

Effects of Gaming on the Gender Gap in Enrolling in Information Technology Classes

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Abstract

The United States is quickly losing its competitive Informational Technology (I.T.) edge to other nations who are better able to meet the demand for qualified I.T. workers. The United States will have only half the qualified graduates needed to fill the 1.5 million information technology jobs by the year 2012 (Bombardieri, 2005). Women make up half of the labor force in the United States yet only three out of 10 computer systems analysts, engineers, and scientists are female (U.S. Department of Labor, Women In High-Tech Jobs, 2002). We cannot afford to leave so much of the population behind in regards to the under-representation of women in high tech fields.

In this study, 176 middle school girls were surveyed to explore possible relationships between their interests in various computer games and their interest in taking computer related classes. Significant relationships were found between their interest in playing “non-violent” social constructive games and in enrolling in Informational Technology classes. Thus, the increased use of “non-violent” games for girls in preK-8 may be a way to encourage more middle school girls to become interested in IT related courses and careers.

1. Introduction

There is significant evidence that the United States is losing its competitive edge in the global marketplace in the critical areas of science, technology, engineering and math (STEM) due to a lack of recruitment of women into these areas. Computer related competence has now become the minimum requirement for even low-level jobs, with advanced technical skills required for most (Friedman, 2005). Broadband technology that spans the globe has connected the world economies and leveled the economic playing field in the process. The global economy mandates that in order for a country to remain competitive, its people must excel in math, science and technology. In order to promote critical technology innovation, we need to encourage our young people to specialize in technology related careers. As it stands now the United States will have only half the qualified graduates needed to fill the 1.5

million information technology jobs by the year 2012 (Bombardieri, 2005). Cultivating an interest in women for technology related careers at a young age will tap a valuable human resource, while adding the female perspective to solutions for solving complex problems facing the global community.

Among high school graduates, half the students interested in computer science are female yet they make up only a third of those who will earn bachelor’s degrees in computer science (Roberts, 1995). In 1985, 37% of the bachelor’s degrees in computer science were earned by women. This number has been on the decline since 1985 reaching a somewhat stable level at 28% (Vegso, 2005). Data reported by the Computer Research Association, places the percentage at 19% in 2000 and only 17% in 2004 (Carlson, 2006). Statistics like these denote that the gender imbalance in computer related careers is in line with data used to describe the percentage of high school boys versus girls who sign up for computer related classes. The Fairfax County Public School District in Fairfax County, Virginia, reflects the national trend with reports that the computer classes considered more technical, such as programming or artificial intelligence, have much larger gender gaps than computer classes such as word processing or information systems. For example, the artificial intelligence class enrollment for females in Fairfax County schools is only 6% compared to 94% for the males. Nationally, only 17% of high school students who take the computer science AP (Advanced Placement) test are female (American Association of University Women, 2000). This trend begins in middle school, remains steady in high school, and continues into college and from there into the world of work (Bean, Campe, Denner and Werner, 2005). While one may argue that there will always be non-traditional careers for boys and girls, technology is one area where we as a nation would be well-served to determine the reason females are not drawn to computer related fields nearly as often as boys, and then find ways to reverse this.

Computer related careers and technological innovation that have so few women represented and participating, prevent

females from sharing the high earning power that benefits men in these careers. The resulting disparity in earning power generates a ripple effect for local, state, and national economies. Determining the reason for this and working to reverse this trend would benefit girls by equipping them with lucrative, marketable skills. The gender gap in high tech careers has implications not only for women, both in regards to missed financial opportunities for themselves and their families, but also for society as a whole.

2. Review of the Research

Research on this topic has focused at times on the personality traits that may or may not contribute to boys and girls who choose to pursue computer related classes and careers. Personality factors that can play a role in career choice include identified ability, self-efficacy, expectancy value, interest, and congruence and barriers and support (Cohoon & Tillberg, 2005). Further research is needed because the data indicates that these traits or factors do not wield enough influence to cause entry into or departure from the IT field (Cohoon & Tillberg, 2005). In addition, personality factors can fall short of being a valid measure because of the career assessments being used. For example, the measures that indicated that women tend to follow social interests whereas men prefer realistic or technical interests were found to be sexist by design (Farmer, 1995). There does continue to be, however, a popular misconception among both girls and boys that to thrive in the IT world you have to be a highly technical, introverted person who prefers machines to human interaction. While there are some jobs that would fit that description, there are far more IT job roles that require strong people skills including communication and the ability to resolve conflicts involving not just mathematical algorithms but human conflicts as well.

Informing girls at an early age that the solitary computer programmer confined to a cubicle is not a true representation of how their skills will be used in an IT field, is critical (American Association of University Women, 2000). As technology has advanced, so too have the different career opportunities in the IT world. Technology fields need strong communicators with technical and people skills who understand the problems of an organization or society as a whole. Workers are needed who can apply their skills toward discovering creative solutions for these challenges.

A research study of secondary and post-secondary schools suggests the need to rethink the way the computer class offerings are marketed in addition to how they are taught (Roberts, 1995). Programming needs to be taught in a manner that the skills learned will transfer to the workplace. But does computer programming have to be the first class prospective students take when they enroll in technology

related majors? To recruit more women into the major and retain the ones who do sign up, the computer classes have to demonstrate the relevance of the programming skill to a higher cause than just giving a machine instructions in binary code (Bombardieri, 2005).

Researching if and how personality factors play a role in determining why more boys than girls sign up for computer classes is only part of the challenge, the effects of environmental factors must also be considered. The environmental factors that are seen as having significance are initial experiences with teachers and parents who introduced the girls to computers and supported their interest in the technology (Cohoon & Tillberg, 2005). Women successful in the field, such as Lenore Blum, a professor of computer science, say that what is needed is more social support for girls interested in learning about technology to pursue that learning. Colleges across the country, such as Carnegie Mellon University and the University of Maryland-Baltimore County, have started programs and clubs for women in computer science degree areas. Carnegie Mellon's program, called Women@SCS, brings in prominent speakers and leaders from the technology world to serve as role models (Carlson, 2006). These same sex role models, women who are proficient users of technology and have demonstrated achievement in technology related fields, can have a positive affect on the attitudes of girls toward technology (Bombardieri, 2005).

Farmer (1995) found that parental influence is equally important to males and females in sparking their continued interest in technology. However, encouragement from parents and teachers is seen to be especially critical for girls as they consider entering a world known in some circles as "the boys club" (American Association for University Women, 2000). In "Can Compute, Won't Compute: Women's Participation in the Culture of Computing," Fiona Wilson (2003) states her belief that encouragement can help extinguish the thought held by many girls that computing is something for boys. Research that focuses on the low self-confidence level that girls may have regarding their technical ability supports the value of encouragement (Wilson, 2003). What is not clear in these studies is whether the confidence level is low because girls' computing abilities are underestimated or overlooked because too many in society still consider technology a man's world. This underestimation can result in girls' lack of self-confidence (Cohoon & Tillberg, 2005). In the Tech-Savvy report by the American Association of University Women Educational Foundation Commission on Technology, Gender, and Teacher Education (2000), girls discount the thought that the gap in tech related interests is due to aptitude or technical anxiety. Rather, the girls in this AAUW study attribute the disparity in interest more to disenchantment. They speak of girls being more socially evolved and

interested in human relationships rather than just a machine (American Association of University Women, 2000).

2.1 The Role of Gaming

Beginning in elementary and middle school, the people that the girls look up to need to emphasize the creative, people-helping aspects of a future high tech career. Thomas & Walkerdine (2000) and Cassell & Jenkins (1998) report that another indicator of what draws boys to computing is gaming. Research exists that suggests that girls make a positive connection between games and computer related pursuits provided they are able to see a beneficial outcome for society in the games or from playing the games (American Association of University Women, 2000; Callen, 1996). This has motivated researchers familiar with this field of study to push for more equity in the types of games that are created (Agosto, 2004; Cassell & Jenkins, 1998). Games that have a storyline with strong female characters in leadership roles are in the minority. Female roles of any kind are not found in the majority of games on the market and too often the female roles that do exist portray the weak, damsel in distress who needs to be rescued by the male. Even worse, many games showcase violence against women (Dietz, 1998).

Girls are attracted in greater numbers to the cooperative, creative, communication related, and adventure-related aspects of gaming (Cassell & Jenkins, 1998). Girls also appreciate the creative artistic potential of the computer. For example, they enjoy using paintbrush to illustrate a story they have created using a word processor (Gorriz & Medina, 2000). When asked about gaming in the American Association of University Women's (AAUW) Tech-Savvy article (2000), girls described the computer, particularly the Internet as a source of information or a virtue, and stated that for boys it is a vice that they use just to play games and fool around with. Girls in the AAUW focus research group also said that they prefer games where they create rather than destroy. Creating games with characters that face challenges similar to adolescent girls is a suggestion made by a middle school girl in the study. Another girl commented:

The game would probably star a teenage girl. She would have to go through different challenges like choosing not to smoke, or real-life questions like that. It would help people not to ruin their lives and help people who might be having family problems, like parents who are getting divorced. (American Association of University Women, 2000, p. 33)

Just as all males do not prefer violent computer games to those that are challenging in some manner other than conquering something or someone, many girls are turned off by games known as "Pink" games. The "Pink" games were designed with females in mind in an attempt to develop an untapped market by the game creators. Too

often however, the games end up being condescending to women and perpetuate negative female stereotypes. Challenging, role playing games that require imagination and are more gender neutral seem to be a better fit for girl gamers. Girls want alternatives, not a "girly antithesis to the boys' games" (de Leet & Sweedyk, 2005).

Additional research indicates that the desire for gaming among girls wanes sometimes as early as kindergarten (Cooper, Mackie & Wilder, 1985). Other studies show the age to be 13 (Gorriz & Medina, 2000). Games that have a purpose, involve solving puzzles, and help to solve problems for the good of humanity do appear to retain an interest for young girls (Gorriz & Medina, 2000). Thus, the potential exists for a correlation to be drawn between girls' disenchantment with the computer and failure to pursue an IT related career. The more apt girls are to use the computer solely for productivity purposes rather than for enjoyment such as gaming, or as a tool girls can use to express themselves creatively, the less apt girls are to pursue further education or specialization in the field.

As the research clearly shows, gaming is perhaps the biggest attraction to enrolling in computer classes for boys (Cassell and Jenkins, 1998). It follows that an increase in the availability of games that more accurately align with the interests of young girls will also help boost their enrollment in the classes. To positively influence the decision to enroll in high school computer classes, the interest in gaming needs to occur well before middle school (Kishor & Ma, 1997). This is because middle school is seen as the time period girls determine what types of classes relate to their relationships and identities. There are indicators that these early decisions affect enrollment in high school computer classes (Kishor & Ma, 1997).

2.2 The Gap and Gaming

The gap in the number of boys to girls in information technology classes is not a new finding (Betz, Heesacker & Shuttleworth, 1990; Cooper, Mackie & Wilder, 1985). Taking a long-term view, however, computer related technology use is still a relatively new area and there remains a lot to learn about who uses it and why. Research into the reason more boys than girls sign up for technology class and ultimately enter technology fields has shown that this phenomenon cannot be attributed to comfort-level with the equipment or lack of self-confidence in the females (American Association of University Women, 2000). Rather, the research is pointing more towards whether or not girls *enjoy* working with computers or find spending time on them an endeavor worthy of their time (Agosto, 2004). This is where gaming becomes relevant. Early studies indicate that girls who enjoy playing computer games, particularly problem solving games, tend to view the computer as a worthwhile expenditure of their time, and are

more likely to sign up for computer classes in high school and beyond (Gorriz & Medina, 2000; Cohoon & Tillberg, 2005). Gaming has been shown to enhance computer literacy skills and be a positive force in the determination by boys regarding whether to enroll in computer classes (Cassell & Jenkins, 1998). These findings formed the framework for this research project.

Given the same opportunity to enjoy games designed to meet the interests of girls, females may be influenced to enroll in high school computer classes at an increased rate. Determining whether there is a correlation between the independent variable, middle school girls who enjoy games computers, and the dependent variable, whether they enroll in computer classes at the secondary level, is the focus of this research, or in other words it will explore the proposition that girls who participate in and enjoy gaming are more likely to enroll in computer classes at the secondary level.

3. Methodology and Data Analysis

The study's methodology included an online survey completed anonymously by 173 of 176 middle school aged girls who participated in this study. The girls in the study are demographically diverse and attend a Michigan middle school. The survey contained 20 close-ended questions. A 5-point Likert-type format was used with 1 = Never and 5 = Always. Higher scores indicate a positive attitude toward computer gaming, computer technology classes, and careers. The surveys were completed voluntarily at the end of regularly scheduled class time after the boys were dismissed from participating in the survey in the district's classrooms of teachers willing to participate. A preliminary survey within the identified school district was conducted to ensure that there were enough teachers with computers in their classroom who would also agree to contribute their time to the study. Spearman correlation and multiple regression were used to determine the significance of the relationship between the independent variables, such as girls who enjoy computer gaming and the dependent variable, if they enroll in future computer classes at the secondary level.

A preliminary task in analyzing the data involved grouping or coding the survey questions into one of three sets. One set of questions polled girls as to whether they enjoy computer games, play computer games, use the computer for more than a productivity tool, how much time they spend on a computer, and so on. The other set of questions queried the girls as to whether they intend or had actually enrolled in a secondary computer classes, think a career in the IT world would be exciting, plan to enter a computer related career, etc. A third set of questions looked at other related issues, such as the amount of encouragement that they received from parents and teachers.

4. Research Methods

An online survey management tool was used to create a survey, so that it would be easier to collect, store, and analyze the surveys. The survey questions were created to focus on the middle school girl's interest in playing computer games, using computers and taking computer related courses. The validity of the survey was assessed by interviewing several middle school girls after taking a draft of the survey. Adjustments to questions were made based upon their feedback to this initial survey. After obtaining school administrator and teacher approval within a Michigan school district, 176 girls from those middle school classes that agreed to participate were separated from the boys in the class before responding to a 20 item online survey.

A total of 173 from 176 participants completed the survey so that their results could be used in the analysis. Students in this study attended schools in a middle size city and represented a good diversity of students from different racial and income backgrounds. Most of the results were reported as descriptive statistics, correlations, and multiple regressions.

5. Findings and Discussion

The relationship between the enjoyment of playing computer games by girls and their future enrollment in a computer class was shown to be significantly positive. The first game playing question did not differentiate among the various types of computer games, while follow-up questions did.

Table 1: Spearman Correlations among Playing Computer Games, Using Computers and Enrolling in a Future Computer Class

	PC GAMES	PC USE	PC COURSE
PC GAMES	1	-.044*	.237**
PC USE	-.044*	1	.154 **
PC COURSE	.237 **	.154 **	1

* Correlation not significant at the .05 level (2 tailed).

**Correlation is significant at the .05 level (2 tailed).

Although Table 1 shows a significant Spearman correlation $r = .237$, between enjoy playing computer games and enrolling in a future computer class, little relationship was found between the amount of current computer use and enrolling in a future computer class. Thus, it appears that playing computer games by middle school girls may contribute more to their choice to enroll in a first time computer course than general computer use.

Table 2: Spearman Correlations among Amount of

Enjoyment from Playing Non-Violent Games in which the Student is Placed in A Helpful Role, Non Violent Games that are more Like their Current Life, Games Used to Create and Enrolling in a Future Computer Class

	CREATIVE	HELPFUL LIFE LIKE	COURSE
CREATIVE	1	.407	.247
HELPFUL GAMES	.407	1	.321
LIFE LIKE GAMES	.247	.246	1
PC COURSE	.285	.321	.491

**Correlation is significant at the .01 level (2 tailed).

As shown in Table 2, the Spearman correlations were between $r = .285$ and $r = .491$ when the girls were asked how much they enjoyed playing various types of non violent games. The relationship $r = .285$ between enjoy playing creative games and the choice to enroll in a first time computer class was the lowest, and “enjoy playing games” that “were like my life,” was the highest $r = .491$. In addition, playing “violent games” had no relationship for these middle schools girl to their enrolling in a first time computer class. When these three different types of games were placed in a regression analysis using the dependent variable, enrolled in a first time future computer class, a total of .585 of the predictive variance is explained.

Thus, a relationship was found between interest and enjoyment in computer games for middle school girls and enrolling in a future first time computer class. While this result is similar to the results with boys, it is different in that it is more about the relationship between non-violent games and interest in exploring Informational Technology as a possible career choice and enrolling in secondary computer classes. As shown in Table 2, games that allow these middle school girls to create, play helpful roles, and simulate their lives, with the dependent variable enrollment in a first time computer class was shown to be stronger than the generic statement “enjoy playing computer games.” Thus, the recognition and promotion of more “female” appropriate non-violent games offers a possible way for schools and society to encourage more girls to take a first time computer class, which may be the first stepping stone to a future IT or other STEM related careers.

To further test this statement, Table 3 also shows positive significant correlations between PC games and thinking by these middle school girls that a lot of IT related jobs are available for females, $r = .442$ and their wanting an IT career

in the future, $r = .221$.

Table 3: Spearman Correlations among Playing Computer Games, Thinking that Good IT Jobs are Available and Wanting an IT Career

	PC GAMES	THINK JOBS	IT CAREER
PC GAMES	1	.442**	.221**
THINK IT JOBS	.442**	1	.185*
WANT IT CAREER	.221**	.185*	1

* Correlation not significant at the .05 level (2 tailed).

**Correlation is significant at the .01 level (2 tailed).

One of the top skills that the Partnership for the 21st (not 21th) Century Skills Project (2007) has identified as an essential skill needed to be successful in this new century, is problem solving. For problem solving is critical in scientific research, using mathematics, and doing technological jobs. In this study, a Spearman correlation between “enjoy problem solving” and “enjoy playing computer games” was also shown to be significant at the .01 level for a two tailed test with $r = .261$. However, it is unclear if middle school girls who like to problem solve find an outlet in playing computer games, or if the process of playing computer games promotes interest in problem solving, or perhaps one leads to the other. There was also a high relationship ($r = .407$) as shown in Table 2 between ‘creative’ games and those in which the girls could be “helpful.” This suggests that there may be a market for educational games that promote creative social problem solving.

The bottom line is how to better ensure that there will be more of these girls who will have the problem solving skills that our nations will need to solve tough STEM related problems in the future. This study also shows that these girls understand the importance of this issue as 62.6% felt that more woman were needed in STEM related careers because “having more women in these positions is important to the future of the world.” However, only 33.3% of the students in this study think that girls get enough encouragement from teachers and parents to pursue computer related courses.

So, what can be done? For starter, a total of 68.3% of the 173 middle school girls in this study also indicated that they would play more of these games if they were available. Game creators make games that will sell. The buying public especially parents and schools needs to let game makers know that by continuing to create and promote male oriented violent games like Grand Theft Auto, Halo, and Resident Evil, they are missing half of their potential market. Also, for many of these girls, it is still a question of computer access, as a total of 64.3% would play more games if they “had greater access to a computer outside of

school.” It might be of interest to find out in a future study how much shared time on the family personal computer, middle school girls are able to negotiate with other members of the family, especially male siblings.

The issue of encouraging girls to play computer games, take computer courses and pursue STEM related careers will become of increasing importance as the world’s wicked social problems continue to increase. It is promising that a total of 65.6% of these middle school girls in this study thought that they would be interested in a computer related career if they “could use computers to help make a better world,” a concept seen lacking in Grand Theft Auto.

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