DISSERTATION

VIDEO GAME PLAY AND COMPUTER SELF-EFFICACY: COLLEGE STUDENTS IN COMPUTER RELATED AND NON COMPUTER RELATED DISCIPLINES

Submitted by

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School of Education

In partial fulfillment of the requirements

For the Degree of Doctor of Philosophy

Colorado State University

Fort Collins, Colorado

Fall 2009

COLORADO STATE UNIVERSITY

November 2, 2009

WE HEREBY RECOMMEND THAT THE DISSERTATION PREPARED UNDER OUR SUPERVISION BY ALLETA CAROL BUSE ENTITLED "VIDEO GAME PLAY AND COMPUTER SELF-EFFICACY: COLLEGE STUDENTS IN COMPUTER RELATED AND NON COMPUTER RELATED DISCIPLINES" BE ACCEPTED AS FULFILLING IN PART REQUIREMENTS FOR THE DEGREE OF DOCTOR OF PHILOSOPHY.

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ABSTRACT OF DISSERTATION

VIDEO GAME PLAY AND COMPUTER SELF-EFFICACY: COLLEGE STUDENTS IN COMPUTER RELATED AND NON COMPUTER RELATED DISCIPLINES

The purpose of this dissertation was to gain new insight into video game playing, exposure, and preferences as well as perceptions toward success with computers between students in computer related disciplines (CRD) and students in non computer related disciplines (NCRD). Perceptions toward success with computers were measured using a slightly modified *Computer Self-Efficacy* scale developed by Cassidy and Eachus with questions about video game play exposure and preference included. Surveys were administered to 379 undergraduate students in college classrooms at five universities in the south region of the United States. Students were separated into four groups--CRD female, CRD male, NCRD female, NCRD male--based upon responses to gender and academic major. Comparisons were made among the groups using chi-square and independent *t*-tests. Logistic regressions were used to examine the predictive influence of Computer Self-Efficacy (CSE), Video Game Play (VGP), exposure, and preferences on the major group (CRD/NCRD).

Computer self-efficacy, based on Bandura's self-efficacy theory, is defined as one's perception of computer ability. The overall theory states that increased CSE may lead to increased use of computers. Studies have related CSE to increased enrollments in

CRD and have shown males to have higher CSE scores than females. This study challenged the outcomes of previous studies by finding no significant differences in male and female CSE scores. Academic discipline, not gender, was found to be related to CSE.

Video games were defined and assumptions that VGP enhances CSE and influences enrollments in CRD were examined. This study found a significantly larger percentage of males than females played video games with no significant differences in CSE scores between males and females. And, no significant differences were found in VGP between students in CRD and NCRD. VGP was not found to explain males in CRD. VGP explained CRD for females; however no VGP exposure or preference variables explained CRD for females.

It appears that video game play has little influence on students being in computer related disciplines. Efforts to recruit students into computer related disciplines through the use of video game play may not be as effective as other recruitment approaches.

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ACKNOWLEDGEMENTS

This dissertation would not have been possible without the patient guidance of my advisor, Carole Makela. Your support, advice, encouragement, insight, feedback, edits, and attention to detail helped me enormously. I feel honored to have worked with you and I'll take the lessons you taught me to other projects in my career and life. I am also very grateful for the encouragement and valuable input provided from other members of my committee: Don Quick, Karen Kaminski, and Sonia Kreidenweiss. I also want to thank my brothers, Philip Camp and Jonathan Camp, who encouraged me throughout the entire process and provided me with much of my sample by introducing me to faculty at their respective institutions. Thank you to Jill Charbonneau and Paul Shelton for taking the time to distribute and collect many surveys and making sure the surveys got back to me. A word of thanks goes to my department chair, Duane Lintner, and fellow employees at Amarillo College. Thank you for working around my schedule and being flexible with me. Special thanks to my division chair, the late Bob Sloger, for introducing me to the program at CSU and encouraging me to "keep at it". To my husband, Mark, thank you for your love, patience, and being both Mom and Dad to our daughter. Your spiritual, emotional, and material support has been both humbling and inspiring. Thank you for modeling true servant leadership in our family. And to my daughter, Cara, who doesn't have a memory of her mom without doctoral work. I look forward to making up lost time with you. I love you both dearly.

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CHAPTER I – INTRODUCTION

According to the Entertainment Software Association (2009), 68 percent of Americans have played video games the past 12 years. Many of these players expect to play as much or more in the future compared to how much they played when they were surveyed. And 63 percent of parents believe that video game playing is a constructive activity for their children (Entertainment Software Association, 2009). Correspondingly, a new discipline, ludology, the study of video games and game research has emerged with emphasis on purpose, experience, educational value, and motivating factors of game play (Lowenstein, 2004). Approaches to study of video games have focused on either player motivation and engagement or player addiction and aggression (Bensley & Van Eenwik, 2001). Integration of computer games into school curriculum through the use of "edutainment" is another emerging field with various organizations investigating the link between learning and video gaming (Carlson, 2003).

Studies show that skills can be learned while playing video games (Kirriemuir & McFarlane, 2004). Many skills developed in playing video games are the same skills required by many academic disciplines (Beedle, 2004; Dickey, 2005; Garris, Ahlers, & Driskell, 2002; Gee, 2003, 2005; Herz, 2002). Critical and logical reasoning (Castell & Jenson, 2004; Garris et al., 2002), problem solving (Dawes & Dumbleton, 2001), spatial visualization (De Lisi & Cammerano, 1996; De Lisi & McGillicuddy-De Lisi, 2002; Green & Bavelier, 2003), technical skills (Garris et al., 2002; Pillay, 2003), and

communication skills (Herz, 2002) can be developed during video game play and are skills required by various academic disciplines and occupations.

Other studies focus on differences between males and females in their game playing behavior and attitudes (Feng, 2006; Kafai, 1999; Lucas & Sherry, 2004; Van Eck, 2006). The focus of these studies tends to be on the reasons why women do not play video games or play less than men. Researchers have categorized these reasons into sociological factors and biological factors (Aquila, 2006). Sociological factors include girls' lack of video game access and exposure (Calvert, Rideout, Woolard, Barr, & Strouse, 2005; Colley & Comber, 2003), gender stereotyping (Colley & Comber, 2003), lack of video game content that appeals to girls (Kafia, 1999; Lucas & Sherry, 2004; Rabasca, 2000), and the overly sexual or passive role of women characters in many video games (Castronova, 2003; Ivory, 2006; Rabasco, 2000). Biological factors include play differences between boys and girls. Generally, boys prefer spatial challenges and competition, features of many video games; while girls prefer logic challenges and cooperation (Kafia, 1999; Lucas & Sherry, 2004; Rabasca 2000).

Relating video game play (VGP) to choosing a major in technology or engineering fields seems to be a natural and logical tendency. Teachers and researchers have employed the use of computer and video games to encourage interest in these disciplines (Gorriz & Medina, 2000, Van Eck, 2006), and some schools are increasing offerings of gaming courses to entice students into their technology programs (Mangan, 2005). For example, Northern Virginia Community College has created a computer lab devoted to video games in the hopes of enticing students into their information technology programs (Young, 2007).

Some studies have shown an association between playing video games and employment in high-tech jobs (Cassell & Jenkins, 1998; Margolis & Fisher, 2002). Microsoft® is partnering with colleges and universities through their Microsoft Research External Research and Programming (MSR ER&P) to help attract students to computer science. Among Microsoft®'s strategies are donating resources and funding for the development of game-centric courses to participating colleges and universities (Microsoft PressPass, 2005).

Some have blamed the video gaming industry for lack of women pursuing careers in technology or have suggested video gaming become more "girl-friendly" to attract girls into the technology and engineering related fields (AAUW Educational Foundation Commission on Technology, Gender, and Teacher Education, 2000; Carlson, 2006; Gorriz & Medina, 2000; Jenkins, Klopper, Squire, & Tan, 2003; Kirriemuir, 2002; Mangan, 2005, Natale, 2002). Sandra Calvert, psychologist and professor at Georgetown University and director of the University's Children in Media Project, stated "We are inadvertently steering girls away from computer technology. Video games are children's gateways to computers. And ultimately this has ramifications for the kinds of careers people choose" (quoted in Rabasca, 2000, p.1). Additionally the AAUW Educational Foundation Commission suggested in its 2000 report "... many girls are turned off to technology at an early age by violent computer games that are geared toward boys" (2000, p.1).

Still others have challenged the assumption that VGP is related to majoring in technology or engineering by stating it does not account for the number of people who play video games but do not go into technology or engineering fields, or people who are

in technology or engineering careers but do not play video games (Aquila, 2006; Elliott, Adams, & Bruckman, 2002).

Purpose of the Study

Several studies have shown playing video games can help develop certain skills used in technology or engineering disciplines. However, the relationship between playing video games and choosing a career in technology or engineering is largely assumed. Indeed, enrollment in computer related disciplines has shrunk (Chabrow, 2004; Freuenheim, 2004; Kessler, 2005; National Center for Education Statistics, 2005, 2008) while the number of people who play or have played video games has increased (Entertainment Software Association, 2009). This decline in students majoring in computer related disciplines is alarming. The purpose of this study is to gain new insight into video game playing, exposure, and preferences as well as perceptions toward success with computers between students in computer related disciplines (CRD) and students in non computer related disciplines (NCRD).

Several factors affect major choice. Understanding video game playing of students in CRD and in NCRD may provide insights into the relationship between playing video games and being in CRD. Being a preliminary study to more in-depth explorations into the reasons why individuals play video games and select their majors, it may provide insight into the possibility of using of video games for recruiting students into computer related fields.

Research Questions

This study explored video game playing activity of college students in CRD and NCRD and their perceptions about computer ability. To determine perceptions about

computer ability, computer self-efficacy (CSE) was measured using Cassidy and Eachus' (n.d.) *Computer Self-Efficacy* survey. Computer self-efficacy refers to one's belief in his or her ability to use a computer (Cassidy & Eachus, 2002).

Primary Question

To what extent do perceptions of computer ability, video game playing, exposure, and preferences explain females being in CRD and males being in CRD?

Hypotheses and Supporting Questions

H1. There is no difference between female students in CRD and female students in NCRD in

1. CSE scores
2. VGP
3. starting age
4. length of time in years they have played video games
5. average hours per week they have played video games
6. single or multi-player preferences
7. challenge level of video games played
8. video game modifications

H2. There is no difference between male students in CRD and male students in NCRD in the above eight variables (same as studied for females).

H3. Perceptions of computer ability, video game playing, exposure, and preferences do not explain females' choice of CRD or males' choice of CRD.

In addition to the hypotheses, the following research questions were asked to gain a more thorough understanding of players' preferences including video game genre, platforms, and types of modifications made to the game.

R1. What gaming genre do

1. females in CRD play?, females in NCRD play?

2. males in CRD play?, males in NCRD play?

R2. What gaming platform do

1. females in CRD play?, females in NCRD play?

2. males in CRD play?, males in NCRD play?

R3. What kinds of modifications to video games do

1. females in CRD make?, females in NCRD make?

2. males in CRD make?, males in NCRD make?

Delimitations and Assumptions

The sample was taken from five universities in the south region of the United States. Universities in different regions of the United States may produce different findings. Additionally, findings may vary depending upon what NCRDs are present in the study. A wide variety of NCRDs exist with varying required skill sets, topics of study, and computer usage. Differing combinations of majors making up the NCRDs may result in different findings.

This study investigated the playing of video games for entertainment purposes. Although many video games played for entertainment may also be used for education (i.e., Sims™) video games played primarily for educational purposes were excluded from this study.

Various factors influence major choice. This study was an exploration into differences in video gaming and CSE between students in CRDs and NCRDs. It was not a study into the factors influencing major choice.

Definition of Terms

Computer Related Disciplines (CRD)

For this study, computer related disciplines are those disciplines that study the computer. Student's identified major was classified as CRD if the major involved the computer as a primary object of study. Examples of majors classified as CRD include computer science, computer engineering, and information science, systems, or technology. Appendix A contains a list of majors that were represented in the study.

Non-Computer Related Disciplines (NCRD)

For this study, non-computer related disciplines are those disciplines in which the computer is not the primary object of study. However, they may incorporate the use of computers within courses. Student's identified major (Appendix A) was classified as NCRD if it did not qualify to be in the CRD group. Undecided majors were classified as NCRD.

Computer Self-Efficacy (CSE)

Coined by Compeau and Higgins (1995) and taken from Bandura's self-efficacy theory (1977), computer self-efficacy refers to "the judgment of one's capability to use a computer" (Compeau & Higgins., p. 192). The overall theory states people having high levels of computer self-efficacy are more likely to use computers; where people with lower levels of computer self-efficacy are less likely to use computers (Compeau &

Higgins, 1995). This construct was used to describe perceptions toward success with computers.

Video Game

Although the definition of a video game may be debatable, for this study a video game is one played on a computer whether that computer is a console, personal computer (PC), or a handheld device as a cell phone. Characteristics that are unique to video games include global participation, quick responses, realistic graphics and animations, inclusion of popular media such as film or music, and the ability to modify (mod) or change a game's design. Generally play is within a set boundary or world and within a given set of rules.

Gaming Genres

Video games can be categorized into genres based upon their characteristics; however, the line distinguishing one genre from another has become somewhat blurred. Some games fall into more than one genre yet have a primary characteristic. The list of genres continues to change. There are, however, some overall genres that are commonly recognized by gamers. The particular list for this study was developed from searching gaming websites, talking to gamers, and playing video games. Other genre lists can be found in various gaming books and websites.

Adventure. Adventure games require the player to explore a virtual world, solve puzzles, and interact with virtual people in the virtual world. Typically they are slow moving and rely on the player's skill level for game advancement. They may have an engaging story or mystery to keep the player interested and engaged.

Casual. These games are smaller, arcade-like games that require little skill to play and little time to learn. Many of these games can be downloaded from the Internet for little to no cost. These games are frequently played as single-player on PCs as a way to pass time.

First-Person Shooter (FPS). The FPS game is viewed and played from the player's perspective. The player aims and fires weapons at oncoming targets. Speed is critical. These games tend to have violence as their theme and have been the source of some controversy over the years.

Music-based. These types of games have music as the main focus. For example, a music-based game may include a rock band and the player plays along on a guitar or dances to a predetermined pattern.

Role-Playing Games (RPGs). The player assumes an avatar (character or role). These games focus on character building, exploration, and adventure. The avatar can advance in characteristics, skills, abilities, or gain special equipment based upon overcoming challenges built into the game. Most RPGs have a fully developed fictional setting. Many times these games are simultaneously played online with thousands of players and are known as Massively Multiplayer Online Role-Playing Games (MMORPG).

Side-scroller. In this genre, game characters move left, right, up, or down. This genre is popular with handheld systems. Players must navigate characters through various obstacles by having them run left or right and jump up or down.

Simulations. Currently, two overall types of simulations exist. One is skill-based such as flying or driving type simulations. In simulations effort is made to simulate the

real world experience so players can get the look and feel of performing the skill without its risks. Other simulations have players create environments or worlds such as a city, neighborhood, theme park, or zoo. Decisions are made by the player as to how to keep game characters happy, well-fed, rested, or amused while managing a limited amount of resources.

Sports. Many types of sports, such as golf or football, can be played as a video game. These games can be played alone or with others.

Strategy. Strategy games are based on the player's decision making skill instead of random chance or luck. These games are generally played with others and players must strategize to overcome their opponent. Examples include war games and online chess games.

Gaming Mods

Mods are short for modifications made to the design or interface of a video game. Modifications usually require the gamer to write scripts or macros to enhance, redesign, or add to the developer's original game.

Gaming Platform

Gaming platforms are devices upon which a game is played. These devices can range from large arcade gaming machines to cell phones. They are changing rapidly with new platforms being developed every year. This study focuses on three categories.

Console. Consoles are gaming devices that usually connect to a television making it the output screen for the game. Input controllers come in a variety of interfaces from a joystick to a dance pad. Games must be purchased for a particular console brand. Popular consoles include PlayStation® 2 and 3, XBOX 360™, and Wii™.

Handheld. These gaming devices are small, portable, and relatively inexpensive. They come with a small screen and some type of input such as arrow keys or a stylus. Games must be purchased for a particular handheld device brand. Popular devices include Nintendo® DS™, PSP®, and Game Boy Advance.

PCs. Personal computers are popular gaming devices. The monitor is the output screen and a mouse and keyboard are usual input devices. Gaming with personal computers has the most potential for enhancing technical skills because of the extra skills needed to install and configure the video game, save and load game settings, and use the keyboard and mouse.

Researcher's Perspective

I have been teaching computer science and information systems since 1983 when I was a graduate student in business computer science at Texas A&M University. I have seen the steady decline in the total number of students majoring in computer science and the decline of women computer science majors in particular. In fact, many times I teach classes that have no women enrollees. I started playing video games in the mid 1990s. The few women I teach also play video games. The idea came to me to study this area when I noticed that my niece plays video games. She told me she wanted to be an engineer when she grew up. I made the connection between her and my female students. If video gaming could motivate girls to study technology or engineering, perhaps it could be used in recruiting. I found this connection between playing video games and majoring in technology or engineering made by others as well. After all, playing video games requires quite a bit of technical knowledge, especially if one plays massively multiplayer online role-playing games (MMORPG).

However, as I started researching this area, I had some questions. For example, the number of video gamers is on the rise. Why is the number of computer science and technology majors declining? The number of women gamers continues to increase. Why are there still so few women in CRD? Additionally, I started coming across girl gamers who were art history, English, and government majors. I started questioning the assumption I and others had made and continue to make concerning VGP and majoring in computer related fields. Therefore, I decided to explore the relationships among VGP, CSE, and CRD.

Summary

The number of students interested in CRD has been on the decline. Some universities and schools are using video games to help recruit into these disciplines. This study explored whether CSE, VGF, exposure, and preferences explain males' and females' choices of CRD, comparing women in CRD to women in NCRD and men in CRD to men in NCRD.

CHAPTER II – LITERATURE REVIEW

An abundance of literature, both theoretical and empirical, can be found in the general field of academic major choice. Indeed, an abundance of both theoretical and empirical literature can be found in the more specialized topics of gender, choice, and science, technology, engineering, and math (STEM) disciplines. Much of the literature centers on reasons why women choose not to participate in STEM disciplines. Various factors and their influence on major choice have been studied. These include factors related directly to the student such as outcome expectations (Peterson, 2006), perceived talent, abilities, aptitudes, skills, personality types, and interest (Abdul-Rahim, 2001; Bandura, Barbaranelli, Caprara, & Pastorelli, 2001), family socio-economic status and values (Eccles, 1987, 1994), ethnicity, gender, parental influence (Eccles, 1994), and pre-college preparation (Coperthwaite & Knight, 1995). External factors have, also, been found to influence women's career choice including college culture (Petrides, 1996), availability of role models (Bandura et al., 2001; Coperthwaite & Knight, 1995), and quality of instruction (Peterson, 2006). Although each of these factors are important aspects of career choice and can influence that choice, this study focuses on one aspect of career choice--self-efficacy. In particular, computer self-efficacy is reviewed with regard to students majoring in computer related disciplines, such as computer science, computer engineering, or information systems.

This review contains two overall parts. The first part begins with an overview of Bandura's self-efficacy theory and continues with the application of self-efficacy theory

to career choice. Gender differences in self-efficacy expectations with regard to career choice are highlighted. Next, computer self-efficacy is defined and literature relating computer self-efficacy to career choices in the computer related disciplines (CRD) are reviewed. The second part of the review defines video games and discusses some educational features of video games. Next is a discussion of studies focusing on computer related skills developed or enhanced through playing video games. Chapter two concludes with an overview of gender differences in video game play.

Self-Efficacy Theory

Bandura's self-efficacy theory focuses on aspects of social cognition theory that view motivation and thinking as influencing self-concept. Bandura developed this theory as part of his overall theory on social learning. According to Bandura, "Perceived self-efficacy is an individual's self-knowledge of his or her ability to initiate necessary steps to achieve situation-specific goals" (1986, p. 72). Self-efficacy influences an individual's choice of behavior, his or her performance quality, and persistence in a particular behavior (Bandura, 1994). Bandura contrasts individuals with weak self-efficacy to those with strong self-efficacy. Table 1 summarizes these contrasts. People with weak self-efficacy tend to avoid tasks perceived as being too difficult. They do not set high goals and are not committed to the goals that they set. They focus on their own inability rather than what is needed to be successful, give up quickly, are easily stressed, and tend to suffer from depression. Individuals with strong self-efficacy have strong beliefs in their abilities to handle difficult tasks and view difficult tasks as challenges, thereby enhancing accomplishment and well-being. They set challenging goals and are strongly committed to these goals. They increase their effort, instead of giving up, when the task becomes

more difficult (Bandura, 1994). Self-efficacy is one of the major predictors of behavior, eclipsing actual capabilities and prior accomplishments (Bandura, 1977; Bandura et al., 2001).

Table 1

Weak self-efficacy vs. Strong self-efficacy

Perceptions or Actions	Weak Self-Efficacy	Strong Self-Efficacy
Perceptions	easily stressed	sense of accomplishment
	suffers from depression	sense of well-being
	focuses on inability	focuses on success
Choice of behavior	avoids difficult tasks	enjoys difficult tasks
	does not set high goals	sets high goals
	not committed to goals	strongly committed to goals
Persistence	gives up quickly	increases effort with difficult tasks

Bandura defined four overall sources of self-efficacy. These sources are used by people in forming their judgments about themselves. In order of strength, they are "performance accomplishments, vicarious experiences, verbal persuasion, and physiological states" (1977, p. 195). Performance accomplishments include previous successes and failures. The more a person succeeds, the stronger is that person's self-efficacy. The reverse also applies. The more a person fails, the weaker is self-efficacy. Vicarious experiences refer to watching others as they succeed in a task. Although the individual is not performing the task, her self-efficacy can be affected by what she learns from watching others succeed or fail. In social persuasion, individuals are brought to higher self-efficacy through coaching, encouragement, and feedback of others. Finally,

physiological and emotional states can impact self-efficacy. For example, anxiety over a certain task can negatively influence self-efficacy regarding that task (Bandura, 1977).

Self-efficacy is a strong predictor of interest and achievement (Bandura, 1993; Bandura, Barbaranelli, Caprara, & Pastorelli, 1996). As such, Bandura and others have studied its influence on career choice (Bandura et al., 2001; Betz & Hackett, 1981, 1983; Branch & Lichtenberg, 1987; Lent, Brown, & Larkin, 1987; Matsui, Ikeda, & Ohnishi, 1989; Wheeler, 1983).

Betz and Hackett (1981) were the first to study self-efficacy in relation to career options and choice and found that self-efficacy influenced career choice and interest. The purpose of their study was to explore self-efficacy as a variable influencing career behavior in general and particularly with women. Two areas were examined--the relationships between "Occupationally related self-efficacy expectations" (p. 400) and perceptions of career options and gender differences in self-efficacy with regard to educational requirements and job duty abilities in what Betz and Hackett define as traditional and non-traditional occupations. They defined traditional occupations as those made up of 70 percent or more women, based on statistics reported by the U.S. Women's Bureau in 1975. Non-traditional occupations were those made up of 30 percent or less women. Twenty common and well-understood occupations were identified and designated as traditional or non-traditional--10 traditional and 10 non-traditional occupations. For each of the 20 occupations, the following measures were constructed and analyzed: self-efficacy with regard to educational requirements and job duties; confidence or the strength of self-efficacy with regard to educational requirements and job duties; interest in the occupations; and the extent that occupation had been

considered. Questionnaires were distributed to 134 female and 101 male undergraduate students in introductory psychology. Gender differences in self-efficacy existed with regard to occupational choice. Males had equivalent self-efficacy scores for both traditional and non-traditional occupations, where females had higher self-efficacy scores for traditional occupations and lower self-efficacy scores for non-traditional occupations. Additionally, females' self-efficacy scores varied depending on the type of occupation within the non-traditional occupations. For example, females scored lower in self-efficacy with regard to engineering and math, but higher for medicine and law. Self-efficacy was, also, found to be related to interest in traditional and non-traditional occupations as well as the number and type of career options considered (Betz & Hackett, 1981).

Other studies replicated and confirmed Betz and Hackett's findings (Branch & Lichtenberg, 1987; Lent, Brown, & Larkin, 1987; Matsui, Ikeda, & Ohnishi, 1989; Wheeler, 1983). Lent et al.'s 1987 study used multiple regression analysis to compare the strength of three variables, self-efficacy, interest congruence, and consequence thinking, in predicting perceived career options, academic achievement, and persistence for students in science and engineering fields. They studied questionnaire responses from 105 students, 75 males and 30 females, and found self-efficacy to be the strongest predictor of the three variables in academic achievement and persistence. Additionally, it was found to be the most efficient predictor of perceived career options within the science and engineering fields (Lent et al., 1987).

Branch and Lichtenberg's study (1987) re-examined and expanded on Betz and Hackett's 1981 study. In addition to studying the usefulness of self-efficacy as a

predictor of career choice and the gender differences in occupational self-efficacy within "traditionally male" and "traditionally female" fields, they examined the relationships among self-efficacy, self-esteem, academic ability, and careers considered. Students, 46 males and 69 females, enrolled in career exploration classes were selected as participants. They were given the Perceived Traditionality Questionnaire for identifying the category, "traditionally male" or "traditionally female", of an occupation selected from the *Strong-Campbell Interest Inventory* (SCII). This approach to categorizing occupations was in contrast to Betz and Hackett's (1981) of using the 1975 U.S. Women's Bureau statistics to categorize occupations. It was felt by the authors that an individual's perception of whether an occupation was "traditionally male" or "traditionally female" may have an influence on his or her response. For each occupation, 10-point Likert scales were used to measure career self-efficacy for educational requirements, career self-efficacy for job duties, and careers considered. Participants also completed the SCII to measure career interests and the *Rosenberg Self-Esteem Scale* (RSE) to measure self-esteem. ACT scores were obtained to measure academic ability. All questionnaires, except for the SCII, were administered during career exploration classes. The SCII was administered by the university's counseling center. This study validated self-efficacy as a predictor for career choice. No significant difference in self-efficacy existed for males between "traditionally male" and "traditionally female" occupations; however, females scored higher in self-efficacy for "traditionally female" occupations and lower for "traditionally male" occupations. This finding supported Betz and Hackett's 1981 study. Interestingly, women who scored high with "traditionally male" occupations also scored low in self-efficacy with "traditionally female" occupations suggesting an inverse relationship. ACT math

scores were inversely related to self-efficacy scores for "traditionally female" occupations, but positively related for "traditionally male" occupations. Math ability was positively related to self-efficacy in "traditionally male" occupations such as engineering and math (Branch & Lichtenberg, 1987).

In a 1983 study, Betz and Hackett expanded their 1981 study finding that math self-efficacy was significantly related to choosing a major within the science fields and males had significantly stronger math self-efficacy beliefs than females. Additionally, females scored lower in math self-efficacy if the math was within "male" fields, i.e. engineering; however, if math was within "female" fields, i.e. nursing, they scored higher in math self-efficacy (Betz & Hackett, 1983). Matsui, Ikeda, and Ohnishi's study replicated Betz and Hackett's 1981 findings and found females scored low in math confidence (1989).

In 2001, Bandura along with Babaranelli, Caprara, and Pastorelli studied children and their mothers in Italy. The purpose was to examine the influence of socioeconomic conditions, parental aspirations, self-efficacy, and academic achievement on career self-efficacy, considerations, and choices. They studied 272 children between 11 and 15 years of age along with their mothers and teachers. They measured children's perceived academic self-efficacy in mastering course work and regulating personal learning activities, social self-efficacy in participating in extracurricular group activities, and self-regulatory efficacy in resisting peer pressure to engage in high-risk activities as alcohol or drug use. No gender differences were found in overall self-efficacy; however, boys were found to have a higher efficacy for math and girls for language. Additionally, girls had higher efficacy for regulating their personal learning activities such as creating and

organizing their learning environment and motivating themselves to learn. As for career self-efficacy, boys had higher efficacy for science and technology, and girls for educational, health-related, and social service fields. Of the variables studied, self-efficacy was the strongest influencer on career self-efficacy. Socioeconomic status had no direct effect on career considerations except through its impact on mothers' aspirations for their children. Aspirations were found to be positively related to children's perceived academic, social and self-regulatory self-efficacy, but not directly to children's career considerations. Academic achievement was not found to influence career efficacy (Bandura et al., 2001).

Computer Self-Efficacy

Researchers have extended self-efficacy theory to specific domains, such as career self-efficacy, math self-efficacy, and computer self-efficacy. Computer self-efficacy (CSE) is defined by Compeau and Higgins as the "judgment of one's capability to use a computer" (1995, p.192). Based on self-efficacy theory, the overall theory states increased CSE may lead to increased use of computers. Like other self-efficacy theorists, Compeau and Higgins distinguish between single component skills versus using skills to solve problems or accomplish tasks, stating CSE refers to the latter rather than the former. For example, CSE refers to a person's beliefs in his or her ability to solve a problem using a computer rather than his or her belief that he or she can copy a file or bold some text. Compeau and Higgins tested their theory with over 1,000 managers and professionals, taking their sample from a subscription list of a Canadian business periodical. The sample, of which 83 percent were male, had an average age of 41 years and had educational backgrounds in business, science, arts, and social science. The

majority of respondents had backgrounds in business. CSE significantly influenced a person's expectations of outcomes in computer use, emotional reactions to using a computer, and actual usage of computers (Compeau & Higgins, 1995).

Studies have incorporated CSE in researching technology usage in workplace settings (Burkhardt & Brass, 1990; Compeau & Higgins, 1995; Harrison & Rainer, 1997) and in university settings (Langford & Reeves, 1998; Miura, 1987a). These studies found relationships between high CSE scores and increased levels of computer competency and use, whether at the office or at school. An underlying theme is that increased exposure to computer technology increases CSE (Cassidy & Eachus, 2002; Khorrami-Arani, 2001; Stephens & Shotick, 2002).

Early studies examining CSE in relationship to interest in and enrollment in computer related courses were by Miura (1987a) and Hill, Smith, and Mann (1987). Miura surveyed 368 students assessing their CSE, plans to enroll in a computer science course, perception of importance of having computer skills, and interest in computers. She found that CSE was positively related to computer science enrollment plans, with males having significantly higher CSE scores than females, and mastery experiences were the strongest predictor of CSE (Miura, 1987a). Likewise Hill et al. showed CSE was a significant predictor of intention to study computers. Other studies continue to support the findings that high CSE is positively related to interest in computer related courses (Goh, Ogan, Ahuja, Herring, & Robinson, 2007; Sam, Othman, & Nordin, 2005; Shaw & Giacquinta, 2000; Smith, 2002; Zhang & Espinoza, 1998).

Many studies focus on gender differences in CSE beliefs with males holding stronger CSE beliefs than females for reasons that computers are more "masculine" in

nature, males have more experience in using computers, and males have more encouragement from others to use computers (Busch, 1995; Cassidy & Eachus, 2002; Hill et al., 1987; Miura, 1987a). However, other studies contradict findings of gender differences showing males and females have equivalent CSE beliefs (Sam et al., 2005; Smith, 2001). Sam et al. found gender differences did not account for differences in CSE; however, the discipline of study did. Undergraduates in CRD had higher CSE beliefs than undergraduates in other disciplines (2005).

Lent, Brown, and Hackett (1994) expanded upon Betz and Hackett's (1981) study of self-efficacy and career choice by developing the Social Cognitive Career Theory (SCCT), a framework for understanding career interest, choice, and performance. The theory consists of four sources of self-efficacy identified by Bandura--mastery experiences, vicarious learning, social persuasion, and affective states--and self-efficacy beliefs, outcome expectations, and goals as well as interconnected paths of influence among these variables. Smith (2002) extended the SCCT to information technology. She used previous work in SCCT as applied to the mathematics domain in developing her instruments, using the Sources of Computer Self-Efficacy scale, the Technology Outcome Expectations scale, and the Information Technology Interest scale. In each of these scales, she replaced the word "mathematics" with "computer". She distributed the instruments to undergraduates in introductory computer applications courses. CSE and outcomes expectations were found to significantly predict interest in information technology. Of the four source variables of self-efficacy--mastery experiences, vicarious learning, social persuasion, and affective states--mastery experiences were the strongest predictor of interest in information technology (Smith, 2002). Mastery experiences,

according to Bandura, are based on personal and direct experiences and enable feelings of personal efficacy as they rely on one's effort and skill (Bandura, 1977; Dweck & Leggett, 1988). Video gaming may provide mastery experiences that influence CSE.

Video Games

Video or computer games are those games played on computers, televisions, hand-held game machines, or on consumer electronic devices such as cell phones (Kirriemuir, 2002). Video games provide visual images to one or more players, take input from one or more players, process input based upon a programmed set of game rules, and alter the video images based upon input and the programmed game rules (Kirriemuir, 2002; Kirriemuir & McFarlane, 2004). Key features of video games include fantasy, rules/goals, challenge, control, mystery, and sensory stimuli (Garris et al., 2002).

Linking video game playing to learning is becoming an area of focus for educators with many asserting the positive learning aspects of video gaming (Beedle, 2004; Garris et al., 2002; Gee, 2003, 2005). Some argue that even the first video game ever written, *Spacewar* in 1962, exhibited elements of learning with collaboration, social contexts, problem solving, and research as a means to an end (Herz, 2002). Games have evolved from *Pong* released in the early 1970s to Massively Multiplayer Online Role Playing Games (MMORPGs), which incorporate narrative, role playing, interaction, three dimensional spaces, and multiple players (Dickey, 2005; Gee, 2003, 2005). These attributes, along with the increasingly social aspect of video gaming, may provide opportunities for learning. Among the attributes of video games, this review focuses on four features that may encourage learning for the player: motivation, challenge, social, and experiential.

Motivation

Video games have the power to intrinsically motivate learning by giving the player control over the gaming environment as the player co-designs the game scenario (Downes, 2004; Gee, 2003) and by providing captivating and engaging settings for narrative, mystery, and fantasy (Garris et al., 2002). Flexibility of game design gives players the ability to select from a variety of activities, strategies, and styles. This flexibility allows players to use experiences to determine the next set of actions or make strategic decisions affecting game outcomes (Garris et al., 2002). Choices made by players change the game so it is different each time it is played (Beedle, 2004; Downes, 2004; Gee, 2003, 2005). Additionally, players have the flexibility of designing the game environment and determining characteristics and personalities of their playing roles (Beedle, 2004). Gee contrasts this to a typical school classroom in which the curriculum is determined without student input (2003). A good video game, on the other hand, allows the player to be a participant in the experience (Downes, 2004; Gee, 2003). This control and empowerment can increase motivation to be fully involved as a learner (Garris et al., 2002).

Another feature is the ability to modify or "mod" a game in a way not anticipated by the game's original designers. Mods can turn game playing into an educational opportunity, for example, by placing a game in a historical setting or using content from geography, archeology, chemistry, and other disciplines (Herz, 2002). *Neverwinter Nights* was used by MIT educators to create a historical game based on a battle in the Revolutionary War (Beedle, 2004).

In addition, video games make use of fantasy, mystery, and narrative to more fully engage the player in the experience. While explaining their Input-Process-Output Game Model, Garris et al. (2002) suggest that material may be "learned more readily when presented in an imagined context that is of interest than when presented in a generic or decontextualized form" (p. 448). While not "real-world", fantasy can provide metaphors or analogies for "real-world" situations the player experiences and from which the player can learn.

Mystery elicits and stimulates curiosity. Curiosity causes the player to explore and learn more about the environment, setting, or story. Prensky (2001) reported a U.S. Navy study that explored use of video games for training on submarines. The Navy found both the mystery and complexity of the video games led to increased engagement and involvement. It led "players of training games to remain involved as they initiate game play, adopt a role, control game play, practice skills, solve problems, persist to the end, and strive to win (which translates as 'learn')" (Prensky, 2001, pp. 147-148).

Video game narrative provides enjoyment. It gives a context for why an action may or may not be important (Garris et al., 2002). In studying the impact of narrative and story on video games, Schneider (2001) found "story is something that players enjoy; it helps involve them in the game play, makes them feel more immersed in the virtual environment, and inhibits the habituation of arousal" (p. 47).

By providing control, the ability to co-design, and an engaging environment, players may be motivated to explore and experiment further (Kirriemuir & McFarlane, 2004). Beedle found 80 percent of players used the library, the Internet, guidebooks, or other related material to investigate the game's background or story (2004). Nearly three-

fifths (59 percent) of players stated video game playing encouraged their completion of school work or tasks (2004). Dawes and Dumbleton found students who played video games used the library more to work on homework, use computers, and borrow books than did non video-game players (2001).

Challenge

Video games can be hard, complex, and take a long time to complete; and yet, as Gee (2003) points out, people increasingly play them and pay to play them. One might assume by making video games easier, more people would be more interested in playing. However, video game designers have learned players demand games be difficult and challenging (Dickey 2005; Downes, 2004; Gee, 2003, 2005). Designers have incorporated the following features to keep games challenging and prevent players from giving up too quickly: well-ordered goals or problems, immediate feedback, information on demand, risk taking, and progressive levels of difficulty.

Goals or problems define the structure of the video game (Garris et al., 2002). Good video games have clearly stated goals (Beedle, 2004; Garris et al., 2002), more than one path to solving a problem (Beedle, 2004; Gee, 2005), a certain amount of ambiguity to effect an uncertain outcome (Garris et al., 2004), and are "pleasantly frustrating" (Downes, 2004) if the goal is just out of reach of the player's best efforts (Gee, 2003, 2005). Problems must be structured such that the assumptions developed in solving previous problems can be used to solve later problems (Gee, 2003, 2005).

Additionally, players expect to receive immediate feedback on their choices and strategies. With immediate feedback, the player is able to perceive discrepancies between his or her action and the goal or problem solution. This allows the player to adjust

strategies to better meet the desired outcome (Beedle, 2004; Garris et al., 2002). One form of feedback is information on demand. Instead of all the information available at one time, as in a textbook, a video game provides information as it is needed and when it can be used (Dickey, 2005; Gee, 2005). At times this information is the result of some action taken by the player, and at other times, it is provided at various intervals. In any case, it is provided in a context meaningful and useful to the recipient (Dickey, 2005; Gee, 2005).

Good video games make failing in terms of either losing or making mistakes less risky by providing situations where failures carry no major consequences (Gee, 2005). Players are encouraged to try new things, take risks, and explore options. Failure is actually positive as players learn from their mistakes. By trying a strategy and failing, players learn the game's behaviors and patterns and gain feedback about progress being made (Beedle, 2004; Dickey, 2005; Gee, 2005).

Finally, most video games contain progressive levels of difficulty (Garris et al., 2002). As players practice through play, they become expert at a particular level. When a level is complete, another level is introduced that requires additional skill. Players progress through increasingly difficult levels allowing them to master increasingly complex skills as they continue to play and complete the game (Beedle, 2004; Gee, 2005).

Social

When players play a massive multiplayer game, they often play in self-organized teams, sometimes referred to as clans or guilds (Herz, 2002). Teams have their own subcultures, politics, hierarchies, systems of government, tribal names with tribal

histories, monikers, and other signs of identification (Beedle, 2004; Herz, 2002). Often crossing cultural and national boundaries (Herz, 2002), teams are highly cooperative with affiliation motivated by common goals and not by race, ethnicity, or gender (Gee, 2003).

Each member brings special skills and expertise to the team. These skills are coordinated with other team members' skills to prioritize objectives, accomplish certain missions, and solve problems (Beedle, 2004; Gee, 2003). Participation is acknowledged by team members in various ways, including download counts and ratings of member contributions. Peer acknowledgment encourages continued participation and becomes a source of pride for many players (Herz, 2002). Not only does team playing make the game environment more enjoyable; it makes it more demanding by requiring members to develop communication and coordination skills (Beedle, 2004; Herz, 2002).

Another way social interaction is achieved is through the use of continuously updated and distributed knowledge bases of game tricks, tips, helps, and cheats (Beedle, 2004; Herz, 2002). These knowledge bases are constructed and maintained, not by game designers, but by the community of players who are interested in helping and teaching each other various game strategies (Herz, 2002). Video game players spanning cultures and nationalities chat, collaborate, find answers, critique, and contribute through message boards (Beedle, 2004; Herz, 2002). Many times, game designers will gain ideas for future games or enhancements by reading the message boards and websites (Beedle, 2004; Herz, 2002).

Participation through teams or through message boards allows players to actively engage with the game and with each other. Players learn from each other as they see how tasks are accomplished or problems are solved. Learning is a social activity (Herz, 2002)

and video games provide environments that demand player collaboration and communication skills.

Experiential

Players often take on an identity or role and are committed to this identity for an extended period of time (Downes, 2004; Gee, 2003). These roles will usually be a compilation of player's experience, attitudes, skills, motives, emotions, values, and interests, similar to an "existential self-portrait" (Herz, 2002, p. 186). Identity is central to learning (Benson & Mekolichick, 2007; Gee, 2003; Prensky, 2001), taking on a role allows the player to experience the game from a first-person perspective, much as the scientist performs experiments (Downes, 2004; Gee, 2003). Players interact with the environment through the identity of a character and many times experience emotions as they play. Emotions include fear for the character's life, thrill of victory, excitement in finding new powers, weapons, or clues, and disappointment when the character or another character is killed (Schneider, 2001).

Marc Prensky, CEO and founder of Games2train, emphasizes the substance of both video games and learning is the players' and students' experiences (Prensky, 2001). Video games provide experiences through role playing, problem-solving, developing complex skills, interacting with others, and researching game contexts. These activities are experiential in nature, as well as intrinsically motivating, involving intellect and emotions in a social context where knowledge is constructed by interactions with other players through clans, tutorial websites, and message boards.

Video Games and Skill Development

Playing video games provides exposure to technology and has been shown to develop or enhance various skills, including skills needed by individuals to be successful in high-tech careers (De Lisi & Cammerano, 1996; De Lisi & McGillicuddy-De Lisi, 2002; Green & Bavelier, 2003). However, in terms of skill development, all video games are not equal. Some genres or types are more suited for certain skill development than other games. For example, one study paired *Tetris*® a puzzle-type game with *Medal of Honor*®, a first-person shooter game. Participants who played *Medal of Honor*® scored better on tasks requiring visual selective attention than participants who played *Tetris*® (Green & Bavelier, 2003), while two other studies found playing *Tetris*® enhanced mental rotation abilities (Okagaki & Frensch, 1994; Sims & Mayer, 2002). Additionally, adventure games rely on deductive reasoning skills to solve mysteries or puzzles not generally present in other genres such as simulations or shooter games (Garris et al., 2002; Gee, 2003). However, simulations and shooters have been shown to enhance other skills as hand-eye coordination or visual attention capabilities (De Lisi & Cammerano, 1996; De Lisi & McGillicuddy-De Lisi, 2002; Green & Bavelier, 2003). The following review discusses those skills specifically used in computer related careers--technical, spatial, and problem-solving or reasoning skills.

Technical Skills

One of the benefits of playing video games is the enhancement of technical skills as computer skills. Pillay (2003) found playing video games enhanced performance on subsequent computer-based instructional tasks. He divided 36 students, aged 14 to 16, into three groups of 12, with equal representation of both genders. One group played a

strategy game, another a puzzle game, and the third group (control group) did not play. After 15 minutes of game play, each group had 30 minutes to complete tasks using educational software. ANOVA comparisons revealed that video game play (VGP) positively affected performance with educational software; and the closer the game genre to the type of tasks required by the educational software, the stronger the positive relationship. He also found, through questioning participants, they used the same actions to complete problems with the educational software as they had used in game play, strengthening the link between game genre and subsequent successful task completion. Other studies support Pillay's findings in showing video game players learn technical skills such as multitasking, switching among windows, internet searches, and skills to download material, query and search databases to find specific information, and use menus (Dawes & Dumbleton, 2001).

Spatial Skills

Spatial visualization refers to the ability to create and manipulate a mental image of an object. This ability has significant application to mathematics, computer sciences, physics, architecture, and engineering. A link has been established between spatial abilities and tasks required in computer-related careers, such as program debugging (Bednarik & Tukiainen, 2004; Greenfield, Brannon & Lohr, 1994; Greenfield, deWinstanely, Kilpatrick, & Kaye, 1996). Spatial skills increased through the playing of video games (Canada & Brusca, 1991; Feng, 2006; Goldstein, 1994; Green & Bavelier, 2003; Greenfield et al., 1994; Greenfield et al., 1996; Subrahmanyam, Kraut, Greenfield, & Gross, 2001). For example, De Lisi and Wolford (2002) found after playing *Tetris®,* a

video puzzle-type game, both men and women demonstrated improvements on tasks requiring mental rotation.

Problem-Solving

Although video games are not unique in providing opportunity to enhance problem solving abilities, one primary purpose regardless of genre is solving one or more problems. These problems include killing before being killed, solving mysteries and puzzles, exploding all balls before they are swallowed, making enough money to build a house, etc. Studies have shown VGP can improve problem solving skills. Ward and Carroll (1998) found participants who played had improved abstract reasoning skills over those who did not play video games. Henderson (2005) studied teenagers as they played *Final Fantasy*®, an action adventure game, and found they used cognitive skills such as induction and deduction. Other studies support the findings that cognitive skills are used and enhanced during play (Hong & Liu, 2003; Ko, 2002; Saldana, 2004). A common theme from these studies suggests age and experience with video games influence the amount of cognitive thinking involved in game play. Ko (2002) studied the relationship between medium of a game, board or electronic, and inferential thinking of children. The medium had no effect on inferential thinking but age and experience did. Younger children were more random in their approaches to playing, while older children used more problem solving techniques. Additionally, the more a child played the game, the better he or she was at solving the problems (Ko, 2002). Likewise, Hong and Liu (2003) found experienced game players used analytical and logical thinking while less experienced players used trial and error to solve problems or progress in the game.

Technical skills, spatial visualization, and reasoning or problem-solving are only a few of the skills developed and enhanced by VGP (Beedle, 2004; Gee 2005). The acquisition of these skills through VGP may provide mastery experiences that fuel CSE. A few studies have indicated VGP influences attitudes toward computers and are associated with interest in high-tech jobs (Cassell & Jenkins, 1998; Feng, 2006; Margolis & Fisher, 2002; Van Eck, 2006). Van Eck (2006) found after playing video games, fifth and sixth grade girls had increased interest in computers and technology. Feng (2006) studied 48 students, 24 played video games and 24 did not, 24 were males and 24 were females, and 24 had a CRD major and 24 had a NCRD major, and investigated differences in attitudes toward computers and whether playing video games would change negative attitudes. To measure attitudes toward computers, each participant was given the Technology Profile Inventory (TPI) questionnaire. Video game players had more positive attitudes toward information technology than non-players. Students having positive attitudes toward computers were more likely to go into computer-related fields, and playing video games improved attitudes toward computers for females but not for males (Feng, 2006).

The relationship between VGP, CSE, and choosing a major within CRDs has been studied as described above. However, the number of empirical studies is minimal. Additionally, gender difference may influence the outcome in studies relating VGP to selecting a major within CRDs. For example, although Feng used an equal number of males and females in his study, it was not apparent how video game players or majors in CRDs were distributed between males and females. That is, of the 24 female participants, it is unclear how many played video games and how many had majors within CRDs.

Likewise, of the 24 male participants, the number of video game players and CRD majors was not specified. If the majority of the 24 female participants were non video game players and majoring in NCRDs, and if the majority of the 24 male participants were video game players and in CRDs, his findings could be questioned as to which may be the stronger influence--gender or VGP.

Video Game Play and Gender

Studies of differences between males and females in VGP behavior and preferences emphasize males play video games more than females (AAUW Educational Foundation Commission, 2000; Kafai, 1999; Lucas & Sherry, 2004; Van Eck, 2006) and are more motivated to play video games than are females (Lucas & Sherry, 2004). Researchers have attempted to explain these differences by hypothesizing females have less access and exposure to video games or by stating video games are more appealing to males because of violence or spatial challenges (AAUW Educational Foundation Commission, 2000; Lucas & Sherry, 2004). Preferred gaming genre have been studied with females preferring games involving stories, puzzles, and problem-solving and males preferring games featuring competition and shooting (Van Eck, 2006). Other differences deal with the types of challenges, females enjoy more logic challenges and males enjoy more spatial challenges (Kafia, 1999; Lucas & Sherry, 2004; Rabasca, 2000). Additionally, Inkpen et al., found girls tend to play video games on the computer, while boys play on consoles (1994). Aquila (2006) interviewed 25 female college students self-identifying 7 as non-gamers, 5 as gamers, and the remainder (13) as in-between non-gamer and gamer. From her interviews, she discovered many of the gamers had very little exposure to video games as children and many of the non-gamers played a lot of video

games as kids, but refused to play as adults. This seemed to contradict the assumption that early exposure to games would lead to increased VGP in later years. Additionally, both gamers and non-gamers did not like complex games. They preferred games that did not require much time to learn the rules and controllers and did not require 3D manipulations. They also preferred games with strategizing and puzzle-solving instead of violence or sports. The majority of the participants interviewed felt access to more "girl-friendly" games would not alter their playing behavior, which may explain why many females do not play the more "girl-friendly" games now available. Many of the participants felt there were better ways to spend time and all felt video game playing should be in moderation.

The above discussion highlights some of the differences between males and females as to VGP. These differences may be sufficient to confound a study's findings in dealing with VGP, CSE, and CRD, unless gender is controlled.

Summary

This review discussed self-efficacy and CSE as it relates to career behavior and choice. Sources of self-efficacy were reviewed with mastery experiences being a strong predictor of strong self-efficacy beliefs. Gender differences were highlighted with regard to CSE with females generally having weaker CSE expectations than males. Research relating CSE to choosing careers in computer related fields was reviewed.

Video games and their features may provide an environment conducive to developing skills needed for careers in CRDs. Studies that showed a relationship between playing video games and skill development and enhancement were reviewed for skills

used in CRDs, specifically technical, spatial visualization, and reasoning skills. The review concluded with an overview of gender and VGP.

CHAPTER III - METHODOLOGY

This study examined computer self-efficacy (CSE), video game play (VGP), exposure, and preferences between students in computer related disciplines (CRD) and students in non computer related disciplines (NCRD). This chapter describes the research design, instrument, population and sample, data collection, research hypotheses and questions, data analyses, reliability and validity, and the pilot test.

Research Design

Researchers in the social sciences have debated whether to use qualitative or quantitative research methods. Morgan, Gliner, and Harmon (2006) divide the discussion between qualitative and quantitative approaches along the lines of paradigm, data and data collection, and data analysis. For purposes of distinction, although not totally accurate, quantitative methods are said to have a positivistic paradigm and qualitative approaches are said to have a constructivist paradigm.

The positivist paradigm uses the scientific method to discover one objective reality. Although quantitative researchers might argue against one objective reality, they would attempt to explain differences in realities as variability. Numbers make up quantitative data collected through the use of tools such as questionnaires, test scores, records, etc., and analyzed using statistical models. Quantitative data are considered to be objective; however, subjective data can be collected and quantified through ratings as Likert scales. Quantitative studies begin with a "set of detailed questions and/or hypotheses. Researchers investigate facts and ... want to know a lot about a few variables" (Morgan et al., 2006, p. 110).

An overall picture of CSE and VGP was sought rather than a deeper and more descriptive understanding of reasons and experiences of CSE and VGP. Additionally, the data collected were easily quantifiable. Simple questions concerning VGP exposure and preferences were asked using closed-ended questions. To collect data concerning CSE, a standard measure was employed with responses recorded on a Likert scale. To gain an overall picture, data were collected from many students.

This study used a non-experimental comparison approach. The independent variable, discipline group (CRD/NRCD) derived from an attribute--major, was not directly manipulated by the researcher. Additionally, comparisons were made between students in CRD and students in NCRD. Studying these two groups allowed the question of whether VGP was related to being in CRD by comparing video game playing, video game exposure, and video game preferences of students in CRD to students in NCRD.

Surveys

As part of the methodology, a survey was used to collect data. Wallen and Fraenkel (2001) define survey research as that in which information is gathered, through asking questions, from a sample for purposes of describing characteristics of a population. The survey responses are "summarized, analyzed, and reported" (p. 377) as answers to research questions. Surveys are a primary method of data collection because they are the most economical and efficient method of gathering large amounts of data (Wood, Nosko, Desmarais, Ross, & Irvine, 2006).

Data were collected through direct administration of the survey. The researcher or a designated survey administrator entered academic classes and administered the survey to students who volunteered to participate. Direct administration was chosen because

access to participants enabled a high response rate (Wallen & Fraenkel, 2001). Additionally, it provided near immediate responses and did not require a wait time as in other data collection modes. Speed of administration was another advantage. Data collection was expedited by administering the survey to several participants at once instead of one at a time. Other advantages of surveying students in classes with the researcher or survey administrator present included immediate and consistent clarification of questions (Nosek, Banaji, & Greenwald, 2002) and participants taking the survey more seriously (Tourangeau, 2004). Finally, entering classrooms to distribute a number of surveys was a quick way of gathering data from large numbers of students in a timely and economical manner.

This study used a pencil-and-paper format to administer the questionnaire. Although some studies have argued that online surveys provide benefits over paper-and-pencil format, other studies have shown that there are no differences in response rates, social desirability bias, reliability, and validity between the two data collection strategies (Wood et al., 2006).

Issues regarding surveys include response rates, missing items, and social desirability bias (Wood et al., 2006). The single most important factor in response rates and missing items seems to be the survey length (Crawford, Couper, & Lamias, 2001; Stanton, Sinar, Balzer, & Smith, 2002; Wood et al., 2006). The survey in this study was short with 29 items and 15 questions; therefore, response rates were optimized and missing responses minimized. Additionally, with direct administration, participants were reminded to review their responses to check for missing items before they submitted their surveys. With social desirability bias, participants respond according to how they believe

others would like them to respond, rather than how they actually feel or believe. Social desirability bias was not a factor as the items and questions were not sensitive in nature. Additionally, confidentiality and anonymity were emphasized as names and other identification were not collected, thereby decreasing social desirability bias (Nancarrow & Brace, 2000).

Instrument

The instrument asked questions regarding CSE and VGP exposure and preferences (Appendix B). It contained three sections. Section I – Video Game Playing--asked questions about video game playing. If the participant responded that he or she did not play video games, either within the last 12 months or prior to the last 12 months, he or she was directed to Section II. Video game players continued with questions concerning the hours per week played within the last 12 months and prior to the last 12 months; age when they first began VGP; length of time in years of VGP; preferences concerning single-player and multi-player games; challenge level of the video games; video game genre played; video game platform used; types of modifications, if any, made to video games; and whether they contributed to a website or discussion board. Participants were asked to respond to questions regarding genre, platform, and modifications by marking one or more possible responses listed in the question.

Section II – Perceptions--contained a slightly modified version of Cassidy and Eachus' *Computer Self-Efficacy* scale. Their 30-item measure, based upon research in CSE (Cassidy & Eachus, n.d.), was developed to correct limitations in earlier CSE scales. For example, Hill et al's. (1987) scale contained four items concerning general computing. Miura's (1987b) and Vasil, Hesketh, and Podd's (1987) scales were validated

with children only. Murphy, Coover, and Owen's (1989) scale presented possible bias as it contained all positively worded items. Additionally, Murphy et al.'s scale, as well as others, contained technically-specific items, which were outdated or obsolete, threatening validity (Cassidy & Eachus, 2002). The Computer Attitude Scale (Lloyd & Gressard, 1984) and the Computer Technologies Survey (Kinzie & Delcourt, 1991) both used CSE as part of the overall measure; however, both instruments were technically specific to the 1980s and 1990s, threatening validity for current usage.

Cassidy and Eachus' *Computer Self-Efficacy* scale was developed initially with 47 items. After sampling both experienced and inexperienced computer users within the University Faculty of Health Care and Social Work Studies at the University of Salford (UK), the scale was reduced to the current 30 items. They tested the 30 item scale with a sample of 212 participants divided into five groups. Four groups were university students, ranging from physiotherapy students to software engineering students, with a fifth group of Internet users. The survey was administered a second time, one month later, to gather test-retest data. All groups except the Internet users and software engineering students completed the scale the second time. Internal consistency of the scale using Cronbach's alpha was 0.97. Test-retest reliability was also high and statistically significant where $r = 0.86$, $p < 0.005$. Additionally, the scale demonstrated discriminant and construct validity by correlating positively with computer experience ($r = 0.79$) and familiarity with software packages ($r = 0.75$) (Cassidy & Eachus, n.d.). Another use of this scale was Brinkerhoff's study on technology professional development and computer self-efficacy, technology skills, and practice (2006).

The scale contained 30 items with responses given on a Likert scale from strongly disagree (1) to strongly agree (6). The items were technologically generic in nature, with only one being technically specific and dealing with the DOS operating system. That item was removed for the purposes of this study, leaving 29 items. One-half of the items were worded in the negative to control for affirmation bias. These items were reverse scored and then all items were summed with possible scores ranging from 29 to 174. Higher scores indicated greater computer self-efficacy.

The format of the scale was slightly altered to present a more attractive survey for pencil-and-paper administration. A visually appealing survey is more likely to have an increased number of responses (Boser, 1990). Individual items were placed in a table with Likert scale responses to the right of each item instead of underneath. Alternate items were shaded to help readily distinguish one from another.

The last section, Section III – About You--contained demographic questions including gender, age, major, and ethnicity. Fink (2006) suggests that demographic questions be placed at the end of a survey to help relieve respondent fatigue by allowing completion with short and easy-to-answer questions. A final item was an open-ended request for further information the respondent might want to give about video game playing or CSE. Such a request was helpful in revealing gaps and flaws in the survey, as well as further insights into the area of inquiry (Reinard, 2008), and it gave voice to the respondents.

Population and Sample

The theoretical population was all undergraduate students. Students from universities in the south region of the United States were selected as the accessible

population. From the accessible population, a purposive sample of 389 undergraduate students from Abilene Christian University (Abilene, TX), Lubbock Christian University (Lubbock, TX), University of Central Oklahoma (Edmond, OK), University of Louisiana at Lafayette (LA), and West Texas A&M University (Canyon, TX) participated in the study.

Data Collection

The researcher visited the websites of the 5 universities listed to gain course scheduling, enrollments, and faculty contact information. For the CRD group, courses in areas such as computer science, computer engineering, and information science, systems, or technology were identified. Other courses in various disciplines were identified for the NCRD group. The number of identified courses was adjusted to achieve a fairly even number of students in CRD and NCRD and males and females. Primarily upper-level courses were selected as students enrolled in these courses were more likely to have selected a major. Faculty members teaching identified courses were contacted via email to ask their interest in having their classes participate in the study. If the faculty member indicated an interest, the researcher either mailed the surveys to the faculty member with instructions for distributing, administering, collecting, and returning the completed surveys or made an appointment to visit the class and administer the survey. Efforts were made to schedule an administration time that ensured minimal disruption of schedules. Participating faculty signed and dated a permission letter (Appendix C) indicating their consent to have their classes surveyed.

After obtaining approval from the Institutional Review Board (Appendix D) for human subjects research, a total of 23 classes were surveyed from the 5 universities. The

researcher surveyed 17 classes at Abilene Christian University, Lubbock Christian University, and West Texas A&M University and surveys were sent to faculty members at University of Central Oklahoma for three classes and University of Louisiana at Lafayette for three classes. In most cases, the survey was given at the beginning of class. The researcher or administrator read instructions and assurances were given of confidentiality and anonymity (Appendix B). Students were made aware that participation was voluntary, yet greatly appreciated. Students enrolled in more than one class in which the survey was administered, completed the survey only one time.

Completed surveys were gathered and grouped by gender and into CRD or NCRD based upon participant's identification of academic major. Academic majors represented in the study are found in Appendix A. An academic major response of "undecided" was not considered a missing response and was coded in the NCRD group. Survey responses from all participants were combined to make up the entire sample.

Research Questions, Hypotheses, Variables

Primary Question

To what extent do perceptions of computer ability, video game playing, exposure, and preferences explain females being in CRD and males being in CRD?

Hypotheses and Supporting Questions

H1. There is no difference between female students in CRD and female students in NCRD in

1. CSE scores
2. VGP
3. starting age

4. length of time in years they have played video games

5. average hours per week they have played video games

6. single or multi-player preferences

7. challenge level of video games played

8. video game modifications

H2. There is no difference between male students in CRD and male students in NCRD in the above eight variables (same as studied for females).

H3. Perceptions of computer ability, video game playing, exposure, and preferences do not explain females' choice of CRD or males' choice of CRD.

In addition to the hypotheses, the following research questions were asked to gain a more thorough understanding of players' preferences including video game genre, platforms, and types of modifications made to the game.

R1. What gaming genre do

1. females in CRD play?, females in NCRD play?

2. males in CRD play?, males in NCRD play?

R2. What gaming platform do

1. females in CRD play?, females in NCRD play?

2. males in CRD play?, males in NCRD play?

R3. What kinds of modifications to video games do

1. females in CRD make?, females in NCRD make?

2. males in CRD make?, males in NCRD make?

Each hypothesis compared females to females in CRD and in NCRD and males to males in CRD and in NCRD. Males and females were compared separately to control for

gender in CSE, VGP, exposure, and preference. Table 2 summarizes these comparisons, which were made horizontally.

Table 2

Comparisons between CRD and NCRD by gender

CRD	NCRD	Comparisons			
				Exposure	Preferences
Male	Male	CSE	VGP	age, years, hrs	mode, challenge, mod
Female	Female	CSE	VGP	age, years, hrs	mode, challenge, mod

Data Analysis

Analyses of completed survey responses were used to answer the research questions. Table 3 contains the variables studied and corresponding survey items or questions that addressed them.

Table 3

Dependent variables and corresponding survey items

Variable (variable name)	Survey Item
VGP (VGP)	Q1: Each "yes" response was coded as 1 for Current VGP (CVPG). Q2: Each "yes" response was coded as 1 for Past VGP (PVGP). Q1 and Q2: A "no" for both was coded as 1 for Non VGP (NVGP). Q1 and Q2: Either or both "yes", coded as 1 for VGP. Q1 and Q2: Either or both "yes" and genre played marked Casual and no other genres selected, coded 1 for NVGP. Q1 and Q2: Either or both "no" and current hours or past hours per week greater than 0, code 1 for VGP.
Current hours per week	Q1b: The response was used. If a range was specified, the mid-point number in the range was used and rounded to the higher number. Missing and "I don't know" responses were null.
Past hours per week	Q2b: The response was used. If a range was specified, the mid-point number in the range was used and rounded to the higher number. Missing and "I don't know" responses were null.
Hours per week (hours)	Derived from the greater of current hours per week and past hours per week.
Starting age (starting age)	Q3: The response was used. If a range was specified, the mid-point number in the range was used and rounded up to the higher number. If a grade level was specified, the age was determined based on that grade. Missing responses were null or derived from subtracting number of years played (if provided) from age of participant (if provided). "I don't know" responses were coded as null.

Table 3 (continued)

Dependent variables and corresponding survey items

Variable (variable name)	Survey Item
Number of years played (years)	Q4: The response was used. If a range was specified, the mid-point number in the range was used and rounded to the higher number. Missing responses were null or derived from subtracting starting age (if provided) from age of participant (if provided). "I don't know" responses were coded as null.
Mode of game play (mode)	Q5: Single-player mode was coded as a 1. Multi-player mode was coded as a 2.
Challenge rating (challenge)	Q6: Ranked 1 through 6 with 1 = "Not Challenging" and 6 = "Highly Challenging".
Gaming genre (genre)	Q7: Checked responses coded as 1 for each category.
Gaming platform (platform)	Q8: Checked responses coded as 1 for each category.
Modifications (mod)	Q9: "Yes" responses coded as 1. "No" or missing as 0.
Modification category (MCat)	Q9b: Checked responses coded as 1 for each category.
Discussion Board (message board)	Q10: "Yes" responses coded as 1."No" or missing as 0.
Computer Self-Efficacy (CSE)	Items 1-29: 3, 4, 5, 7, 9, 12, 13, 14, 16, 18, 20, 21, 22, 24, 25, 27, 29 – reverse scored. Responses were totaled for individual CSE score.

Demographic information was used to describe the sample and reported using descriptive statistics. In addition, academic major was used to group responses into CRD or NCRD and the gender response was used to group by male or female.

The number of CVGP, PVGP, NVGP, and VGP responses from Q1 and Q2 were counted for males and females in CRD and NCRD. Counts were compared using the chi-squared (χ^2) statistic.

Responses for start age (Q3), years (Q4), and hours (derived from Q1b and Q2b) comprised the video game exposure category of the research question. Means and standard deviations of each of the variables were calculated for females and males within CRD and NCRD who played video games.

Responses for mode (Q5), challenge (Q6), mod (Q9), and message board (Q10) comprised preferences category of the research question. Single-player and multi-player responses for the mode variable were counted for females and males in CRD and NCRD who played video games. Counts were compared using χ^2. Means and standard deviations were calculated for the challenge variable for females and males in CRD and NCRD who played video games. Independent *t*-tests were used for group comparisons. Finally, the number of "yes" and "no" responses for the mod variable were counted for females and males in CRD and NCRD who played video games. These counts were compared using χ^2.

The CSE score, from *the Computer Self-efficacy* scale, described the perceptions of computer ability. The *Computer Self-efficacy* scale items 1 through 29 were summed with negatively worded items reverse scored to calculate the CSE score. Means and standard deviations were calculated for males and females in CRD and NCRD and independent *t*-tests were used for comparisons.

CSE scores, VGP variables, exposure variables, and preferences variables were used as covariates in logistic regressions with major group (CRD/NCRD) as the dependent variable. Logistic regressions were run on the entire sample, the female group, and the male group.

Other data examined included genre (Q7), platform (Q8), modification category (Q9), and whether the participant contributed to gaming websites or discussion boards (Q10). Category responses for genre (Q7), platform (Q8), and modification category (Q9) were counted for females and males in CRD and NCRD who played video games. The number of "yes" responses to the message board variable (Q10) was counted for females and males in CRD and NCRD who played video games.

Table 4 summarizes dependent variables and the statistics used to describe and compare the variables.

Table 4

Summary of statistics used by dependent variable

Dependent Variables	CRD/NCRD Females/Males	Statistic
CSE	counts; means; standard deviations	independent *t*-test
VGP	counts	χ^2
hours	means; standard deviations	
start age	means; standard deviations.	
years	means; standard deviations	
mode	counts	χ^2
challenge	counts; means; standard deviations	independent *t*-test
genre	counts	
platform	counts	
mod	counts	χ^2
MCat	counts	
msg boards	counts	

Reliability and Validity

The published *Computer Self-Efficacy Scale* (CSE) by Cassidy and Eachus (n.d.) was evaluated for measurement reliability and validity. For the CSE scale in this study, Cronbach's α was performed on pilot responses and on study responses before analysis. Pilot responses were analyzed to determine whether the instrument was appropriate in addressing the research questions.

Pilot Test

A pilot test was performed to estimate response rates, survey completion time, and potential participants' questions and misunderstandings. Responses were verified as to their appropriateness for start age of VGP, hours of VGP per week, and number of years respondents have played video games. Gaming genres, examples of the genres, and modification options were also verified and additions or deletions made as needed. Finally, the *computer self-efficacy* (*CSE*) scale was analyzed for reliability using Cronbach's α for all participants and by gender within major group.

Five classes were selected from Amarillo College (TX), specifically, an English class, a computer engineering class, a beginning computer programming class, an advanced web page programming class, and a computer literacy class. Each class had a mix of male and female students, except the computer engineering class, which had only male students enrolled.

At the beginning of class and with the instructor's permission, the researcher introduced herself and asked the students if they were willing to participate in a pilot study for this dissertation. The surveys were distributed and the researcher explained

responses were anonymous. Additionally, they were told their participation was voluntary and they would not be penalized or rewarded whether or not they chose to participate.

Thirty-eight students participated in the pilot study spanning the five classes. The response rate was 100 percent. Students who were absent were not considered as "non-participating" as they may have participated had they been present. Approximately ten minutes was required to complete the survey and submit it to the administrator. No student took longer than ten minutes.

Participants were encouraged to ask for clarification on any confusing questions. No participant asked for more information or required clarification. When the surveys were completed and submitted, participants were asked for feedback on clarity of the survey. No student considered the survey confusing and all agreed the survey was clear and understandable.

After all the classes were surveyed, the responses were grouped based upon the participant's self-identification of academic major. Majors identified as computer science, computer information systems, computer engineering, World Wide Web programming, computer engineering, or engineering technology were coded as the CRD group. All others (i.e., business, accounting, education) were identified with the NCRD group. Table 5 contains the counts of participants by group and gender.

Table 5

Counts of grouped participants—pilot test

Gender	CRD	NCRD	TOTAL
Male	14	7	21
Female	3	14	17
Total	17	21	38

Responses for the starting age variable, years of game play variable, and hours per week variable were verified for appropriateness. Based on the responses, coding rules were developed.

Gaming genres, examples of the genres, and modification options were verified by examining responses. From examining pilot responses, the music-based genre was added to the survey. Finally, the *computer self-efficacy* (*CSE*) scale was analyzed for reliability using Cronbach's α for all participants and by gender within major group. If any participant omitted one or more items in the scale, that participant's response was not included in the computation. Seven participants had at least one item missing, leaving 31 responses that were completed. The range of scores was 84 to 173, with a mean of 143.77 and a standard deviation of 21.82. The inter-item correlation for the group was 0.96, similar to Cassidy and Eachus' 0.97. Table 6 contains the Cronbach's α for the CSE scale by gender within major group. The scores show sufficient reliability for this study.

Table 6

Cronbach's α by gender and CRD/NCRD—pilot test

Gender	CRD	NCRD
Male	0.95	0.95
Female	0.98	0.97

Summary

This study explored VGP, exposure, preferences, and perceptions between students in CRD and NCRD. To answer the research question, a survey was administered to students in CRD and NCRD. Descriptive, comparison, and regression statistics were performed on survey responses.

This study provided additional insights into the role that VGP may have in selecting CRD. It was timely due to the interest in VGP by industry and educators and by the decline in computer-related college enrollments. By comparing students in CRD with students in NCRD, a better understanding of the relationship between VGP and CRD was gained.

CHAPTER IV – FINDINGS

This study investigated the relationships among computer self-efficacy (CSE), video game play (VGP), preferences, and exposure of:

- female college students in computer-related disciplines (CRD)
- female college students in non computer-related disciplines (NCRD)
- male college students in CRD
- male college students in NCRD.

This chapter contains the analysis of data collected by surveys distributed in undergraduate classes. Findings are presented in table format and explained within the context of the variables studied in the hypotheses and research questions. The p value reported by SPSS was used in the following narrative; however, it is acknowledged that the accurate value of p is less than 0.001 when p is shown to be equal to 0.000.

Study Participants

College students attending five universities in the south region of the United States participated in this study. A total of 389 undergraduate students from Abilene Christian University (Abilene, TX), Lubbock Christian University (Lubbock, TX), University of Central Oklahoma (Edmond, OK), University of Louisiana at Lafayette (LA), and West Texas A&M University (Canyon, TX) participated. Initial screening of completed surveys eliminated 11 which were unusable, leaving 378 usable responses (97.1%) as the sample. Surveys were eliminated based upon erroneous, incomplete, or missing responses to the majority of the items and, in particular, missing responses to gender and academic major. Surveys were grouped by gender and by academic major

into CRD and NCRD. An academic major response of "undecided" was not considered a missing response and was placed in the NCRD group.

Table 7 contains the number of participants by gender and by CRD (n = 153) and NCRD (n = 225). Although sampling efforts were made to balance the number of CRD participants to NCRD participants, more NCRD students participated. A low number of females in CRD (n = 26) participated; however, this low number was representative of the few females currently enrolled in CRD. The number of female NCRD participants (n = 128) was equivalent to the number of male CRD participants (n = 127); both had more participants than males in NCRD (n = 97) and females in CRD (n = 26).

Participant age and ethnicity were collected as demographic characteristics. Table 7 contains the range of ages and the means and standard deviations by gender and by CRD and NCRD. The range of ages for females was from 18 to 45 years for CRD respondents and 17 to 56 years for NCRD respondents. The range of ages for male CRD respondents was from 18 to 45 years and 18 to 59 years for NCRD respondents. These age ranges indicated an older student population than the traditional collegiate age range of 18 to 22 years. Females in the CRD group had the oldest mean age (m = 24.88, s.d. = 8.00) approximately 2.5 years older than NCRD females (m = 22.35, s.d. = 6.33) and NCRD males (m = 22.32, s.d. = 6.23) 3.2 years older than CRD males (m = 21.68, s.d. = 4.63).

Table 7

Counts and ages of grouped participants by gender and major group

			Age (years)		
Participants	N	%	Range	Mean	S.D.
Female					
CRD	26	7	18-45	24.88	8.00
NCRD	128	34	17-56	22.35	6.33
Female Total	154	41	17-56	22.78	6.68
Male					
CRD	127	34	18-45	21.68	4.63
NCRD	97	26	18-59	22.32	6.23
Male Total	224	59	18-59	21.96	5.38
Total All Participants	378	100	17-59	22.29	5.95

Table 8 contains the ethnic make-up of participants by gender and major group. Because responses for "Native" and "Missing" were very few, they were included with "Other". The majority of both female (77%) and male (71%) students was Caucasian. The other ethnic groups were represented at less than 10 percent, with the exception of male Hispanic students at 13 percent. A few interesting observations were made. The female CRD group, by percentage, had more ethnic participants (35%) than the female NCRD group (20%). This was especially interesting, considering how few (n = 26) were in the female CRD group. For example, the female CRD group (n = 26) had 27 percent Hispanics (n = 7), compared with the female NCRD group (n = 128) which had 2 percent Hispanics (n = 3). Of the 10 Hispanic women who participated, 7 (70%) reported a major

within the CRD group. The difference in ethnic makeup between male CRD and NCRD was not as interesting. However, of the 15 African male respondents, 11 (73%) reported a major within the CRD group. For both male and female, very few identified in the Asian ethnic group.

Table 8

Participant ethnicity by gender and major group

	CRD			NCRD				
Ethnicity	N	% of CRD	% of Ethnic Group	N	% of NCRD	% of Ethnic Group	TOTAL	%
Female								
Caucasian	17	65	14	102	80	86	119	77
Hispanic	7	27	70	3	2	30	10	6
African	1	4	13	7	5	88	8	5
Asian	1	4	25	3	2	75	4	3
Other	0	0	0	13	10	100	13	8
Total	26	100		128	100		154	100
Male								
Caucasian	84	66	53	75	77	47	159	71
Hispanic	17	13	59	12	12	41	29	13
African	11	9	73	4	4	27	15	7
Asian	8	6	67	4	4	33	12	5
Other	7	6	78	2	2	22	9	4
Total	127	100		97	100		224	100

Computer Self-Efficacy Scale

A slightly modified version of Cassidy and Eachus' *Computer Self-Efficacy Scale* (Cassidy & Eachus, n.d.) was used to measure students' perceptions of their abilities to use computers. This scale contained 29 items with responses on a Likert scale from

strongly disagree (1) to strongly agree (6). One-half of the items were worded in the negative and were reverse scored and summed with the other items on the scale. Possible scores ranged from 29 to 174 with higher scores indicating greater computer self-efficacy (CSE) perceptions. Any survey that had one or more missing items on the scale was not included in the CSE calculations. Of the 378 survey responses, 20 had one or more missing items on the scale, leaving 358 surveys for which the CSE scores were calculated. The overall CSE scores ranged from 59 (34% of possible) to 174 (100%), with a mean of 145.67 (84% of possible) and a standard deviation of 20.90.

The scale was analyzed for reliability using Cronbach's α for all participants and by gender within major groups. The inter-item correlation for the entire group was 0.95, similar to Cassidy and Eachus' 0.97 (n.d.) and the pilot study's 0.96. Table 9 contains the Cronbach's α for the CSE scale by gender within major group. The scores showed sufficient reliability for this study.

Table 9

Cronbach's α by Gender and CRD/NCRD, n = 358

Gender	N	CRD	N	NCRD
Female	24	0.91	121	0.94
Male	123	0.92	90	0.95

Analysis of Differences Between Students in CRD and NCRD

The following findings are discussed in context of the variables studied. Hypotheses one and two enumerate eight variables in the context of examining differences between females in CRD and NCRD and males in CRD and NCRD, with research questions one, two, and three adding three more variables to the investigation.

After presenting and analyzing the findings of these eleven variables, the influence of computer self-efficacy, video game play, exposure, and preferences on CRD is examined (hypothesis three).

Hypothesis One and Hypothesis Two

There is no difference between female students in CRD and female students in NCRD and male students in CRD and male students in NCRD in

1. CSE scores
2. VGP
3. starting age
4. length of time in years they have played video games
5. average hours per week they have played video games
6. single or multi-player preferences
7. challenge level of video games played
8. video game modifications

Computer Self-Efficacy Scores. Table 10 presents the ranges, means, standard deviations, and independent *t*-tests of CSE scores for students in CRD and NCRD. Although skewness was not between -1.0 and +1.0, it was close to -1.0 with CRD females' CSE scores skewed at -1.075, NCRD females' skewed at -0.713, CRD males' skewed at -0.912, NCRD males' skewed at -1.03. The independent *t*-test is robust to violations of the assumption of normal distribution; therefore, it was used to compare CSE mean scores. As Table 10 shows, both males and females in CRD had higher CSE scores than males and females in NCRD. Female students in CRD scored significantly higher ($p = .000$) on the CSE (158.71) than females in NCRD (140.64). The difference

between the means was 18.07. The minimum CSE score for CRD females was 126 as compared to 72 for NCRD females. The effect size (d = 1.006) was a much larger than typical effect (Morgan, Leech, Gloeckner, & Barrett, 2004). Male students in CRD scored significantly higher (p = .000) in CSE (152.11) than males in NCRD (140.16). The difference between the means was 11.95. The minimum CSE score for CRD male participants was 97 as compared to the minimum score of 59 for the NCRD male participants. The effect size was calculated at 0.606 which is a medium effect (Morgan et al., 2004).

Not surprising, CRD students scored higher than NCRD students in CSE. Females in CRD had the highest mean CSE scores (158.71) of all four groups, slightly out-scoring males in CRD (152.11). One interesting finding was female NCRD students had equivalent mean scores (140.64) with male NCRD students (140.16). However, when the CRD and NCRD groups were combined for males and females, the males (147.06) slightly outscored the females (143.63), although this difference was not statistically significant (t = 1.526, df = 356, p = .128). The few females in CRD and the large numbers of females in NCRD likely contributed to the overall lower female CSE scores when the CRD and NCRD groups were combined.

Table 10

CSE Scores: Minimum, maximum, means, s.d., and independent t-tests by gender and major group

	CSE Scores							
Students	N	Min	Max	Mean	S.D.	*t*	df	p
Female								
CRD	24	126	174	158.71	12.90	-5.474[a]	53.422[a]	.000
NCRD	121	72	174	140.64	21.88			
Total	145	72	174	143.63	21.70			
Male								
CRD	123	97	174	152.11	16.52	-4.228[a]	153.890[a]	.000
NCRD	90	59	174	140.16	22.81			
Total	213	59	174	147.06	20.26			

[a] Adjusted scores were used because the variances were not equal.

Video Game Play. The counts and percentages of students in CRD and NCRD who self-identified as current players, past players, non players, and casual only players are in Table 11. Current players played video games within the last 12 months and past players played video games prior to the last 12 months. Overall, more participants self-identified as past players than current players. As the sample was college students, studies and other activities may have left less time for video game play. A larger percentage of males in CRD (91%) reported they currently play video games than males in NCRD (81%), females in CRD (69%), and females in NCRD (49%). For both males and females, a larger percentage of CRD students self-identified as current players of video games than NCRD students. A larger percentage of male students (87%) reported they currently play video games than female students (53%). Interestingly, a larger

percentage of NCRD males reported currently playing video games (81%) than CRD females (69%).

As mentioned previously, overall, more students reported playing video games prior to the last 12 months than in the last 12 months. Percentagewise, more males in CRD (98%) reported past play than males in NCRD (96%), females in CRD (85%), and females in NCRD (72%). An interesting finding is the percentage difference in past play between CRD males (98%) and NCRD males (96%) was negligible, yet the percentage point difference between current play and past play for CRD males (7) was about one-half of the percentage difference for NCRD males (15). This leads one to question why a larger percentage of NCRD males than CRD males quit playing video games within the last 12 months. Does the academic discipline make a difference? Females had slightly larger percentage differences between current play and past play--CRD females' percentage difference of 16 and NCRD females' percentage difference of 23. Not surprisingly, a larger percentage of females in CRD (85%) reported past play than females in NCRD (72%). And finally, as with current play, a larger percentage of males (97%) reported past play than females (74%).

Non players were those students who reported being neither current players nor past players. Females, primarily, identified themselves as non players with over one-fourth of female NCRD participants reporting non play (28%) compared to 15 percent of female CRD participants. Less than 5 percent of male respondents (3%) reported being non players with 2 percent in CRD and 4 percent in NCRD.

"Casual only" was the category for respondents who reported playing video games, but selected casual as the only genre played. Because many gamers, as well as the

gaming industry, do not consider the casual gamer to be a video game player (Aquila, 2006; Tams, 2007), those who identified as playing only casual games were re-coded as non video game players. Four participants, in the female NCRD group, played casual games only.

Table 11

Video game play: Counts and percentages of video game play by gender and major group

		Current Players		Past Players		Non Players		Casual Only	
Students	N	#	%	#	%	#	%	#	%
Female									
CRD	26	18	69	22	85	4	15	0	0
NCRD	128	63	49	92	72	36	28	4	3
Total	154	81	53	114	74	40	26	4	3
Male									
CRD	127	115	91	125	98	2	2	0	0
NCRD	97	79	81	93	96	4	4	0	0
Total	224	194	87	218	97	6	3	0	0

Table 12 presents the counts, percentages, Pearson chi-square (χ^2), and Fisher's exact test analysis of the video game play (VGP) variable and the non video game play variable (NVGP). VGP was derived from current or past video game players. If a participant selected either current, past, or both, they were coded as VGP. For female CRD (n = 22), male CRD (n = 125), and male NCRD (n = 93), past video game play was the same as the VGP variable. For females in NCRD, four casual players were coded as NVGP, leaving the VGP count 88 (92 - 4) and the NVGP count 40 (36 + 4). As in past

video game play, there was a larger percentage of male players (97%) than female players (71%), little percentage difference in male CRD players (98%) and male NCRD players (96%), and a larger percentage of female CRD players (85%) than female NCRD players (69%).

Four Pearson chi-square tests were performed on the VGP variable. The first two tests were done for reference purposes and to gain an overall picture, rather than to address a particular hypothesis. The first compared all females to males. Outcomes (χ^2 = 53.306, df = 1, p = .000) indicated the distributions of males and females were different in whether they were video game players. The second test compared all CRD students to NCRD students. Outcomes of this test (χ^2 = 19.394, df = 1, p = .000) indicated the distributions of CRD and NCRD students were different in whether they were video game players. Outcomes of these two tests were no surprise and they confirmed the assumption that more males play video games than females and more CRD students play video games than NCRD students (Gorriz & Medina, 2000; Lucas & Sherry, 2004; Natale, 2002; Rabasca, 2000). However, when the numerical composition of this sample is considered, a more accurate "outcomes" statement may be that more CRD males play video games than NCRD females. Analyzing the data by gender (hypotheses one and two) provide more insight into the findings.

The next two tests addressed hypotheses one and two regarding the video game play variable. A Pearson chi-square test was performed comparing females in CRD and females in NCRD on the VGP variable. Table 12 shows these outcomes, which indicated distributions of female CRD students and female NCRD students did not significantly differ in video game playing (χ^2 = 2.665, df = 1, p = .103). A fourth Pearson chi-square

test compared males in CRD and males in NCRD on the VGP variable. Because two cells had expected counts of less than 5, the Fisher's Exact Test was used. Table 12 shows these outcomes indicating that male CRD students and male NCRD students did not significantly differ in video game playing (p = .407).

Outcomes of the second test, described above, showed when gender was not accounted for, it appeared that video game play may influence whether students are in CRD or NCRD. However, when gender was compared separately within CRD and NCRD, video game play may have little to no influence on whether students are in CRD or NCRD as outcomes of the third and fourth tests indicated no significant difference in actual and expected distributions on VGP of females in CRD and females in NCRD or between males in CRD and males in NCRD.

Table 12

Video game play: Counts, percentages, and chi-square analysis of students in CRD and NCRD by gender

		VGP			NVGP				
Students	N	Actual	%	Expected	Actual	%	Expected	Statistic	p
Female								χ^2	
CRD	26	22	85	18.6	4	15	7.4	2.665	0.103
NCRD	128	88	69	91.4	40	31	36.6		
Total	154	110	71		44	29			
Male								Fisher's Exact Test	
CRD	127	125	98	123.6	2	2	3.5		0.407
NCRD	97	93	96	94.4	4	4	2.6		
Total	224	218	97		6	3			

Table 13 summarizes the findings of the CSE and VGP variables. Overall, CRD students had higher CSE scores than NCRD students and a larger percentage of CRD students played video games than NCRD students. Males and females differed on video game play, although they did not differ on CSE scores. When females in CRD were compared to females in NCRD and males in CRD were compared to males in NCRD, both females and males in CRD had higher CSE scores than females and males in NCRD; however neither group significantly differed in video game play. Hypotheses one and two for CSE were rejected for both males and females. Hypotheses one and two for VGP were not rejected for both males and females.

Table 13

CSE and VGP: Summary of findings for first 2 variables of Hypotheses 1 and 2

Variable	Finding
CSE	$H1_1$-- rejected for CSE. Females in CRD had higher CSE mean scores than females in NCRD.
	$H2_1$-- rejected for CSE. Males in CRD had higher CSE mean scores than males in NCRD.
Other Findings for CSE	Females and males did not significantly differ on CSE mean scores.
	Females in NCRD had similar CSE mean scores as males in NCRD.
	Females in CRD had the highest CSE mean score.
VGP	$H1_2$--fail to reject for VGP. A larger percentage of CRD females than NCRD females reported playing video games, but the difference was not statistically significant.
	$H2_2$--fail to reject for VGP. Males in CRD did not significantly differ in VGP with males in NCRD.
Other Findings for VGP	A larger percentage of males than females reported playing video games.
	Over 65% of females reported playing video games.
	Over 95% of males reported playing video games.
	A larger percentage of CRD male players than NCRD male players reported playing video games in the current year.

Video Game Exposure. Video game exposure variables measure the amount of exposure to video games. Exposure variables were age the participant started playing video games (starting age in years), number of years the participant has played video games (years of play), and number of hours per week the participant currently plays or

has played video games (hours per week). Hours per week was derived from taking the greater of either the current hours per week or the past hours per week of video game play to allow for the possibility of college activities limiting the amount of video game play. From the pilot study, college students indicated they would play and had played video games but they currently did not have time to play as much as they liked or as much as in the past. The greater number of current hours or past hours was used as an overall picture of amount of video game play and was not used to analyze when the play occurred. Table 14 presents minimum, maximum, means, and standard deviations of responses for starting age, years, and hours per week of video game play for students in CRD and NCRD, who were coded as video game players. Those who were coded as non video game players were not included.

Males, whether in CRD (7.10 years) or NCRD (7.90 years), started playing video games at a younger age, on average, than females in CRD (10.14 years) or NCRD (8.25 years). Not much difference between males and females was found in the average number of years they played video games; however, a larger difference was found between males and females in average number of hours per week of play. Males in CRD reported the highest average hours per week (14.36 hours) and females in NCRD reported the lowest average hours per week (2.89 hours). Interestingly, females in CRD reported a lower average hours per week of video game play (5.57 hours) than males in NCRD (8.52 hours).

On average, females in NCRD started playing video games at a younger age (8.25) than females in CRD (10.14); however, females in CRD (12.09 years) reported more years of play than females in NCRD (10.52 years) and more hours per week with

CRD females reporting an average of 5.57 hours per week and NCRD females reporting an average of 2.89 hours per week.

The average start age for males in CRD (7.10 years) was not much different than the average start age for males in NCRD (7.90 years). On average, males in CRD reported playing video games slightly longer (13.48 years) than males in NCRD (11.96 years) and reported playing more hours per week (14.36 hours) than males in NCRD (8.52 hours).

Although, average starting age for females in NCRD was younger than females in CRD, females in CRD played an average of 1.5 years more and an average of 2.68 hours more per week than females in NCRD. The greater average years of play may have been due to the slightly older female CRD group. It appeared females in CRD may have had slightly more exposure to VGP than females in NCRD. Likewise, males in CRD did not differ much in average starting age (7.9; 7.1) or average number of years (13.48; 11.96) from males in NCRD. However in the average number of hours per week, the difference was more pronounced. CRD males played an average of 5.84 (14.36; 8.52) more hours per week than NCRD males. Also, it appeared males had more exposure to video games than females, especially in the average weekly number of hours they played.

Table 14

Exposure variables: Ranges, means, standard deviations of players by gender and major group

	CRD					NCRD				
Exposure Variable	N	Min	Max	Mean	S.D.	N	Min	Max	Mean	S.D.
					Female					
Start age (years)	22	4	23	10.14	4.98	88	2	18	8.25	3.11
Years of play	22	1	25	12.09	6.62	86	1	42	10.52	6.82
Hours per week	21	1	18	5.57	4.42	83	1	13	2.89	2.68
					Male					
Start age (years)	124	1	13	7.10	2.96	93	1	22	7.90	3.64
Years of play	122	3	30	13.48	5.15	93	1	27	11.96	4.98
Hours per week	123	1	70	14.36	11.97	90	1	69	8.52	9.96

Video Game Mode. Video game preference included mode, challenge level, and mod. Mode referred to single-player or multi-player video games. Although many gamers played both single and multiplayer games, participants were asked to select their preferred mode of play, either single or multi-player. Participants coded as NVGP were not included in this analysis.

Table 15 presents the actual and expected counts, percentages, and Pearson chi-square (χ^2) analysis of video game mode playing preferences of students in CRD and in NCRD by gender. Overall, students in both CRD and NCRD preferred to play multi-player games. For females in CRD, playing single or multi-player games was split with one-half (n = 11) preferring single player games and one-half (n = 11) preferring multi-player video games. For females in NCRD, the majority (65.5%) preferred multi-player games (n = 57). Pearson chi-square (χ^2) was used to investigate expected and observed distributions of video game mode preferences between female players in CRD and female players in NCRD. As Table 15 shows, the difference in video game playing mode preferences between females in CRD and NCRD was not statistically significant (p = 0.179).

Males in both CRD and NCRD preferred multi-player games over single-player games. Sixty-five percent of males in CRD preferred multi-player games (n = 80) and 35.5 percent preferred single-player games (n = 43). For NCRD, 64.5 percent of males preferred multi-player games (n = 60) and 35.5 percent preferred single-player games (n = 33). Pearson chi-square was used to investigate expected and observed distributions of video game mode preferences between male players in CRD and male players in NCRD. As Table 15 shows, the difference in video game playing mode preferences between males in CRD and NCRD was not statistically significant (p = 0.936).

Table 15

Video game mode: Counts, percentages, and chi-square analysis of video game players in CRD and NCRD by gender

		Single Players			Multi-Players				
Students	N	Actual	%	Expected	Actual	%	Expected	χ^2	*p*
Female									
CRD	22	11	50.0	8.3	11	50.0	13.7	1.802	0.179
NCRD	87	30	34.5	32.7	57	65.5	54.3		
Total	109	41	37.6		68	62.4			
Male									
CRD	123	43	35.5	43.3	80	65.0	79.7	0.006	0.936
NCRD	93	33	35.5	32.7	60	64.5	60.3		
Total	216	76	35.2		140	64.8			

Video Game Challenge Level. Table 16 presents means, medians, modes, standard deviations, and independent *t*-tests of the preferred challenge level of students in CRD and NCRD by gender. Responses were based on a six-point Likert scale from "Not Challenging" = 1 to "Highly Challenging" = 6. Participants identified as NVGP were not included.

For males and females in CRD and NCRD, the challenge level was approximately normally distributed with skewness between -1.0 and +1.0. Females in CRD preferred slightly more challenging games (3.81) than females in NCRD (3.33); however, as Table 16 shows, the difference was not statistically significant (p = 0.101). Likewise, although males in NCRD preferred slightly more challenging games (4.01) than males in CRD (3.95), the difference was not statistically significant (p = 0.698).

Table 16

Challenge level scale (1 to 6): Mean, median, mode, s.d, and independent t-tests of video game players in CRD and NCRD by gender

Students	N	Mean	Median	Mode	Standard Deviation	*t*	df	p
Female								
CRD	21	3.81	4	4	1.29	-1.654	107	0.101
NCRD	88	3.33	3	3	1.17			
Total	109	3.42	4	4	1.20			
Male								
CRD	125	3.95	4	4	1.22	.389[a]	211.822[a]	0.698
NCRD	92	4.01	4	4	1.01			
Total	217	3.98	4	4	1.13			

[a] Adjusted scores were used because the variances were not equal.

Video Game Mods. Video game mods measured whether or not a participant changed or modified the design of a game. Responses were either "yes" or "no". Participants coded as NVGP were not included.

Table 17 presents actual and expected counts, percentages, Pearson chi-squares (χ^2), and Fisher's exact test analysis of the "yes" and "no" responses to the mod question. Twenty-three percent of females in CRD (n = 5) reported modding a game compared to 2 percent of females in NCRD (n = 2). Because CRD females had an expected count of less than 5 (1.4), Fisher's Exact Test was used to examine whether female players in CRD differed from female players in NCRD. As Table 17 shows, significantly more CRD female players modded games than NCRD female players (p = .003). Phi was .335; therefore, the effect size was considered to be medium or typical (Morgan et al., 2004).

Almost one-half (44%) of the males in CRD (n = 55) reported modding video games and 31 percent of the entire male VGP sample (n = 67) modded. This compared to almost 13 percent of males in NCRD (n = 12). Pearson chi-square was used to examine whether males in CRD differed on modding games with males in NCRD. Table 17 shows the Pearson chi-square (χ^2) outcomes indicating the observed and expected distributions of CRD and NCRD males were different whether they modded video games ($\chi^2 = 24.223$, df = 1, p = .000). Significantly more CRD male players modded games than NCRD male players. Phi was .333, an effect size or medium or typical (Morgan et al., 2004).

Summary of eight variables. Table 18 summarizes the findings of the eight variables from hypothesis one and two. CRD females differed from NCRD females on CSE scores and on modding games. Likewise, CRD males differed from NCRD males on CSE scores and on modding games.

Table 17

Video game mods: Counts, percentages, expected counts, Pearson chi-square analysis of video game players in CRD and NCRD by gender

Students	N	Yes	%	Exp.	No	%	Exp.	Statistic	p
Female								Fisher's Exact Test	0.003
CRD	22	5	22.73	1.4	17	77.27	20.6		
NCRD	88	2	2.27	5.6	86	97.73	82.4		
Total	110	7	6.36[a]		103	93.64[a]			
Male								χ^2	
CRD	125	55	44.00	38.40	70	56.00	86.6	24.223	0.000
NCRD	93	12	12.90	28.60	81	87.11	64.4		
Total	218	67	30.73[a]		151	69.27[a]			

[a]These values are percentages calculated on the columnar totals and not columnar totals themselves.

Table 18

Summary of findings of eight variables

Variable	Findings	
	Female	Male
CSE	CRD (158.71) had higher mean scores than NCRD (140.64)	CRD (152.11) had higher mean scores than NCRD (140.16)
VGP	CRD – 85% play NCRD – 69% play	CRD – 98% play NCRD – 96% play
Exposure		
Start age	On average, NCRD started almost 2 years before CRD	On average, CRD started 0.8 years before NCRD
Years played	On average, CRD played about 1.6 years more than NCRD	On average, CRD played 1.5 years more than NCRD
Hours/week	On average, CRD played 2.90 hours/week more than NCRD	CRD played the most with a mean of 14.36 hours/week and 5.90 hours a week more than NCRD
Preferences		
Mode	Both CRD and NCRD preferred multi-player modes CRD preferred single and multi-player modes equally	Both CRD and NCRD preferred multi-player modes
Challenge	CRD (3.81) and NCRD (3.33) preferred challenge between 3.3 and 3.8 on a 6 point scale	CRD (3.95) and NCRD (4.01) preferred challenge between 3.95 and 4.01 on a 6 point scale
Mods	Larger percentage of CRD (22.73%) modded games than NCRD (2.27%)	Larger percentage of CRD (44.00%) modded games than NCRD (12.90%)

Research Questions

The next three research questions added three variables to the investigation: gaming genres, gaming platforms, and modification types. Each of these questions was analyzed based upon responses of video game players. Non video game players were excluded.

What gaming genres (RQ1), gaming platforms (RQ2), and modifications (RQ3), do females in CRD and NCRD and males in CRD and NCRD make?

Genres. A list of genres was provided with directions for participants to select all genres they typically played. Table 19 presents counts and percentages of genre selections by gender and major group. The casual genre was the most selected genre by females in both CRD (n = 15, 68.2%) and NCRD (n = 77, 87.5%) while first person shooter (FPS) genre was most selected by males in both CRD (n = 108, 86.4%) and NCRD (n = 76, 81.7%). Adventure was selected by 50 percent (n = 11) of CRD female gamers and by 28.4 percent of NCRD female (n = 25) gamers. Interestingly, first person shooters (FPS), a genre typically considered to be more "masculine", was selected by 45.5 percent (n = 10) of female players in CRD. And, role playing games (RPG) was, also, selected by 45.5 percent (n = 10) of CRD female players and 14.3 percent (n = 13) of NCRD females video game players.

Males in both CRD and NCRD selected more genres than females as indicated by the larger percentages as well as number of genres selected by 50 percent or more of the participants. Excluding the "Other" genre, all the genres were selected by 50 percent or more of male CRD players; and all but two genres, simulation and RPG, were selected by 50 percent or more of male NCRD players. Strategy was selected by 76.0 percent of male

CRD players (n = 95) and by 53.8 percent of male NCRD players (n = 50). Also, role playing (RPG) was selected by 72.8 percent of male CRD players (n = 91), and by 40.9 percent of male NCRD players (n = 38).

Table 19

Genres selected by video game players. Counts and percentages by gender and major group

Gender	Genre	Counts	%	Genre	Counts	%
	CRD (n = 22)			NCRD (n = 88)		
Female						
	Casual	15	68.2	Casual	77	87.5
	Music	13	59.1	Side Scroller	72	81.8
	Adventure	11	50.0	Music	63	71.6
	FPS	10	45.5	Adventure	25	28.4
	RPG	10	45.5	Simulation	25	28.4
	Side Scroller	8	36.4	FPS	23	26.1
	Simulation	7	31.8	Sport	23	26.1
	Sport	7	31.8	Strategy	16	18.2
	Strategy	6	27.3	Other	14	15.9
	Other	2	9.1	RPG	13	14.8
	CRD (n = 125)			NCRD (n = 93)		
Male	FPS	108	86.4	FPS	76	81.7
	Side Scroller	100	80.0	Sport	74	79.6
	Casual	96	76.8	Side Scroller	62	66.7
	Strategy	95	76.0	Casual	59	63.4
	Adventure	93	74.4	Music	59	63.4
	Sport	93	74.4	Adventure	55	59.1
	RPG	91	72.8	Strategy	50	53.8
	Music	77	61.6	Simulation	41	44.1
	Simulation	67	53.6	RPG	38	40.9
	Other	12	9.6	Other	8	8.6

Platforms. A list of platforms was provided and participants were to select all platforms typically played. Table 20 lists the platform selections by gender and major group. Both PC and console were selected more than handheld and cell phone by both males and females in both CRD and NCRD. PCs headed the list for female CRD players with 86.4 percent (n = 19). Consoles headed the list for the other groups--NCRD females, CRD males, and NCRD males. Over 90 percent of males in both CRD (91.2%, n = 114) and NCRD (92.5%, n = 86) selected consoles. Participants in CRD selected PCs more than NCRD participants, with 86.4 percent females (n = 19) and 84.8 percent males (n = 106), compared with 69.3 percent (n = 61) NCRD females and 64.5 percent (n = 60) NCRD males.

Table 20

Platforms: Counts and percentages of CRD/NCRD by gender

Gender	Platform	Counts	%	Platform	Counts	%
		CRD (n = 22)			NCRD (n = 88)	
Female						
	PC	19	86.4	Console	73	83.0
	Console	18	81.8	PC	61	69.3
	Handheld	11	50.0	Handheld	40	45.5
	Cell phone	11	50.0	Cell phone	39	44.3
	Other	3	13.6	Other	1	1.1
		CRD (n = 125)			NCRD (n = 93)	
Male						
	Console	114	91.2	Console	86	92.5
	PC	106	84.8	PC	60	64.5
	Handheld	64	51.2	Handheld	34	36.6
	Cell phone	55	44.0	Cell phone	34	36.6
	Other	7	5.6	Other	5	5.4

Modifications. A list of modification categories was provided to the participants. If they answered "yes", they were asked to select all the modifications they typically made. Table 21 presents counts and percentages of types of modifications made to video games by females and males in CRD and NCRD. Of the few CRD female players who modded games, script/macro mods (13.6%, n = 3) and user interface mods (13.6%, n = 3) were the categories most selected. Less than 2.5 percent of females in NCRD selected a mod category.

Males in CRD performed all three types of video game mods--user interface (28.8%, n = 36), script/macro (28%, n = 35), and level design (24%, n = 30). Less than ten percent of males in NCRD performed mods in each of these categories.

Female and male CRD gamers selected script/macro as a mod performed on games; however the percentage of CRD gamers who selected it was fairly small. Interestingly, user interface was selected at the same percentage as script/macro mods by both females and males. Perhaps those who perform script/macro mods also perform user interface mods. Script/macro and user interface mods can require some computer programming skills.

Another question related to modifications made to video games, but not a mod category, was whether participants contributed to message boards. Thirty-two percent of CRD females (n = 7), compared to 3.4 percent of NCRD females (n = 3), reported they contributed to message boards and 47.2 percent of CRD males (n = 59), compared to 17.2 percent of NCRD males (n = 16), reported contributing. Contributing to message boards may indicate more engagement with the video game and the gaming community.

Table 21

Mod categories: Counts and percentages of CRD/NCRD by gender

Gender	Category	Counts	%	Category	Counts	%
	CRD (n = 22)			NCRD (n = 88)		
Female						
	Scripts/macros	3	13.6	Level Design	2	2.3
	User Interface	3	13.6	User Interface	1	1.1
	Level Design	1	4.5	Scripts/macros	0	0.0
	Other	0	0.0	Other	0	0.0
	Msg Boards	7	31.8	Msg Boards	3	3.4
	CRD (n = 125)			NCRD (n = 93)		
Male						
	User Interface	36	28.8	User Interface	8	8.6
	Scripts/macros	35	28.0	Scripts/macros	5	5.4
	Level Design	30	24.0	Level Design	5	5.4
	Other	7	5.6	Other	2	2.2
	Msg Boards	59	47.2	Msg Boards	16	17.2

Hypothesis Three

Perceptions of computer ability and video game playing, exposure, and preferences do not explain females' choice of CRD or males' choice of CRD.

The third hypothesis addressed the influences of computer self-efficacy and video game playing variables on major group for both males and females. A series of logistic regressions were performed with major group as the dependent variable.

Two overall series of logistic regressions were performed to examine whether CSE scores, VGP, exposure variables, and preferences variables significantly explained

whether or not a student was in CRD (dependent variable). The first series used CSE scores and the VGP variable as independent variables. In this series, logistic regressions for the entire sample, females, and males were run. Outcomes are shown in Table 22.

The first logistic regression was performed with the entire sample. When both CSE and VGP were considered together, they significantly explained CRD, $\chi^2 = 60.847$, $df = 2$, $n = 358$, $p = .000$. The first part of Table 22 shows the odds ratios of the entire sample, which suggest the odds of students being in CRD improved by 1.035 (95% CI = 1.022 - 1.049) for each unit increase in CSE scores (p = .000) and by 8.862 (95% CI = 3.043 – 25.089) for each additional student who played video games (p = .000). That is to say, for each point increase in CSE a student was 1.035 times more likely be in CRD, and video game players were almost nine times more likely to be in CRD than non video game players. Overall, the model explained 68 percent of the students in CRD or NCRD. CSE and VGP were better at explaining NCRD (75%) than CRD (57%).

The second logistic regression was performed with the female group. Like the entire sample, when both CSE and VGP were considered together, they significantly explained CRD for females, $\chi^2 = 23.711$, $df = 2$, $n = 145$, $p = .000$. The second part of Table 22 shows the odds ratios, which suggest the odds of females being in CRD improved by 1.064 (95% CI = 1.026 - 1.103) for each unit increase in CSE scores (p = .001) and by 4.757 (95% CI = 1.019 – 22.221) for each additional female who played video games (p = .047). Female video game players were almost 5 times more likely to be in CRD than female non video game players. Overall, the model explained 83 percent of the female students in CRD and NCRD. CSE and VGP were much better at explaining females in NCRD (98%) than CRD (8%).

The third logistic regression was performed with the male group. Like the entire sample, when CSE and VGP were considered together, they significantly explained CRD for males, $\chi^2 = 20.093$, $df = 2$, $n = 213$, $p = .000$. The third part of Table 22 shows the odds ratios for males, which suggest the odds of being in CRD improved by 1.032 (95% CI = 1.016 - 1.049) for each unit increase in CSE scores (p = .000). VGP did not significantly explain CRD. Overall, the model explained 65 percent of the male students in CRD and NCRD. CSE and VGP were better at explaining males in CRD (85%) than NCRD (39%).

It was not surprising CSE explained CRD for all three groups--female, male, and the entire sample. Interestingly. VGP explained CRD for the entire sample. However, when the sample was separated on gender, VGP did not explain CRD for males. It was also interesting, though not surprising, the model was better at explaining NCRD for females and CRD for males.

Table 22

CSE and VGP on major group: Logistic regression

Participants	Variable	*B*	*SE*	*Odds Ratio*	*p*	*95% CI* *Lower*	*Upper*
Entire Sample							
	CSE	0.035	0.007	1.035	0.000	1.022	1.049
	VGP	2.182	0.545	8.862	0.000	3.043	25.809
	Constant	-7.485	1.155	0.001	0.000		
Female							
	CSE	0.062	0.019	1.064	0.001	1.026	1.103
	VGP	1.560	0.786	4.757	0.047	1.019	22.221
	Constant	12.236	3.017	0.000	0.000		
Male							
	CSE	0.032	0.008	1.032	0.000	1.016	1.049
	VGP	1.037	0.933	2.821	0.266	0.454	17.550
	Constant	-5.367	1.514	0.005	0.000		

The second series of logistic regressions used CSE scores, video game exposure, and video game preference variables as independent variables for the major group (dependent variable). Years played and hours played per week were the exposure variables. Challenge level and mods were preference variables. Because these variables were dependent on whether a participant played video games, only video game players were included in this analysis.

Like the first series, the second series contained three logistic regressions. The first was with the entire sample of video game players (n = 294), the second with female players (n = 96), and the third with male players (n = 198). Outcomes are shown in Table 23.

The first logistic regression was performed with the entire sample of video game players and used CSE scores, hours played per week, years played, challenge level, and mods as independent variables. When these variables were considered together, they significantly explained CRD for video game players, $\chi^2 = 79.008$, $df = 5$, $n = 294$, $p = .000$. The first part of Table 23 shows the odds ratios for the entire sample, which suggest the odds of video game players being in CRD improved by 1.025 (95% CI = 1.009 – 1.040) for each unit increase in CSE scores (p = .002), by 1.053 (95% CI = 1.016 – 1.092) for each additional hour played per week (p = .005), and by 4.682 (95% CI = 2.225 – 9.853) for each additional player who modified games (p = .000). Players who modified games were 4.7 times more likely to be in CRD than players who did not modify games. Overall, the model explained 75.5 percent of student players in CRD and NCRD. This model was better at explaining NCRD (87.3%) than CRD (61.8%).

The second logistic regression of the second series was performed with the female player group. Like the entire player sample, when all variables were considered together, they significantly explained CRD for female video game players, $\chi^2 = 23.031$, $df = 5$, $n = 96$, $p = .000$. The second part of Table 23 shows the odds ratios for female players, which suggest the odds of female players being in CRD improved by 1.059 (95% CI = 1.011 – 1.108) for each unit increase in CSE scores (p = 0.014). VGP exposure and preference variables did not significantly explain CRD. Overall, the model explained 83.3 percent of female players in CRD and NCRD. This model was much better at explaining females in NCRD (96.1%) than CRD (35.0%).

The third logistic regression was performed with male players. Like the entire player sample, when all the variables were considered together, they significantly

explained CRD for male video game players, $\chi^2 = 39.950$, $df = 5$, $n = 198$, $p = .000$. The third part of Table 23 shows the odds ratios, which suggest the odds of males being in CRD improved by 1.023 (95% CI = 1.005 - 1.041) for each unit increase in CSE scores (p = .011) and by 4.328 (95% CI = 1.896 – 9.876) for each additional male player who modified video games (p = .001). Similar to the entire video game player sample, male players who modified video games were 4.3 times more likely to be in CRD than players who did not modify games. Overall, the model explained 68.2 percent of male players in CRD and NCRD. This model was better at explaining male players in CRD (74.1%) than NCRD (59.8%).

In both series of logistic regressions, CSE significantly explained CRD for females and males. When females and males were considered together, the VGP variables of hours played per week and mod significantly explained CRD. When females and males were analyzed separately, none of the VGP variables--hours played per week, years played, challenge level, or mod--significantly explained CRD for females and only the mod variable significantly explained CRD for males.

Table 23

CSE and VGP exposure and preference on major group: Logistic regression

Participants	Variable	*B*	*SE*	*Odds Ratio*	*p*	*95% CI Lower*	*Upper*
Entire Sample	CSE	0.024	0.008	1.025	0.002	1.009	1.040
	Hours	0.051	0.018	1.053	0.005	1.016	1.092
	Years play	0.029	0.025	1.030	0.231	0.982	1.080
	Challenge	0.078	0.119	1.082	0.509	0.857	1.365
	Mod	1.544	0.380	4.682	0.000	2.225	9.853
	Constant	-5.159	1.282	0.006	0.000		
Female	CSE	0.057	0.023	1.059	0.014	1.011	1.108
	Hours	0.099	0.091	1.104	0.276	0.924	1.318
	Years play	0.000	0.048	1.000	0.998	0.909	1.099
	Challenge	0.461	0.286	1.585	0.107	0.906	2.775
	Mod	1.149	1.078	3.155	0.287	0.381	26.112
	Constant	-12.180	3.876	0.000	0.002		
Male	CSE	0.023	0.009	1.023	0.011	1.005	1.041
	Hours	0.023	0.018	1.023	0.205	0.988	1.059
	Years play	0.031	0.033	1.032	0.346	0.967	1.101
	Challenge	-0.133	0.143	0.875	0.351	0.661	1.158
	Mod	1.465	0.421	4.328	0.001	1.896	9.876
	Constant	-3.48	1.447	0.031	0.016		

Conclusion

Chapter four presented the findings from a survey of college students in a variety of majors, which were categorized as CRD and NCRD. Participants provided demographic information, video game playing exposure and preferences, and completed the Computer Self-Efficacy scale. Responses were grouped by gender and by major. Descriptive statistics, independent t-tests, and chi-squares were calculated and used to examine student responses. Logistic regressions were performed to examine whether

variables, CSE scores, VGP, exposure variables, and preferences variables significantly explained CRD (dependent variable). Table 24 summarizes the findings.

Table 24

Summary of findings

Variables	Findings
CSE	CRD students had higher mean CSE scores than NCRD students Reject $H1_1$ and $H2_1$
	CSE significantly explained CRD for both females and males Reject $H3_1$
VGP	No significant difference in VGP was found between CRD and NCRD students (female and male) Fail to reject $H1_2$ and $H2_2$
	VGP significantly explained CRD for females Reject $H3_2$ for females
	VGP did not significantly explain CRD for males Fail to reject $H3_2$ for males
Exposure	Hours played per week and years played did not significantly explain CRD (female and male) Fail to reject $H3_3$
	CRD males had the highest mean hours per week of VGP
Preference mode	Multi-player and single player modes were equally preferred by CRD females. Multi-player modes were preferred by NCRD females, CRD males, and NCRD females
	No significant difference in mode was found between CRD and NCRD students (female and male) Fail to reject $H1_6$ and $H2_6$

Table 24 (continued)

Summary of findings

Variables	Findings
challenge	Challenge did not significantly explain CRD (female and male) Fail to reject $H3_4$
	No significant difference in challenge level was found between CRD and NCRD students (female and male) Fail to reject $H1_7$ and $H2_7$
mod	More CRD students modded games than NCRD students (female and male) Reject $H1_8$ and $H2_8$
	Mod significantly explained CRD for males, but not for females Reject $H3_4$
genre (R1)	CRD females selected Adventure, RPG, FPS at a larger percentage than NCRD females
	CRD males selected Strategy and RPG at a larger percentage than NCRD males
platforms (R2)	CRD females selected PCs more than other platforms
	NCRD females, CRD males, NCRD males selected consoles more than other platforms
	CRD students selected PCs at a larger percentage than NCRD students (female and male)
mod cat. (R3)	Scripting and user interface design mods were the most selected modification categories by CRD students (female and male)
msg boards (R3)	Larger percentage of CRD students contributed to message boards about video games than NCRD students (female and male)

There was a significant difference in mean CSE scores between CRD and NCRD students for both females ($H1_1$) and males ($H2_1$). Additionally, CSE significantly

explained CRD for both female ($H3_1$) and male students ($H3_1$). However, no significant difference in VGP was found between CRD and NCRD students, whether female ($H1_2$) or male ($H2_2$). VGP failed to explain CRD for males ($H3_2$), although it explained CRD for females ($H3_2$). The only VGP variable that significantly explained CRD was mod. Mod significantly explained VGP for males ($H3_4$), not for females ($H3_4$). The next chapter discusses the relevance of these findings in the context of literature and research and provides implications for application.

CHAPTER V - DISCUSSION

According to the National Center for Education Statistics (2008), the number of bachelor degrees conferred in Computer and Information Sciences shrunk by 20 percent between 2003 (59,488) and 2005 (47,480). The decline of enrollments in computer related fields is well-documented (Chabrow, 2004; Freuenheim, 2004; Kessler, 2005; Lomerson & Pollacia, 2006; NCES, 2008; Zweben, 2005). The enrollment of females in computer related disciplines (CRD) is decreasing at an even higher rate. *The Chronicle of Higher Education* reported that interest in CRD among females dropped 80 percent between 1984 and 2004 and estimated that currently 0.3 percent of female college enrollees are in CRD (Foster, 2005). This dearth of students in general and females in particular have led some to look to the influence of video and computer games, among other contributing factors, on these enrollments. From suggesting that the video gaming industry discourages females from entering the computer profession (AAUW Educational Foundation Commission, 2000; Carlson, 2006; Natale, 2002) to using video games to recruit students and encourage interest in CRD (Gorriz & Medina, 2000; Mangan, 2005; Van Eck, 2006), people have associated video games with CRD. However, very little empirical research exists to indicate that video game playing is related to enrollments in CRD.

The purpose of this study was to gain new insight into video game playing, exposure, and preferences as well as perceptions toward success with computers among students in computer related disciplines (CRD) and students in non computer related disciplines (NCRD). Comparisons were made between students in CRD and students in

NCRD regarding computer self-efficacy (CSE), video game playing (VGP), exposure, and preferences and the influence of these variables on being in CRD. This chapter discusses the findings of the study. It is organized with a discussion of the participants, followed by a discussion of the findings in CSE, VGP, VGP exposure, and VGP preferences. It concludes with implications for application, additional research, and limitations.

Study Participants

Data were gathered by entering 23 undergraduate academic classes from five universities in the south region of the United States. Surveys were distributed to students in the classes with instructor's approval. Classes were selected based upon topic taught, especially for the CRD major. For example, a course in computer programming was selected because it was thought more CRD students would be taking this course. Based upon responses to gender and major, students were grouped into CRD females, CRD males, NCRD females, and NCRD males. A total of 389 students participated providing 378 (97.1%) usable responses as the sample. Efforts were made to balance the number of CRD students with the number of NCRD students; however, the number of NCRD students exceeded the number of CRD students. In particular, the number of females in CRD was very low (26) as many of the classes selected for CRD had only one or two females enrolled and frequently had no female students enrolled.

Age and ethnicity were collected as demographic information. Ages of all participants ranged from 17 to 59 years with the average age consistent with the national average of 22 to 24 years for college students enrolled in degree-granting institutions in 2005 (NCES, 2008).

The overall percentage of ethnic students who participated was less than the overall percentage of ethnic students enrolled in degree granting institutions, both two and four year, in 2005 (NCES, 2008). Slightly more than one quarter or one of four participants was an ethnic student compared to 31 percent enrolled nationally. However, when looking at the studied groups, both females and males in CRD had larger percentages of ethnic participants than the national average of ethnic students. Additionally a larger percentage of ethnic students were in the CRD group than the NCRD group--34 percent in the male CRD group and 35 percent in the female CRD group. Although the greater percentage of ethnic participants was likely due to the area of the country sampled, it was interesting and encouraging in light of the Bureau of Labor and Statistics reporting of ethnic makeup in IT fields of 7.2 percent Blacks and 5.1 percent Hispanics (Bureau of Labor Statistics, 2008).

Overall, participants in the study were similar in age to national averages of college students. In the entire sample, ethnic groups were not represented at the same percentages as nationally; however, in CRD fields, they were represented at proportionally greater levels than national levels.

Findings

The primary research question was "To what extent do perceptions of computer ability and video game playing, exposure, and preferences explain females being in CRD and males being in CRD?" The following discussion will center on the four aspects of the research question--perceptions of computer ability, video game playing, exposure, and preferences.

Perceptions of Computer Ability

The *Computer Self-Efficacy Scale* (Cassidy & Eachus, n.d.) was used to measure participant's perceptions of computer ability. Computer self-efficacy is defined by Compeau and Higgins as the "judgment of one's capability to use a computer" (1995, p. 192). It is based on Bandura's self-efficacy, which can be defined as a person's self-perception of his or her ability to achieve (1986).

One of the main applications of self-efficacy theory is the relationship of self-efficacy to being in a particular discipline or industry. Many studies, including this one, support such a link (Goh et al., 2007; Sam et al., 2005; Shaw & Giacquinta, 2000; Smith, 2002; Zhang & Espinoza, 1998). In this study, students in CRD had significantly higher CSE scores than students in NCRD, supporting the findings from other studies that increased exposure to computers leads to higher CSE scores, if one assumes students in CRD use computers to a greater extent than students in NCRD. This finding applied to both females and males; students in CRD outscored students in NCRD on the CSE scale. Additionally, CSE was found to be highly related to CRD, supporting the relationship between computer self-efficacy and being in a computer related major.

Other findings with CSE were not supported by this study, primarily with gender. For example, studies have found females tend to have higher self-efficacy in traditionally female fields and lower self-efficacy in traditionally male fields (Betz & Hackett, 1981; Branch & Lichtenburg, 1987). Most fields and/or majors within CRD are considered traditionally male; correspondingly, some studies have found that males have higher CSE than females (Busch, 1995; Cassidy & Eachus, 2002; Hill et al., 1987; Natale, 2002; Young, 2002). This study did not find significant differences in CSE by gender. In fact,

females in CRD outscored males in CRD, and females in NCRD had similar scores to males in NCRD. The students' discipline (CRD or NCRD), not their gender, was related to differences in CSE scores. Sam et al. (2005) and Smith (2001) had similar findings.

Interestingly, and a little confusing, are the findings

1. CRD/NCRD, not gender, was related to CSE differences
2. No significant differences in CSE scores were found between males and females
3. CSE explained females and males in CRD.

In light of these findings, one might assume the number of males and females in CRD would be similar. However, females are underrepresented in CRD (Foster, 2005). This seeming contradiction can seem confounding. Two overall reasons for this discrepancy are proposed and discussed here.

CSE scores from both females and males in CRD and NCRD were quite high with means ranging from 140 to 159 of a possible score of 174. This compares to Cassidy and Eachus' (n.d.) findings of CSE means ranging from 101 for nursing students to 159 for software engineering students using the same measure as this study (adjusted for 29 versus 30 items--see Chapter 3). Students today have access to a breadth of technology. Texting, email, the Internet and World Wide Web, downloading music and video, social networking sites, and video games may suggest greater exposure and explain higher CSE scores. The Cassidy and Eachus scale, used in this study, was technically non-specific and dealt with generalities in computer usage. Perhaps a more specific scale, such as one that distinguishes among technologies or measures programmer self-efficacy would have different outcomes.

Other reasons for this finding could be while CSE is highly related to CRD, it is neither the only nor probably the strongest factor in enrolling in CRD. Many researchers have studied why females choose careers in technology and have found many other influences on females and career choices, including role models (Bandura et al., 2001), parental occupation (Askar & Davenport, 2009), and bias among counselors, teachers, and peers (Lomerson & Pollacia, 2006) . These factors may be related to corresponding enrollments in CRD.

Video Game Playing

The assumption video game players choose CRD has been one of the bases for using video games to recruit students into CRD (Gorriz & Medina, 2000; Nagel, 2008; Natale, 2002; Young, 2007). One of the purposes of this study was to investigate this assumption by asking students in CRD and NCRD about their video game playing habits. The first point in question was to determine patterns in video game play between females in CRD and NCRD and males in CRD and NCRD.

Overall 65 percent of females played video games regardless of major. This percentage is lower than the study by Lenhart et al. (2008) who found 94 percent of female teens play video games. However, differences may be explained by the older female demographic in this study. In another survey, comScore Media Metrix reported the number of female gamers to be increasing with the largest percentage increase among the 12 to 17 year olds (55%) and 55 to 64 year olds (43%). For women in the 18 to 34 age range, an age range similar to that of this study, a lesser percentage increase was reported--18 to 24 had a 35 percent increase and 25 to 34 had a 14 percent increase (comScore Media Metrix, 2008).

A small difference in the percentage of video game players between females in CRD and NCRD was found; however, the difference was not significant. When analyzed with logistic regressions, female video game players were almost 5 times more likely to have a major in CRD than female non video game players. So, there may be some merit to the assumption of a relationship between playing video games and being in CRD, at least for females. The model, however, was much better at explaining NCRD than CRD. There are many more NCRD females than CRD and the number of females in CRD is declining, yet the number of female gamers is increasing.

For males, this study found no significant difference in video game play between those in CRD and in NCRD. Over 95 percent of males played video games regardless of academic major group. A comparable finding was made by the Pew Internet & American Life Project (Lenhart et al., 2008) in their study of teens and video games. They found 99 percent of teen boys play video games, not surprising considering the popularity, availability, and male-orientation (Natale, 2002) of video games. Additionally, this study found VGP did not explain CRD for men. However, when comparing the number of males who "currently" (within the past year) played video games, a larger percentage of CRD males than NCRD males were current players. Perhaps this is because of the proximity of video games to the CRD students' academic major choice. For example, while taking a break from writing a program on a computer, a student may choose to play a video game without leaving the computer.

When one considers the findings of CSE and VGP between students in CRD and NCRD, a couple of myths or false assumptions can be examined.

Myth #1. Video game play is related to males having higher computer self-efficacy than females (AAUW Educational Foundation Commission, 2000; Natale, 2002; Rabasca, 2000). This study found no significant difference in CSE for males and females, even though a significantly larger percentage of males (95%) than females (65%) played video games.

Myth #2. Video or computer game play leads to interest in computer careers (Gorriz & Medina, 2000; Natale, 2002). This study found no significant difference in video game play with males in CRD and NCRD, nor did it find video game play to explain males in CRD. Additionally, no significant difference in video game play with females in CRD and NCRD was found, although video game play was found to explain females in CRD. However, the number of female gamers is rising, yet the number of females majoring in CRD is declining. An analogy can be made to the music industry. Many people listen to music, sing, or play an instrument, yet a small portion become music majors or have a career in the music industry.

It is important to point out that when the entire sample was analyzed (both males and females together), it appeared VGP explained enrollment in CRD. That is, a larger percentage of CRD students reported playing video games. It is understandable that researchers, educators, and industry professionals would look to video games as influencing CRD. However, gender may be related to VGP differences between CRD and NCRD. As discussed above, when gender was analyzed separately, VGP showed little to no relationship to CRD.

Although VGP, itself, may not explain CRD, the amount of VGP and types of games played may in part explain it. Investigating video game exposure and preferences may help in understanding the role VGP may have with females and males in CRD.

Video Game Exposure

An argument of video game researchers is the amount of video game exposure makes a difference in attitudes and perceptions toward computers (Gorriz & Medina, 2000; Lucas & Sherry, 2004; Natale, 2002; Rabasca, 2000). This study analyzed VGP exposure by comparing the years of play and hours of play per week for females and males in CRD and NCRD. The analysis suggested two overall findings. One was males had more exposure to VGP than females in terms of years of play and hours per week of play. The second was for the entire sample, CRD students had more exposure to video games than NCRD students; however, when analyzed by gender, females in CRD had slightly more exposure than females in NCRD and males in CRD had slightly more exposure than males in NCRD.

The findings that males had more video game playing exposure than females and CRD students had more exposure than NCRD students were obviously no surprise. These findings have been reported in numerous studies and have been the basis for the assumption about VGP and major choice within CRD. The assumption seems to make sense--males have more exposure than females to video game play and more males than females choose CRD--therefore, exposure to video games is the underlying reason for the gender discrepancy in CRD (Natale, 2002). Although this study found males had greater video game play exposure than females, it found the above assumption to be erroneous when CRD students were compared to NCRD students by gender. CRD students had

more exposure to video games than NCRD students; however, the differences were quite small when gender was analyzed separately. In fact, NCRD females reported an earlier mean starting age of VGP than CRD females. Additionally, the exposure variables were used as covariates in a logistic regression with group (CRD/NCRD) as the dependent variable. In this analysis, although hours of play per week explained CRD for the entire sample, none of the exposure variables significantly explained CRD for either male or female students when analyzed separately. A larger number of males were in CRD and played more hours per week and a larger number of females were in NCRD and played fewer hours per week. This seemed to suggest gender, rather than CRD, was related to hours per week of video game play.

Another observation confirmed Aquila's (2006) findings. For women, there seemed to be little direct relationship between early exposure to video game play and amount of current video game play. NCRD females reported a younger starting age (8.25 years) on average than CRD females (10.14 years); yet CRD females reported playing more hours per week (5.57 hours) on average than NCRD females (2.89 hours) and a higher percentage of CRD females (85%) reported playing video games in the last year than NCRD females (72%). This study did not try to determine the motivation for women to play video games, but apparently, a younger starting age was not a primary reason females currently play video games.

Video Game Preferences

In addition to video game play and the amount of video game play (exposure), preferences and practices were analyzed for females and males in CRD and NCRD. These included the mode of play (single or multi-player), challenge level, genres played,

platforms played upon, whether the player modded a game, types of mods made, and whether the player contributed to a message board about a video game. Preferences and practices were both used in gathering data. For example, participants were asked what video game mode they preferred to play--single player or multi-player. But for genre and platforms, participants were asked to select all genres they played and all platforms they played. For convenience, preferences and practices were grouped under the heading "preferences".

All groups, females in CRD and NCRD and males in CRD and NCRD, preferred to play multi-player games. This is consistent with findings that players prefer the social or community aspect of video games (Beedle, 2004; Gee, 2003; Herz, 2002; Lenhart et al., 2008). One interesting finding was CRD females preferred single player games equally with multi-player games. One may speculate why this may be, recognizing this sample group to be older and older players may play more casual type games (Tams, 2007). Casual games are generally single-player games; however, more multi-player casual games are being made available for download and play.

Challenge level was measured on a six-point Likert scale with "Not Challenging" = 1 and "Highly Challenging" = 6. All groups, females in CRD and NCRD and males in CRD and NCRD, preferred moderately challenging video games, reporting mean challenge levels between 3.0 and 4.0. Females in CRD did not differ significantly from females in NCRD and males in CRD did not differ significantly from males in NCRD. Females in NCRD reported the least challenging preferences with a mean between 3.0 and 3.5 (3.33), and the other groups reported challenge preferences with means between 3.5 and 4.0. Although this study did not distinguish among types of challenges, challenge

level can be understood various ways, with the game being challenging to play or challenging to learn or both. From other studies, girls prefer games challenging to play, but not challenging to learn. For example, they prefer puzzles that may be hard to solve, but use uncomplicated input controls to interact with the puzzles (Aquila, 2006). Interestingly, in this study, females in CRD preferred about the same level of challenge as males in CRD and males in NCRD.

The difference in genres between males and females and then CRD and NCRD students was fascinating. Other studies have analyzed video game genres by age or gender (Beedle, 2004; comScore, 2008; Lenhart et al., 2008) and although each researcher had slight variations of gaming genres, some common themes were apparent. The first theme was that casual games are a popular genre regardless of age and gender (comScore, 2008; Lenhart et al., 2008). Although some do not consider the casual game to be a true video game (Aquila, 2006; Tams, 2007), many play casual games along with other genres. In this study, those who selected the "Casual" genre and no other genre, were considered non video game players (NVGP) and were not considered in the genre analysis. However, the "Casual" genre was selected by over 60 percent of both males and females indicating in addition to other genres, over one-half of the gamers played casual games. Females, both CRD and NCRD, selected the "Casual" genre more than other genres with a larger percentage of NCRD females (87.5%) selecting "Casual" than CRD females (68.2%). Interestingly, 76.8 percent of CRD males selected the "Casual" genre versus 63.4 percent of NCRD males.

A second theme found by other researchers was that gamers tend to play more than one genre (Lenhart et al., 2008). This study confirmed these findings with several

genres selected by over 50 percent of each group. All the genres, excluding "Other", were selected by over 50 percent of the male CRD group, followed by seven genres selected by over 50 percent of the male NCRD group. Females did not select as many genres with three genres selected by over 50 percent of both CRD and NCRD females. This confirmed other studies that males have exposure to a greater variety of genres than females (Calvert et al., 2005; Colley & Comber, 2003; Natale, 2002). The variety of game genres played was not apparent in females, whether CRD or NCRD.

A third theme regarding preferences related to genres is the types of games girls like (Denner, Bean, & Werner, 2005; Gorriz & Medina, 2000; Inkpen et al., 1994; Van Eck, 2006). Studies have found girls prefer non-violent and cooperative games. Interestingly, this study showed a difference in gaming preferences, which may challenge previous studies in that over 45 percent of CRD females selected first person shooter (FPS) games as those they played. FPS games are violent and competitive in nature. Additionally, role playing games (RPG) were selected by over 45 percent of CRD females. RPG games may have some competitive and violent features, although not all do. Both FPS and RPG were selected by a smaller percentage of NCRD females (14.8).

Whether to develop "girl-friendly" games has been a subject of debate among researchers and game developers (Denner et al., 2005). "Girl-friendly" games have an engaging plot, are socially based, use bright graphics, and are in a realistic setting (Cassell & Jenkins, 1998; Denner et al., 2005). Examples of these games include *Nancy Drew*® or *Sims*™. Within the last few years, the gaming industry has responded to the demand for more games that appeal to girls. Nevertheless, girls are not selecting CRD to

any large extent as indicated by the low female enrollments within CRD. Perhaps "girl friendly" games have little to do with interest in CRD.

It was interesting of those females who were drawn to CRD, a traditionally male discipline, a fairly large percentage played competitive and violent video games. Age may have influenced the types or genres of games played by CRD females. In this study, CRD females were older than NCRD females. "Girl-friendly" games may not have been developed when the older students were young precluding access to them. Many "girl-friendly" games appeal to younger girls, not teens or adults. If the predominant gaming genres available were violent, competitive ones, then perhaps that is why CRD females played them. Motivation for playing genres was not a part of this study. Research is needed into what game genres CRD females play and for what reasons.

Not much difference was found in gaming platforms between the gender and major groups. All four groups selected consoles and PCs more than other platforms. This was consistent with Lenhart et al.'s (2008) findings that consoles and PCs were played more than other platforms. This study contradicted Inkpen's (1994) findings that girls preferred the personal computer over consoles; however the gaming industry has changed since that study. CRD students, both females and males, selected PCs as one of their gaming platforms to a larger extent than NCRD students. For males, the percentage point difference was over 20. Playing games on a computer by students who study computers was not surprising, if for the convenience of proximity alone. Most CRD students use computers for many of their classes. It makes sense that they would use a computer to play video games. Additionally, understanding how the computer operates, how to install and configure software, and how networks are set up may encourage CRD players to play

multiplayer video games on computers. This study did not distinguish between video and computer games. Distinguishing between the two may have led to different outcomes and may have found computer game play explained CRD. Although video game play is on the rise, both in the number of players and in the amount of time played, the number of students majoring in CRD is on the decline. It would be interesting to see if computer game play is declining as well--in number of players and amount of time played--especially with proliferation and popularity of consoles.

Responses to whether players modified games were interesting and may give support to game development courses for recruitment purposes at the middle-school, high school, and college levels. Seventy-four of 328 players (22.5%) reported modding games. Both males and females in CRD modded games, although a larger percentage of males in CRD (44.0%) reported modding games than females in CRD (22.7%). Very few students in NCRD reported modding, whether female (2.3%) or male (12.9%). The types of mods done were mainly user interface design and scripts/macros. Additionally, males in CRD reported level design mods. Level design and script/macros require some computer programming and are directly related to the types of activities performed in CRD. Modding a game significantly explained CRD for males.

Work is being done to introduce girls to game design at an early age such as middle school (Denner et al., 2005). What impact this may have on future enrollments of females in CRD remains to be seen; however, because the activity, game design, is related to and can be a subset of the activities in CRD, it may prove more beneficial than relying on "girl-friendly" games to encourage CRD interest.

Finally, a larger percentage of CRD students, female (31.8%) and male (47.2%) contributed to message boards than NCRD students, female (3.4%) and male (17.2%). Perhaps this implies for CRD students video game play is a community activity that includes sharing knowledge, ideas, and tips. Contributing to message boards may indicate more involvement with the video game and the game community, as well as interest in aspects of the video game design.

Implications for Application

The primary motivation for this study was the decline in CRD enrollments, especially females, and understanding the relationship of video games to CRD. As stated previously, some schools have used video games to encourage general interest in CRD and some writers have encouraged the gaming industry to develop "girl-friendly" games to help encourage female interest in CRD. However, when analyzing the saturation of video game play among males and increasing video game play among females, and observing the decline of CRD enrollments, it would appear that video game play has no direct impact on CRD enrollments. Indeed, this study found little to no relationship between video game play and CRD. This section begins with implications and ideas for increasing male CRD enrollments and then concludes with implications and ideas for increasing female CRD enrollments within the context of video games.

More males played video games and played more video game genres than females. However, video game play did not explain male enrollment in CRD as NCRD males were as likely to play video games. Although video game play did not explain CRD for males, video game mods did. Video game mods may be related to video game design and may indicate that modders are interested in game design. Colleges and

universities offering game design courses may foster interest in CRD. However, more research is needed into the relationship between video game mods, game design courses, and interest in CRD.

It is important to be aware, though, that game design courses may not necessarily be in a computer related discipline. Not only does game design address a small area within CRD, the game design field is extremely diverse with needed skills in art, education, graphics, physics, writing, math, computer programming, to name a few. Some schools have created departments and divisions solely for game design. Additionally, the field is difficult and can be discouraging to some gamers who think that they can design games because they have modded a few. Therefore, using game design courses solely for recruiting into CRD may not be as effective as other recruiting efforts.

Females may also benefit from game design classes. Some studies have shown that introducing game design to girls in late elementary and middle school years may increase their interest in CRD (Denner et al., 2005; Gorriz & Medina, 2000). An increase in programming self-confidence was found by college females entering a game development contest (Schaffhauser, 2009). Using "girl-friendly" games to foster interest in CRD does not seem to be effective. Although they provide an added market to the game industry, they are not related to females selecting CRD. How to encourage females to choose a male dominated field such as CRD is an ongoing complex question. From this study, violent video games are not a reason females do not choose CRD as some have suggested (AAUW Educational Foundation Commission, 2000; Carlson, 2006; Natale, 2002; Rabasca, 2000), nor are "girl-friendly" games a reason females may choose CRD. It may be more beneficial to rely on more traditional sources of recruitment, such

as role models in CRD, high school counselors, social activities for CRD students, cohort approaches, or business and industry involvement in recruiting.

Additional Research

The intent of this study was to gain an overall picture of CSE and VGP and their relationship to CRD, rather than a deeper and more descriptive understanding of the VGP and CRD experience. In part, the motivation for the study was to examine assumptions by some that video games influence CRD enrollments by either being partly responsible for declining female interest and participation in CRD or by video games being partly responsible for interest in CRD by players, particularly male. To that end, the study was successful. However, the problem of declining CRD enrollments, especially with females was not directly addressed. A more in-depth study of experiences, perceptions, and motivations of students in CRD and NCRD may shed some light. Understanding experiences of students in CRD and perceptions of CRD by NCRD students may provide insight into what recruitment efforts may prove successful. Using this study as a framework and starting point, following are some suggestions for additional research.

This study found CRD females played video games thought to be disliked by females, such as FPS. Do CRD females play video games differently than NCRD females? Why? Is it important for CRD females to be competitive in play? What other extra curricular activities do CRD females pursue and do these influence their major choice?

Although the number of enrollments in CRD is declining, many students, including females, not only play video games, but participate in social networking sites, customize social networking pages with Hyper Text Markup Language (HTML),

upload/download photos, music, and videos, blog, text, tweet, etc. What influence does using computers for leisure activities have with students in CRD and NCRD? Do these activities influence students' perception of CRD? How? What role does early experiences with computers, either with video games or other activities, influence perceptions of CRD?

Continuing research into perceptions of CRD is also suggested. For example, what perceptions of CRD do students in CRD and NCRD have? Where did these perceptions come from? What influences these perceptions? Are the perceptions and sources of perceptions different for females and males? Do perceptions include stereotypes that need to be countered?

Limitations

The "equivalence of groups on participant characteristics" (Morgan et al., 2006, p. 318) was not considered to be high because this study was non-experimental. The groups were, however, designated according to gender and academic major classification. The groups were balanced in number, except for the CRD female group, which was much smaller in size. This discrepancy in size may have influenced outcomes and analysis, as comparisons were made across groups. Other variables (i.e., ethnicity, age, family of origin) may influence differences in VGP and CSE; however, it was not the intent of this study to explore all explanatory variables.

Conclusion

This study explored CSE, VGP, exposure, and preferences of students in CRD and NCRD. Overall it found CSE explained students in CRD; it appears VGP has little influence on students being in CRD. The underlying assumptions that video games

influence enrollments in CRD were not supported by this study. Efforts to recruit students into CRD through the use of VGP may not be as effective as other recruitment approaches.

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APPENDIXES

A. Academic Major Codes

Major Codes

CRD (Computer Related Disciplines):

10 - CS (Computer Science, Computer Engineering, Math/CS, Programming, Software Engineer, Software Development)
11 - CIS (VCM, Networking, Business Administration/CIS, BCIS,Web, Computer Systems, Software Systems, Information Systems, Industrial Engineering)
12 - Other (Mechanical Engineer, Electrical Engineer, Engineer, BioTech, Instr. Tech, Educational Tech)

NCRD (Non-computer Related Disciplines):

20 - Business (General Business, Business Administration,)
21 - Management
22 - Marketing (Advertising)
23 - Accounting
24 - Finance
25 - Organizational Communication
26 - HR Management
27 - Public Relations

30 - Fashion Merchandising (Apparel Merchandising, Fashion Design, Apparel)
35 - Interior Design

40 - Education (Primary Education, Secondary Education)

50 - Math
51 - Math Education

55 - Science (Chemistry, Life Science, Biology, Physics)
56 - Nursing
57 - Prevet, Animal Science
58 - Premed
59 - Nutrition and Food Science/ Exercise Science

60 - Music (Performance, Instrumental--any type, Music Education, Premusic Therapy)
61 - Theater (Theater Ed)

70 - Criminal Justice (Law Enforcement, JD)

80 - Liberal Arts (Humanities)
81 - English
82 - Art

NCRD (cont.):

83 - History
84 - Political Science

85 - Bible
86 - Youth ministry (family ministry)

90 - General Studies
95 - Family Studies

null - I don't know or undecided

B. Survey

Note: The survey students received was as described in the text. The version here has the gray scale removed and has been reduced to fit margins.

00374

Colorado State University

School of Education
1588 Campus Delivery
Fort Collins, Colorado 80523-1588

PLAYING VIDEO GAMES AND COMPUTER PERCEPTIONS

The following survey is designed to gather information to help us understand the relationship between playing video games, perceptions of computer ability, and academic major. Your class is one of several that will participate in this research.

The project is entitled *Video Game Play and Computer Self-Efficacy: College Students in Computer Related and Non Computer Related Disciplines.* The purpose of this project is to explore the influence of video game play and student's perceptions of computers. There are no risks in participating in this research.

There are no direct benefits of participating in this study; however, the anticipated benefits include a better understanding of the relationship of video game play and majoring in computer related disciplines. This information may provide empirical evidence to support or not support the use of video games in recruiting students into computer related disciplines.

The survey should take about 15 minutes to complete. Your responses are completely anonymous and are held in the strictest professional confidence; only grouped findings will be reported and no one will know how you responded to any of the items. Your participation in this study is completely voluntary and will have no impact on your grade.

When you are finished with the survey, please submit it to either your instructor or to the person who is administering the survey. By returning the completed survey to your instructor or to the person administering the survey, you are giving your consent to participate in the study. If you have any questions or are interested in the outcomes of this study, please contact Carol Buse at carol.buse@gmail.com or 806-355-5709 or Dr. Carole Makela at 970-491-5141. If you have any questions about your rights as a volunteer in this research, contact Janell Barker, Human Research Administrator, at 970-491-1655,

Thank you for participating in this study.

Carole Makela

Carol Buse

Carole Makela, Ph.D.
Professor

Carol Buse
Doctoral Candidate

PLAYING VIDEO GAMES AND COMPUTER PERCEPTIONS

I. Video Game Playing

The first few questions ask about your experiences in playing video games. For this survey, video games refer to both video games and computer games. Please respond by marking X for the most appropriate response, or by supplying the information requested in the blank provided.

1. Do you currently (within the last 12 months) play video games for recreation?

   [ ] Yes
   [ ] No

   If yes, on average how many hours per week do you play?

   _____ hours per week

2. Have you played video games for recreation in the past (prior to the last 12 months)?

   [ ] Yes
   [ ] No

   If yes, on average how many hours per week did you play?

   _____ hours per week

Note: If you answered "No" to both 1 and 2, please skip to Section II

3. How old were you when you first began playing video games?

   _____age in years when I started

4. Realizing that there may be a period of time in which you did not play video games, approximately how many years have you been playing video games?

   _____Years

5. Which mode do you prefer to play? Please select one.

   [ ] single-player
   [ ] multi-player

6. How challenging do you find the video games that you typically play?

Not Challenging					Highly Challenging
1[ ]	2[ ]	3[ ]	4[ ]	5[ ]	6[ ]

7. What type(s) of video games do you play or have you played? Check all that apply. The examples do not include every game in the category.

[ ] Adventure (e.g., Gabriel Knight, Syberia, Silent Hill)
[ ] Casual games (e.g., Tetris, Yahoo! Games)
[ ] First-Person Shooters (e.g., Quake, Doom, Halo, Rainbow 6)
[ ] Music-based (e.g. Guitar Hero®, DDR)
[ ] Role-playing (e.g., Neverwinter Nights, Everquest, World of Warcraft, Oblivion)
[ ] Side-scroller (e.g., Super Mario Brothers)
[ ] Simulations (e.g., Sims, Microsoft Flight Simulator)
[ ] Sports (e.g.. Madden, ESPN, XSN sports title)
[ ] Strategy (e.g., Age of Empires II, Civilization III, Cossacks, StarCraft)
[ ] Other. Please specify. _____

8. Which platform(s) do you use to play video games?
Check all that apply. The examples do not included all possible platforms.

[ ] Console (e.g., XBOX 360™, PlayStation® II, PlayStation® III, Wii™, GameCube)
[ ] Handheld (e.g., Game Boy Advance, Nintendo DS, PSP)
[ ] Personal Computer (e.g., PC or Mac)
[ ] Cell phone
[ ] Other _____
[ ] Do not know

9. Have you ever made modifications ("modded") to a video game?

[ ] No, I have not made modifications to a video game

[ ] Yes, I have made modifications by (check all that apply)
- [ ] scripting/macros
- [ ] level design
- [ ] user interface modification
- [ ] other – please describe the modifications (ok to use the back of this page)

10. Have you ever contributed to a video gaming web site or discussion board?

[ ] Yes
[ ] No

II. Perceptions About Using a Computer

This set of statements reflects perceptions about using computers. There are no 'correct' answers; it is your views that are important. It will take you only a few minutes to complete this section, but it is important that you respond to each statement.

Please respond to each statement by putting a circle around the number that best reflects your agreement or disagreement with that statement. There are six possible responses to each statement ranging from: 'Strongly Disagree' (number 1) to 'Strongly Agree' (number 6):

1 . . . . . 2 . . . . . 3 . . . . . 4 . . . . . 5 6
St· ngly Disagree — Strongly Agree

		Circle One					
1.	Most difficulties I encounter when using computers, I can usually deal with.	1	2	3	4	5	6
2.	I find working with computers very easy.	1	2	3	4	5	6
3.	I am very unsure of my abilities to use computers.	1	2	3	4	5	6
4.	I seem to have difficulties with most of the packages I have tried to use.	1	2	3	4	5	6
5.	Computers frighten me.	1	2	3	4	5	6
6.	I enjoy working with computers.	1	2	3	4	5	6
7.	I find computers get in the way of learning.	1	2	3	4	5	6
8.	Computers make me much more productive.	1	2	3	4	5	6
9.	I often have difficulties when trying to learn how to use a new computer package.	1	2	3	4	5	6
10.	Most of the computer packages I have had experience with have been easy to use.	1	2	3	4	5	6
11.	I am very confident in my abilities to use computers.	1	2	3	4	5	6
12.	I find it difficult to get computers to do what I want them to.	1	2	3	4	5	6
13.	At times I find working with computers very confusing.	1	2	3	4	5	6
14.	I would rather that we did not have to learn how to use a computer.	1	2	3	4	5	6
15.	I usually find it easy to learn how to use a new software package.	1	2	3	4	5	6
16.	I seem to waste a lot of time struggling with computers.	1	2	3	4	5	6
17	Using computers makes learning more interesting	1	2	3	4	5	6

18.	I always seem to have problems when trying to use computers.	1	2	3	4	5	6
19.	Some computer packages definitely make learning easier.	1	2	3	4	5	6
20.	Computer jargon baffles me.	1	2	3	4	5	6
21.	Computers are far too complicated for me.	1	2	3	4	5	6
22.	Using computers is something I rarely enjoy.	1	2	3	4	5	6
23.	Computers are good aids for learning.	1	2	3	4	5	6
24.	Sometimes, when using a computer, things seem to happen and I don't know why.	1	2	3	4	5	6
25.	As far as computers go, I don't consider myself to be very competent.	1	2	3	4	5	6
26.	Computers help me save a lot of time.	1	2	3	4	5	6
27.	I find working with computers very frustrating.	1	2	3	4	5	6
28.	I consider myself a skilled computer user.	1	2	3	4	5	6
29	When using computers I worry that I might press the wrong button and damage it.	1	2	3	4	5	6

III. About You.

Please answer these questions by either filling in the blank or marking an "X".

1. What is your age? _____years

2. What is your gender?
   [ ] female
   [ ] male

3. What is your academic major? _____

4. Which category best describes your ethnicity? Please select one.

   [ ] African-American or of African descent
   [ ] Asian-American or of Asian descent
   [ ] Caucasian
   [ ] Hispanic-American or of Latin descent
   [ ] Native American
   [ ] Other _____

5. What would you like to share about video game playing and/or perceptions about using computers to improve our understanding? OK to continue on the other side.

C. Letter to Professors

Colorado State University

School of Education
1588 Campus Delivery
Fort Collins, Colorado 80523-1588

Dear Professor,

My name is Carol Buse. I am a graduate student at Colorado State University in Fort Collins.

I am inviting your class to participate in my research project, *Video Game Play and Computer Self-Efficacy: College Students in Computer Related and Non Computer Related Disciplines.* The purpose of this project is to explore the influence of video game play and student's perceptions of computers.

At a time that is convenient to you within the next couple of weeks, I would like to survey students in classes you teach. The survey asks students about their video game playing, preferences and their perceptions of computers. No identifying information will be collected and the risks of participating in this study are very small, if existent. The survey will take students approximately 15 minutes to complete.

There are no direct benefits of participating in this study; however, anticipated benefits include a better understanding of the relationship of video game play and majoring in computer related disciplines. This information may provide empirical evidence to support or not support the use of video games in recruiting students into computer related disciplines.

If you are willing to have your class(es) participate, please sign below. Also, please indicate, below and next to your signature, one or two dates and times you would permit your class to be surveyed. Once a date is arranged, I will send you the surveys with postage paid return envelopes, I will identify a designated person to come to your class and administer the survey, or I will come to your class and administer the survey myself. I will be happy to provide you with a summary of the outcomes of this study if you are interested.

If you have any questions, please contact me, Carol Buse at carol.buse@gmail.com or 806-355-5709 or Dr. Carole Makela at 970-491-5141. If you have any questions about your rights as a volunteer in this research, contact Janell Barker, Human Research Administrator, at 970-491-1655,

Thank you for your consideration and participation.

Carole Makela, Ph.D.
Professor

Carol Buse
Doctoral Candidate

Colorado State University

School of Education
1588 Campus Delivery
Fort Collins, Colorado 80523-1588

Yes, I am willing to have my class(es) participate.

Class:_____ Dates/ Times best for survey
_____
_____

Class:_____ Dates/ Times best for survey
_____
_____

My contact information:

I would like a summary of the study, sent to me at:_____
_____

_____ _____
Signature Date

D. Human Subjects Research Approval

Colorado State University

Research Integrity & Compliance Review Office
Office of Vice President for Research
Fort Collins, CO 80523-2011
(970) 491-1553
FAX (970) 491-2293

DATE: October 20, 2008

TO: Carole Makela, Education, 1588
Carol Buse, Education, carol.buse@gmail.com

FROM: Janet Barker, IRB Administrator
Research Integrity & Compliance Review Office

TITLE: Video Game Play and Computer Self-Efficacy: College Students in Computer Related and Non Computer Related Disciplines

IRB ID: 019-08H **Review Date:** October 20, 2008

The Institutional Review Board (IRB) Administrator has reviewed this project and has declared the study exempt from the requirements of the human subject protections regulations as described in 45 CFR 46.101(b)(2). The IRB determination of exemption means that:

- **You do not need to submit an application for annual continuing review.**
- **You must carry out the research as proposed in the IRB application**, including obtaining and documenting (signed) informed consent if stated in your application or if required by the IRB.
- **Any modification of this research should be submitted to the IRB through an email to the IRB Administrator, prior to implementing <u>any</u> changes**, to determine if the project still meets the Federal criteria for exemption. If it is determined that exemption is no longer warranted, then an IRB proposal will need to be submitted and approved before proceeding with data collection.
- **Please notify the IRB if any problems or complaints of the research occur.**

Please note that you must submit all research involving human participants for review by the IRB. **Only the IRB may make the determination of exemption**, even if you conduct a similar study in the future.