present in their homes, respectively, responded similarly in all 10 of the computing self-efficacy items. The female (M = 2.95) group with three or more computers present in their home indicated similar levels of enjoyment working with computers as the female (M = 2.91) group with zero to one computer and slightly higher than the female (M = 2.71) group with two computers. The data also indicated the female (M = 3.19) group with three or more computers in their home felt as comfortable using computers in their future careers as the female (M = 3.18) group with zero to one computer and slightly more comfortable than the female (M = 2.92) group with two computers present in their home.

One-way ANOVAs for males and females were utilized to analyze differences in computing self-efficacy based on the number of computers present in the home of the students. Results of the one-way ANOVAs for the male respondent group summarized in

Table 10 indicated that the group with three or more computers present in their home rated themselves to have significantly higher computing self-efficacy in all 10 computing self-efficacy items. Although the female respondents with three or more computers present in their home indicated slightly higher self-efficacy scores, the results summarized in Table 11 indicated no items of significant difference in the 10 computing self-efficacy items based on the number of computers present in the students' homes.

Table 10

Differences in Male Respondent's Computing Self-Efficacy and Computer Ownership (Number of Computers Present in Home)

	Means				
	0-1 computers	2 computers	3+ computers	*F*	*p*
I enjoy working with computers	2.84	2.97	3.37	5.74	.004*
I am good at using computers	2.88	3.06	3.37	6.66	.002*
I often help my friends or family	2.52	2.74	3.20	8.31	.000*
I enjoy programming	1.60	1.97	2.44	11.36	.000*
I help others with programming	1.51	1.80	2.26	7.75	.001*
I am comfortable using computers in my future career	2.63	3.17	3.24	8.87	.000*
I troubleshoot computer problems	2.14	2.57	2.87	8.48	.000*
I feel confident using computers to organize information	2.74	3.11	3.33	8.92	.000*
I can explain why a program will or will not run on a computer	1.88	2.31	2.61	7.05	.001*
I understand the stages of data processing	2.02	2.29	2.76	8.32	.000*

*significant difference at .05.

Table 11

Differences in Female Respondent's Computing Self-Efficacy and Computer Ownership (Number of Computers Present in Home)

	Means				
	0-1 computers	2 computers	3+ computers	*F*	*p*
I enjoy working with computers	2.91	2.72	2.95	.98	.377
I am good at using computers	2.93	2.97	3.05	.33	.717
I often help my friends or family	2.89	2.97	2.95	.17	.839
I enjoy programming	1.43	1.62	1.78	2.26	.108
I help others with programming	1.50	1.82	1.88	2.85	.062
I am comfortable using computers in my future career	3.18	2.92	3.19	1.67	.192
I troubleshoot computer problems	2.09	2.23	2.26	.45	.639
I feel confident using computers to organize information	3.27	3.08	3.22	1.08	.341
I can explain why a program will or will not run on a computer	1.75	2.08	2.10	1.94	.147
I understand the stages of data processing	2.09	2.33	2.26	.76	.469

*significant difference at .05.

Differences in Parental Encouragement to Work with Computers and Computing Self-Efficacy

The relationships between the specific environmental factor of parental encouragement for the students to work with computers and student computer self-efficacy (research question six) are summarized in Table 12 (male respondents) and Table 13 (female respondents). Results of the Pearson product moment correlations for the male respondents indicated significant positive correlations between all 10 self-efficacy items and encouragement from the father. For the male group the data indicated the greatest positive correlations between encouragement from the father and enjoyment of programming (r = .632, p = .000), ability to troubleshoot computer problems (r = .415, p = .000), and ability to explain why a program will or will not run on a computer (r = .506, p = .000). The results for the male respondents also indicated significant positive correlations between all 10 self-efficacy items and encouragement from the mother. The highest positive correlations for the males between encouragement from the mother were found in the areas of enjoyment of programming (r = .567, p = .000), ability to explain why a program will or will not run on a computer (r = .548, p = .000), and ability to troubleshoot computer problems (r = .414, p = .000).

Results of the Pearson product moment correlations for the female respondents only indicated three significant positive correlations between encouragement from the father and computing self-efficacy. The data from the female group indicated the greatest positive correlations between encouragement from the father and enjoyment of programming (r = .455, p = .000), ability to explain why a program will or will not run on a computer (r = .278, p = .002), and ability to help others with programming (r = .273, *p* = .002). The results of the female respondents indicated the mother's encouragement had a strong positive correlation in eight out of the 10 computing self-efficacy items. The highest positive correlations for the females between encouragement from the mother were found in the areas of enjoyment of programming ($r = .376$, $p = .000$), ability to explain why a program will or will not run on a computer ($r = .365$, $p = .000$), and understanding of the stages of data processing ($r = .339$, $p = .000$).

Table 12

Differences in Parental Encouragement of the Male Respondents to Work with Computers and Computing Self-Efficacy

	Encouragement from Father	Encouragement from Mother
I enjoy working with computers	r = .298** p = .001	r = .306** p = .001
I am good at using computers	r = .379** p = .001	r = .388** p = .000
I often help my friends or family	r = .374** p = .000	r = .353** p = .000
I enjoy programming	r = .632** p = .000	r = .567** p = .000
I help others with programming	r = .451** p = .000	r = .332** p = .000
I am comfortable using computers in my future career	r = .250** p = .005	r = .295** p = .001
I troubleshoot computer problems	r = .415* p = .000	r = .414** p = .000
I feel confident using computers to organize information	r = .260** p = .003	r = .276** p = .002
I can explain why a program will or will not run on a computer	r = .506** p = .000	r = .548** p = .000
I understand the stages of data processing	r = .466** p = .000	r = .461** p = .000

**significant correlation at .01.
*significant correlation at .05.

Table 13

Differences in Parental Encouragement of the Female Respondents to Work with Computers and Computing Self-Efficacy

	Encouragement from Father	Encouragement from Mother
I enjoy working with computers	*r* = .150 *p* = .094	*r* = .177* *p* = .050
I am good at using computers	*r* = .103 *p* = .001	*r* = .201* *p* = .036
I often help my friends or family	*r* = .170 *p* = .000	*r* = .264** *p* = .003
I enjoy programming	*r* = .455 *p* = .000	*r* = .376** *p* = .000
I help others with programming	*r* = .273** *p* = .002	*r* = .277** *p* = .002
I am comfortable using computers in my future career	*r* = .095 *p* = .290	*r* = .171 *p* = .058
I troubleshoot computer problems	*r* = .208* *p* = .019	*r* = .277** *p* = .002
I feel confident using computers to organize information	*r* = .169 *p* = .060	*r* = .240** *p* = .007
I can explain why a program will or will not run on a computer	*r* = .278** *p* = .002	*r* = .365** *p* = .000
I understand the stages of data processing	*r* = .247** *p* = .005	*r* = .339** *p* = .000

**significant correlation at .01.
*significant correlation at .05.

Differences in Parental Encouragement to work with Computers based on Student Gender

Table 14 summarizes differences between male and female students' parental encouragement to work with computers and pursue careers in computing science (research question seven). The data analysis indicated that there was a significant difference between the male and female groups in their father's encouragement to work with computers and pursue careers in computing science with the males ($M = 1.78$) reporting significant higher levels of encouragement than their female ($M = 1.49$) counterparts, $t(250) = 2.85$, $p = .005$. There also was a significant difference in the encouragement to work with computers and pursue a career in computer science received from the mother with males ($M = 1.81$) again indicating they received more encouragement than the female ($M = 1.51$) group, $t(247) = 2.90$, $p = .004$.

Table 14

Differences in Parental Encouragement to work with Computers based on Student Gender

	Means		*t*		
	Male	Female	Value	*df*	*p*
Encouragement from Father	1.78	1.49	2.85	250	.005*
Encouragement from Mother	1.81	1.51	2.90	247	.004*

*significant difference at .05.

Summary

Chapter 4 has presented the results of the data analyses and findings of this study regarding specific gender differences related to computing self-efficacy, computer usage, and selected environmental factors influencing gender differences within high school seniors in a one-to-one computing environment in South Dakota. Chapter 5 presents a summary of the study along with the researcher's conclusions, discussion of the conclusions, and recommendations for practice and further research.

CHAPTER 5

Summary, Conclusions, Discussion, and Recommendations

This final chapter of the study includes four sections. The summary section provides a summary of the review of literature, an overview of the study's purpose and guiding researching questions, along with a brief summary of the research methodology and findings. The next two sections present the conclusions and discussion of the conclusions drawn from the findings. The fourth and final section of the chapter includes recommendations for practice and further research.

Summary

Purpose

This study investigated specific gender differences related to computing self-efficacy, computer usage, and selected environmental factors influencing gender differences within high schools seniors in a one-to-one computing environment in South Dakota. The primary purpose of the study was to examine self-efficacy regarding computers and computing science, and identify any potential differences in self-efficacy between male and female students who have been involved in a ubiquitous classroom environment where each student had 24-hour access to personal tablet computers.

The following research questions were framed to guide this study and the data analysis:

1. What differences in self-efficacy toward computers and interest in computer science are there between females and males within a one-to-one computing environment in South Dakota?

2. What differences are there between female and male students' use of computers

in a one-to-one computing environment?

3. What differences in perceived computer anxiety are there between female and male students within a one-to-one computing environment?

4. To what extent does age of first exposure to computers impact the attitudes of the male and female students toward computing self-efficacy?

5. To what extent does the number of computers (other than the one-to-one initiative issued computer) already present in the home make a difference in the attitudes of the male and female students toward computing self-efficacy?

6. What is the relationship between parental encouragement to work with computers and the students' overall computer self-efficacy?

7. What differences are there between male and female students' parental encouragement for the student to work with computers and pursue careers in computing science?

Literature Review

In today's technologically rich world there is no doubt that computers and technology are not only infused into daily life, but in today's workplace, the top three occupations with the fastest employment growth are computer science, computer engineering, and system analysts (Lanius, 2006). In their synthesis of research regarding the gender digital divide, Cooper and Weaver (2003) reported that women are unrepresented in their use and ownership of computers, take fewer technology classes, are far less likely to graduate college with degrees in informational technology fields, and are less likely to enroll in postgraduate technology fields. Previous research regarding the gender gap in technology and computing science has identified a number of complex, interacting factors potentially contributing to the gender gap in the areas of science, math, technology, and engineering: effects of environment (family influence, neighborhood, peers, and educational influences/policy), cultural context, and experiences or training (Halpern et al., 2007).

According to the United States Department of Education (2006), "almost 100% of public schools in the United States had access to the Internet and the rate at which schools have been purchasing computers has been climbing at greater than 10% per year, with purchases running at approximately $1 billion annually" (Cooper & Weaver, 2003, pp. 1-2). One-to-one computing initiatives continue to grow at a rapidly advancing rate throughout the United States and previous research on successful one-to-one laptop programs have identified the following positive outcomes: independent learning, responsible ownership, a sense of pride, better organization skills, increased self-efficacy, in-depth learning, more student interest, and increased technological proficiency (Blumenfeld, Kempler, & Krajcik, 2006; Heynderickx, 2005; Mouza, 2006; Rockman, 2004; Warschauer, 2006; Windschitl & Sahl, 2002).

Research indicates that males and females use computers in different ways at different levels of sophistication including general access to computers (Solvberg, 2002; Young, 2000), general use at home (Solvberg, 2002, Volman, Eck, Heemskerk, & Kuiper, 2005), playing games (Colley & Comber, 2003; Miller, Schweingruber, & Brandenburg, 2001; Volman et al., 2005), using the Internet and e-mail (Jackson, Ervin, Gardner, & Schmitt, 2001; Miller, Schweingruber & Brandenburg., 2001) and using a variety of application software (Colley & Comber, 2003; Volman et al., 2005).

Parental influence and encouragement, along with the social context has an impact on females' attitudes, thoughts, and behavior regarding computing technologies and pursuit of computing-related professions (Cooper & Weaver, 2003; Davis-Kean, 2007; Fouad, 2007; Shashaani, 1994). Previous research has indicated the existence of parents' gender-based stereotypes as they relate to computers as parents indicate a greater willingness to spend more money for computers for their sons than for their daughters and also provide more encouragement and support to their son's computer involvement (Fouad, 2008; Kekelis, Ancheta, Wepsic, & Countryman, 2004; Littleton, Light, Joiner, Messer, & Barnes, 1998; Shashaani, 1997). Studies conducted by Fouad (2008) at the University of Wisconsin-Milwaukee and Pamela Davis-Kean (2007) University of Michigan Institute for Social Research also indicated that the self-confidence instilled by parents and teachers impacts interests and girls' long-term interests are shaped more by environmental factors, including the influence of parents and teachers in the self-confidence building process.

Research has indicated that motivation and self-efficacy influences performance and choices within various situations or in other words, high personal academic expectations predict subsequent performance, course enrollment, and occupational choice (Bandura, 1997; Pajares, 1996; Schunk & Pajares, 2002). Previous research has indicated that boys and girls use computers differently and have very different attitudes toward the technology (American Association of University Women, 2000; Comber, Colley, Hargreaves, & Dorn, 1997; Margolis & Fisher, 2002). Research on early exposure has indicated that early play and other childhood experiences influence brain development, social interests, and the progression through developmental stages (Gurian & Stevens, 2004; Margolis & Fisher, 2002), and early exposure to computers has an impact on a students' motivation toward computers (Papastergiou, 2008). Computer anxiety can impact an individual's overall attitude towards computing technologies (Brosnan, 1998; Chua, Chen & Wong, 1999) and as a result of the anxiety females often acquire a diminished sense of computing self-efficacy (Cooper & Weaver, 2003). Research supports the theory that self-efficacy influences performance and choices within various situations or in other words high personal academic expectations predict subsequent performance, course enrollment, and occupational choice (Bandura, 1997; Pajares, 1996; Schunk & Pajares, 2002). Recent theories suggest that females generally perceive themselves as less capable than males in advanced computer skills and that they lack an interest in computer-related tasks because of the structural, social, and psychological setting of the "computer world" (American Association of University Women Educational Foundation, 2000; Margolis & Fisher, 2002; Xie & Shauman, 2003).

Methodology

The population for this study consisted of South Dakota high school seniors who have been involved in a one-to-one computing environment for two or more years. Students surveyed consisted on an almost equal number of males (49.8%) and females (50.2%). A vast majority of the respondents reported being White (91.4%). Over one-fourth (27.0%) of the students reported their grade point average to be between 3.00-3.49, while 25.5% reported 2.50 or less, 21.0% between 3.50-3.74, 19.1% between 2.50-2.99, and only 6.7% reported 3.75 or above. Over half (61.4%) of the respondents attended school in an A school, while 24.7% attended smaller B schools and only 13.9% attended larger AA schools.

The instrument utilized in this study was adapted with permission (Appendix A) from dissertation instruments utilized in the studies of Boitnott (2007) and Drobnis (2010). Questions from an instrument developed by Murphy, Coover, and Owen (1989), which aimed to measure perceptions on capability regarding specific computer-related knowledge and skills, also were utilized in the researcher's instrument to better measure computing self-efficacy. The researcher-adapted instrument utilized in this study, the One-to-One Computing Survey (Appendix B), is comprised of five parts. Part I consists of basic demographic questions that define the proposed independent variables of the study including gender, ethnicity, age, and school size. Part II categorizes laptop computer usage in terms of hours spent per week performing various computing tasks. In Part III, respondents were asked to indicate the degree to which they believe a statement to be true using a four-point Likert type differential scale. Part IV focuses on the environmental factor of encouragement to work with computers. In Part V the respondents were asked to input their answers to the questions. The individual survey questions aimed to collect information related to five identified categories directly related to the research questions guiding the study. The data from the survey were analyzed using descriptive and inferential statistics for the determined variables.

Summary of Findings

The data analysis indicated no significant difference between the males and females in confidence using computers (males M = 3.12, females M = 2.97); confidence helping family and friends with computers or computer programming (males M = 2.85, females M = 2.93); comfort levels working with computers in their future career (males M = 3.01, females M = 3.11); confidence using computers to organize information (males M = 3.07, females M = 3.18); and understanding of the stages of data processing (males

M = 2.38, females *M* = 2.22). There were four significant differences in computing self-efficacy items between males and females. Males (*M* = 3.08) enjoyed working with computers to a significant greater degree than females (*M* = 2.85), *t*(254) = 2.26, *p* = .024. The males (*M* = 2.03) indicated significantly higher enjoyment levels in the area of programming than their females (*M* = 1.61) counterparts, *t*(252) = 4.04, *p* = .000. Males (*M* = 2.53) indicated significantly higher confident levels troubleshooting computer problems than the female (*M* = 2.20) group, *t*(253) = 2.98, *p* = .003. The males (*M* = 2.28) also rated themselves much stronger in explaining why a program will or will not run on a computer than their female (*M* = 2.22) counterparts, *t*(252) = 2.75, *p* = .006.

The data analysis of computer usage indicated males (*M* = 1.98) utilized their computer for playing online games more than their female (*M* = 1.47) counterparts, *t*(264) = 5.33, *p* = .000. Although there was not a significant difference, the data analysis regarding perceived computer anxiety indicated that males (*M* = 1.60) reported slightly higher levels of computer anxiety compared to their females (*M* = 1.47) counterparts, *t*(254) = 1.34, *p* = .179. The data analysis also indicated the students with early exposure to computers rated themselves higher in the 10 self-efficacy survey items. Results of the one-way ANOVAs for the male respondent group indicated that all 10 items had significant differences in self-efficacy based on the number of computers present in the students' homes with three or more being the greatest in each comparison. Although the female respondents with three or more computers present in their home indicated slightly higher self-efficacy scores the results indicated no items of significant difference in the 10 computing self-efficacy items based on the number of computers present in the students' homes.

Results of the Pearson product moment correlations for the male respondents indicated significant positive correlations between all 10 self-efficacy items and encouragement from both the father and the mother. The results for the female respondents indicated only three significant positive correlations between encouragement from the father and computing self-efficacy. However the results of the female respondents indicated eight out of the 10 self-efficacy items to have significant positive correlations to encouragement from the mother. Results of a *t* test, analyzing difference in parental encouragement, indicated that there was a significant difference between the male and female groups in their father's encouragement to work with computers and pursue careers in computing science with the males (M = 1.78) reporting higher levels of encouragement than their female (M = 1.49) counterparts, $t(250) = 2.85$, $p = .005$. There also was a significant difference in the encouragement to work with computers and pursue a career in computer science received from the mother with males (M = 1.81) again indicating they received more encouragement than the female (M = 1.51) group, $t(247) = 2.90$, $p = .004$.

Conclusions

The following conclusions are drawn from the data analysis and findings of the study:

1. Overall, there is very little difference in perceived computing self-efficacy between male and female students.

2. Male and female students utilize computers similarly, but males spend more time using their computers to play online games. Both groups commonly use their computers equally to complete homework, entertain themselves, participate in social

networks, and create other products.

3. Males and females do not perceive much difference in their own computer anxiety.

4. Early exposure to computers (the age at which the student is first exposed to a computer) impacts computing self-efficacy. In essence the younger the age of exposure the higher the students' computing self-efficacy.

5. The number of computers present in the home (computer ownership) has a different impact on males and females. While males' self-efficacy is related to the number of computers present in the house, females show no such relationship.

6. Parental encouragement to work with computers contributes positively to both male and female students' computing self-efficacy. There appears to be a strong relationship between parental encouragement to work with computers and students' pursuit of a career in computing science and their computing self-efficacy. The influence of both parents is important for males, whereas females appear to be more influenced by their mother's encouragement.

7. Males receive more encouragement than females from both their mothers and their fathers to work with computers and pursue a career in a computing science field. Both mothers and fathers encourage their sons to work with computers more than their daughters.

Discussion

Previous research has indicated that computer anxiety can greatly impact computing self-efficacy, interest, usage, and overall performance (Bozionelos, 2001; Cooper & Weaver, 2003) and that females experience higher levels of anxiety when working with computers (Beyer, 2008; Thatcher & Perrewe, 2002). The results of the data analysis appeared to indicate that computer anxiety is equally impacting both males and females in this study. Previous research has indicated that boys and girls use computers differently and have very different attitudes and interest levels toward the technology (American Association of University Women, 2000; Comber, Colley, Hargreaves, & Dorn, 1997; Margolis & Fisher, 2002). The study found the attitudes and interests towards technology to be similar for both males and females; however, there were three areas of significant difference in reported interest. The areas where the male students indicated significantly higher levels of interest were in computer programming, confidence in troubleshooting computer problems, and explaining why a program will or will not run on a computer. This study found that although there was a discrepancy between the male and female groups in the interests in the programming and troubleshooting areas, the reported self-efficacy ratings were not different. Previous research has indicated that although many young women may possess the qualifications and skill to pursue a career in a technology-related field, they simply chose to do something better correlated to their interest based on personal choice (Committee on Maximizing the Potential of Women in Academic Science and Engineering and the National Academy of Sciences, 2007; Rosenbloom, Ash, Dupont, & Coder, 2008). If it is interest, not skill or self-efficacy that leads females to their career choice, this could help explain the discrepancy in the overall number of males and females in computing science fields.

Previous research suggested that although females and males are equally inclined to use computers as a tool for general access tasks such as surfing the Web and entertainment, fewer females are involved in the research, design, and other more sophisticated computing-based tasks (American Association of University Women, 2000; Margolis & Fisher, 2002). The results of this study indicated that male and female high school seniors involved in the one-to-one computing environment utilized computers similarly and both groups commonly use their computers equally to complete homework, entertain themselves, participate in social networks, and create other products. The only significant difference found in terms of computer usage in this study was that boys indicated spending more time playing online computing games. This is consistent with previous research on gender and computing-based video games which indicated boys were more interested in playing computing-based video games and it was more socially acceptable for boys to play computer games (American Association of University Women, 2000; Cooper & Weaver, 2003; Funk & Buchman, 2006).

Previous research has indicated that computer anxiety can greatly impact computing self-efficacy, interest, usage, and overall performance (Bozionelos, 2001; Cooper & Weaver, 2003). Research also has suggested that females experience higher levels of anxiety when working with computers (Beyer, 2008; Thatcher & Perrewe, 2002). In the current study it would appear that computer anxiety is equally impacting both males and females. The computing self-efficacy ratings also show no differences based on gender, therefore it may be fair to say that any computer anxiety experienced impacted the computing self-efficacy of males and females equally.

In this study it was found that early exposure to computers (the age at which the student is first exposed to a computer) and the presence of a computer in the student's home (ownership) impacted computing self-efficacy. In essence, the younger the age of first exposure and the more computers present in the home, the higher the student's computing self-efficacy. This is consistent with previous research which also indicated that computing self-efficacy improved when students had ownership access to a computer at home (Cuban, 2001) or a high level of early exposure to computers (Margolis & Fisher, 2002; Papastergiou, 2008).

The environmental factor of parental encouragement is vital in the development of computing self-efficacy and interest to pursue a career in a computing science field. The data analysis in this study indicated parental encouragement to work with computers contributed positively to both male and female students' reported computing self-efficacy. This is consistent with previous research which indicated that parental encouragement plays a vital role in the development of interests, attitudes, and overall computing self-efficacy (Cooper & Weaver, 2003; Spencer, Steele, & Quinn, 1999). In the study males' self-efficacy was positive impacted by the encouragement of both their mothers and fathers. Although the females were impacted by both parents, they were more strongly impacted by their mother's encouragement to work with computers and pursue careers in computing science-related fields. It would appear that one of the greatest influences toward working with computers for females is the mother.

Males received more encouragement than females from both their mothers and their fathers to work with computers and pursue a career in a computing science field. Both mothers and fathers encouraged their sons to work with computers more than their daughters. This is consistent with numerous previous studies on parental encouragement that have indicated that parents encourage their sons more than their daughters to work with computers and pursue computing science-related activities (Davis-Kean, 2007; Fouad, 2008; Kekelis, Ancheta, Wepsic, & Countryman, 2004; Shashaani, 1997).

Recommendations for Practice

Based on the review of literature as well as the conclusions of this study, the following recommendations for practice have emerged:

1. It is important for administrators and teachers to adequately understand the nature of any existing computing gender divide. Computing self-efficacy, computer usage levels, and perceived computing anxiety levels should be considered in any technology integrated learning environment as previous research has indicated that the learning environment should match an individual's learning style to enhance student learning outcomes (Baldwin & Sabry, 2003; Crawford, 2008; Leigle & Janicki, 2006).

2. School leaders should push for and support the integration of technology into the classroom and give access opportunities to all students. Various access barriers exist for different groups of students, therefore public schools should aim to be an equalizer and provide opportunities for all students regardless of socio-economic status, gender, ability, or cultural beliefs. Schools must aim to provide early exposure/access opportunities to all students in an effort to help increase the overall computing comfort level and self-efficacy of the students served. Within the rapidly advancing, technologically-rich world we live in, school districts are aiming to harness and employ the power of technology through a one-to-one computing initiatives. Schools must aim to utilize technology as a tool to help provide an engaging, authentic, real-world learning environment for students living in the informational age. This changing nature of technologically enhanced classrooms warrants the teachers to embrace the role of

facilitator instead of previous methods of information disseminator. It will take strong school leadership and dedicated teachers to continue to facilitate 21st century learning outcomes and ensure the computing gender gap continues to become less prevalent.

3. Parents should consider the impact of their influence on their children and provide equal amounts of encouragement to work with computers to both male and female children. Schools should aim to encourage parents to encourage both their male and female children to work with computers and consider pursuing computing science careers.

4. School boards and school leaders should look for ways to provide adequate computing access to all students. It appears plausible to assume that one-to-one initiatives can help equalize the playing field as not only does it help eliminate the gaps between wealthy and poor student, but it also ensures that all students have access to a laptop computer regardless of gender. It is important for school leaders, school boards, and policy makers to consider one-to-one computing initiatives as one of the potential solutions towards providing equal access for all students, which may help bridge any potential digital divide or gender divide between groups of students.

Recommendations for Further Study

In today's age of exponential change and technological advancement, awareness of the gender gap in technology and computer science-related fields is crucial, but further research must be done in an effort to better understand the complex interacting factors contributing to the computing gender gap. The following themes for further research have been identified as a result of the findings of this study.

1. Dramatic changes in learning environments using ubiquitous computing are

taking place in schools across the nation. This study focused more on perceived attitudes and gender differences of students using computers for academic purposes and does not fully take into account or analyze the dramatic changes in computer usage and social networking applications. The study does not directly investigate the potential impact social networking has on computer usage levels, attitudes, and computing self-efficacy; therefore, the researcher recognizes this as a recommendation for future research.

2. This study was delimited to a sample of South Dakota high school seniors who have engaged in a one-to-one computing environment throughout their high school careers (two or more years) and in order to generalize the data a replication study in other states implementing one-to-one computing initiatives could be conducted.

3. This study was delimited by the focused investigation of the specific environmental factors of computer access, exposure, and parental encouragement to work with computers. The researcher recognizes the complex nature of the computing gender gap and numerous complex, interacting factors potentially contributing to the computing gender gap and differences that may not have all been addressed in the scope of this study. Future research regarding other factors potentially contributing to the computing gender divide is recommended.

4. Although there was not a significant difference between groups, the males showed slightly higher levels of perceived computing anxiety than females. Future research is recommended regarding factors contributing to increasing or decreasing levels computing anxiety in male and female students.

5. Additional research could be conducted to investigate the concept of computer ownership. The research could analyze whether or not the students involved in the one-

to-one program perceive their school issued laptop to be theirs and assume an ownership role of it.

6. This study could be extended and examine the specific learning outcomes of students in terms of student test results within the one-to-one computing school in an effort to quantify the impact of the technology on student learning. The study could be expanded to compare students within one-to-one computing environments and students in schools who are not involved in a one-to-one computing initiative. The window for future research is open regarding the long-term effects of one-to-one computing initiatives on both teachers and students.

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Appendix A

Permission to Adapt Instruments (Email Messages)

Drobnis Permission Email Message

RE: Question - Survey Instrument

Drobnis, Ann W. [AWDrobnis@fcps.edu]

Sent: Thursday, August 05, 2010 8:41 PM

To: Nelson, Mathew

Dear Matt,

Thank you for contacting me. You are more than welcome to use my instrument. I will mention that I wound up aggregating some of the questions for reporting purposes and also acknowledge that if I was to do it again, I would make it a true five scale answer scale without the N/A - instead it would be neither agree nor disagree. Some of this is mentioned in my dissertation. Feel free to email if you have any questions.

-Ann

From: Mathew.Nelson@k12.sd.us [Mathew.Nelson@k12.sd.us]
Sent: Thursday, August 05, 2010 4:36 PM
To: Drobnis, Ann W.
Subject: Question - Survey Instrument

Dear Ann W. Drobnis,
My name is Mathew Nelson and I am a graduate student at the University of South Dakota. I am currently in the beginning stages of my dissertation, which will aim to analyze student self efficacy of high school seniors within 1 to 1 computing environments in South Dakota. In the process of locating an appropriate instrument I came across the instrument you utilized in your dissertation. I am writing to ask for your permission to adapt a couple of your instrument questions to meet my specific research question and then use it within my study. When you have time if you would respond either way I would greatly appreciate it.
Thanks much for your time and take care,
Mathew Nelson

Mathew Nelson
6th Grade Science
Head Girls Basketball Coach
Madison Middle School

Boitnott Permission Email Message

RE: Question - Survey Instrument

kboitnott@veanea.org [kboitnott@veanea.org]

Sent: Thursday, August 05, 2010 7:48 PM

To: Nelson, Mathew

Matthew,

I will be honored for you to adapt any question that you may need.

Kitty

Kitty Boitnott, Ph.D., NBCT
President
Virginia Education Association
Phone: 804-648-5801
Cell: 804-873-8303

-----Original Message-----
From: Mathew.Nelson@k12.sd.us [mailto:Mathew.Nelson@k12.sd.us]
Sent: Thu 8/5/2010 4:35 PM
To: Boitnott, Kitty [VA]
Subject: Question - Survey Instrument

Dear Kitty Jean Boitnott,
My name is Mathew Nelson and I am a graduate student at the University of South Dakota. I am currently in the beginning stages of my dissertation, which will aim to analyze student self efficacy of high school seniors within 1 to 1 computing environments in South Dakota. In the process of locating an appropriate instrument I came across the instrument you utilized in your dissertation. I am writing to ask for your permission to adapt a couple of your instrument questions to meet my specific research question and then use it within my study.
When you have time if you would respond either way I would greatly appreciate it.
Thanks much for your time and take care,
Mathew Nelson

Mathew Nelson
6th Grade Science
Head Girls Basketball Coach
Madison Middle School

Appendix B

Introductory Letter to School Administrators

Dear South Dakota Administrator,

I would like to formally invite you to participate in a study entitled "Self-Efficacy and Gender Differences of High School Seniors Within One-to-One Computing Environments in South Dakota," which is being conducted by Mathew Nelson for a doctoral dissertation at the University of South Dakota. The primary focus of this study is to examine self-efficacy toward computers by investigating specific gender differences of high school seniors within one-to-one computing environments relating to computer usage within a one-to-one computing environment and analyze the specific environmental factors of computer access, exposure, and parental encouragement to work with computers. The survey can be administered to your **high school seniors** during home room, study hall, or prep time so that the survey will not impact the students' classroom instruction time or time outside of school. Participation in the survey is voluntary and will take roughly 15 minutes for the students to complete. *Survey Monkey* will be utilized for the survey. Anonymity will be maintained as all responses are treated confidentially and responses will not be individually identified. Your senior students' opinions are highly regarded and the information you provide will be valuable in developing a better understanding of any potential gender differences in computing technologies.

Attached to this letter you will find the following materials: parental consent and student assent form which must be signed by the parent in order for the student to complete the study; survey administration instructions for the administering teacher; and the ***Survey Monkey*** **link** for the students to click on to complete the survey. If you do choose to have your students complete survey using paper and pencil, please contact me to receive a self-addressed stamped envelope for you to return the completed surveys. The survey completion deadline is **May 5th, 2011**. If you have any questions regarding your rights as a human subject, please contact the Human Subjects Committee through The University of South Dakota Research Compliance Office at (605) 677-6184. The results of the research will be published in my dissertation, and I would be glad to share the results with you if interested. Please feel free to contact me if you have any questions regarding the survey.

Sincerely,

Mathew Nelson
Doctoral Candidate
Mathew.Nelson@k12.sd.us

Dr. Mark Baron, Advisor
Educational Administration
University of South Dakota

This study is being conducted under direction and approval of the student's doctoral committee.

Appendix C

Survey Instrument

One-to-One High School Computing Survey

Please take a few minutes to complete this survey about your computer use. No one will see your answers but the researcher—your information remains confidential. Be as honest and accurate as you can. Your answers will help us better understand the dynamics of laptop computer use among South Dakota High School students.

Part I - About You:

(Please check one answer in each column):

1. Gender:	2. High School Enrollment:	3. High School GPA:	4. Ethnicity:
❑ White	❑ AA - 450 or more students	❑ 3.75 - 4.00	❑ White
❑ Non-White	❑ A - 449 to 90 students	❑ 3.50 - 3.74	❑ Non-White
	❑ B - 89 or below	❑ 3.00 - 3.49	
		❑ 2.50 - 2.99	
		❑ Less than 2.50	

Part II - Laptop Use

On average, how much do you use your laptop each week to do the following?

	Never	1 to 8 hours per week	9 to 18 hours per week	More than 18 hours per week
5. Completing School Work (assignments, research, papers).	❑	❑	❑	❑
6. Entertainment Purposes (movies, music, shopping).	❑	❑	❑	❑
7. Playing Computer Games (online games).	❑	❑	❑	❑
8. Social Networking (Facebook, Twitter, blogging).	❑	❑	❑	❑
9. Surf the Internet.	❑	❑	❑	❑
10. Create things (programs, web pages, art, graphics)	❑	❑	❑	❑

Part III - How you feel about computer use?	Disagree a lot	Disagree a little	Agree	Agree a lot
11. I enjoy working with computers.	❑	❑	❑	❑
12. I am good at using computers.	❑	❑	❑	❑
13. I often help my friends or family in teaching them how to use a computer.	❑	❑	❑	❑

14. I enjoy programming in a computer science language.	❑	❑	❑	❑
15. I get nervous when working with computers or experience computer anxiety.	❑	❑	❑	❑
16. I often help my friends or family in teaching them how to program using a computer science language.	❑	❑	❑	❑
17. After high school, I plan to pursue a degree in a computer science related field.	❑	❑	❑	❑
18. I am comfortable frequently using computers in my future career.	❑	❑	❑	❑
19. I feel confident troubleshooting computer problems.	❑	❑	❑	❑
20. I feel confident using the computer to organize information.	❑	❑	❑	❑
21. I feel confident explaining why a program (software) will or will not run on a given computer.	❑	❑	❑	❑
22. I understand the stages of data processing: input, processing, output.	❑	❑	❑	❑

Part IV - Your encouragement with computer use?	**Disagree a lot**	**Disagree a little**	**Agree**	**Agree a lot**
23. My mother is a competent computer user.	❑	❑	❑	❑
24. My father is a competent computer user.	❑	❑	❑	❑
25. My father encouraged me to work with computers and pursue a career in a Computer Science-related field.	❑	❑	❑	❑
26. My mother encouraged me to work with computers and pursue a career in a Computer Science-related field.	❑	❑	❑	❑
27. My teachers encouraged me to work with computers and pursue a career in a Computer Science-related field.	❑	❑	❑	❑

Part V - Your experience with computer use?

Please respond to the following questions using the space provided.

28. On average how many hours per day do you use your computer outside of school?

29. At what age did you first work or play using a computer?

30. Not including your school issued computer, how many computers do you have access to at home?

31. Please share any additional information about your overall experience with your laptop computer. Do you feel as if your laptop has helped you learn and gain confidence using computers? Why or why not?

Appendix D

Parent Consent and Student Assent Forms

April 2011

Dear Parent or Guardian and High School Senior,

I am **asking permission and student assent for your child to be in a research study** “Self-Efficacy and Gender Differences of High School Seniors Within One-to-one Computing Environments in South Dakota,” which is being conducted by Mathew Nelson for a doctoral dissertation at the University of South Dakota. The survey will be administered to during home room, study hall, or prep time so that the survey will not impact the students’ classroom instruction time or time outside of school. Participation in the survey is voluntary and will take roughly 15 minutes for the students to complete. **Your child's responses will remain anonymous and confidential.** No reports about the study will contain your child's name. **Taking part is voluntary** and the survey will not be a part of your child's record and will not affect his/her grade in any way.

Parents/guardians please sign and date the permission form at the bottom of this letter and students please sign and date the student assent for to participate in this study. After you have signed this form please send it back to school with your child.

Your opinions are highly regarded and the information you provide will be valuable in developing a better understanding of any potential gender differences in computing technologies. If you have any questions regarding rights as a human subject, please contact the Human Subjects Committee through The University of South Dakota Research Compliance Office at (605) 677-6184. This study is being conducted under direction and approval of the student’s doctoral committee. Please feel free to contact me at Mathew.Nelson@k12.sd.us if you have any questions regarding the survey.

Sincerely,

Mathew Nelson
Doctoral Candidate
Mathew.Nelson@k12.sd.us

Dr. Mark Baron, Advisor
Educational Administration
University of South Dakota

Parent Consent

I give permission for my child ____

(Child's Name)

to participate in the research study on one-to-one computing.

Parent/Guardian Signature ______________________________ (Date) _________

Student Assent

The study has been explained to me and I would like to take part in the study by completing the survey.

Student's Signature:_______________________________________ Date_________

Appendix E

Survey Administration Directions

Directions for Administering the Survey

We are asking you and other seniors in South Dakota to complete a brief survey about your computing experiences throughout the past two years. This survey is part of his doctoral dissertation at the University of South Dakota. Participation in the survey is voluntary and will take roughly 15 minutes to complete. Your responses will remain confidential, but please answer the questions honestly. The survey is composed of five parts, be sure to read the directions for each section before completing it. We value and appreciate your opinions you provide in the survey.

Your teacher will project or write the web address (link) that will be used to access the survey on the board. The web address is: http://www.surveymonkey.com/s/1to1

Thank you!