Cultural Influences and New Programs Affecting Women in Technology

Senior Honors Thesis

Pooja Shah

Information Systems
Carnegie Mellon University
5000 Forbes Avenue
Pittsburgh, PA 15213

Abstract

As technology becomes more prevalent in our daily lives, the technical job field continues to grow. However, women still hold only a small percentage of these technical jobs. What is the reason for this occurrence? What cultural and social influences do women face that hinders them from opting for technology? These are precisely the questions that are answered with the thesis, titled, "Cultural Influences and New Programs Affecting Women in Technology."

This thesis was an empirical based research project comprised of multiple methodologies. Survey questions were sent to various women in different technical majors attending Carnegie Mellon University. A total of 37 women responded to the survey, out of which 10 volunteered to participate in follow up interviews. After analyzing this data, it was discovered that women are typically influenced by two major factors: family and teacher experiences. For instance, if a parent is in technology, most girls receive exposure to computers very early on and thus, may become interested in the field. Moreover, if teachers are unbiased and display enthusiasm for technology, women may feel more encouraged to pursue technical fields. The thesis demonstrates that a women's selection of a technical degree of study is not due to innate gender qualities, but rather due to social influences related to the type of exposure to computers received.

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Introduction

Fact: there are approximately 10 million Information Technology (IT) professionals in the United States, according to the Information Technology Association of America report, "Bridging the Gap; Information Technology Skills for a New Millennium" published in 2000. Fact: according to Gartner, the percentage of women in IT has dropped from 42% in 1996 to 32.4% in 2004 worldwide. In the United States, this statistic has dropped below 30%. What is causing these low numbers of women in IT? How can we fix this problem?

The purpose of this study is to determine the various cultural influences such as family, school and early education and social influences that affect the way women choose their degree of study and consequently their career path. Another aspect of the study is to review the different programs created to encourage girls in middle and high school to pursue the IT field and to help those women that do select IT as their major. In order to look at the various influences, surveys and interviews were conducted on the campus of Carnegie Mellon University.

The following thesis is divided into several sections. First, the background section highlights the historical and monumental accomplishments of women in technology. The literature review section provides a summary of research and prior studies of cultural influences and intervention programs. Next, the research design section summarizes the methodological procedure of the administered surveys and interviews. The findings section provides a thorough analysis of the data collected, which is subsequently summarized in the conclusion.

Background

Women have been a part of the computing and information processing industry from the very beginning. Their work and achievements may not be as widely known or recognized as those of men in computing, but are crucial to the development of technology nonetheless. At the same time, there are several different cultural stereotypes that affect the perception of women in technology and their contributions to the field. The lack of an understanding of women's historical contributions to the field of computing, coupled with unfounded stereotypes, may be contributing factors to the lower participation rates of women in the field.

A. History

In the early 1900s, record keeping was done on punch cards[1]. Women mostly did the labor for the entry and validation of massive pieces of data. In the 1950s, as computing machines were added to the scientific and business worlds, female mathematicians were sought after to perform mathematics related roles. Some attribute this demand to the fact that the male mathematicians were in the military service and that women were qualified for such tasks (Little, 1999).

Yet, in the late 1960s, women shifted into largely data entry positions and by the late 1970s were encountering what is known as the "glass ceiling" as they made their way up the corporate managerial ladder. The glass ceiling was a barrier that disallowed women to continue any further in terms of executive positions. During the 1980s, with the invention of personal computers, women began to create small businesses. By the 1990s, women were involved in the rise of Internet companies (Little, 1999).

The world is recognizing the benefits and progress that can be made by utilizing the Information Technology (IT) workforce in the 21st century. Women continue to play a major role in the development as leaders and founders of several initiatives (Trauth, 2008).

Although, women have played a significant role in the computing industry, their achievements are not as well known or publicized as those of men. Below is a list of pivotal women in technology that have made noteworthy contributions over the years:

1. *Ada Lovelace*: Invented the first programming constructs. She developed a method of storing sequences of operations or instructions as information values which is very similar to today's concepts of subroutines and stored programs. (Gurer, 2002)
2. *Betty Jennings, Betty Snyder, Fran Bilas, Kay McNulty, Marlyn Wescoff, and Ruth Lichterman*: Were original programmers of the ENIAC[2] (Gurer, 2002).

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[1] A punched card is a piece of stiff paper that contains digital information represented by the presence or absence of holes in predefined positions. (Wikipedia, 2011)
[2] The world's first electronic computing machine was called the ENIAC. (Gurer, 2002)

3. *Grace Murray Hopper*: Wrote a program to create a program – basically developed a compiler. She also created FLOWMATIC – which is a programming language in short hand English that influenced the development of COBOL. Her efforts made programming much more efficient (Gurer, 2002).
4. *Adele Goldstine*: Developed ENIAC as a stored program computer, which allowed the computer to perform a new task without having to reconfigure the entire system. She also wrote the manual for the ENIAC. (Wikipedia)
5. *Jean Sammet*: Developed FORMAC programming language, which was the first broadly used computer language for manipulation of mathematical formulas (Gurer, 2002).
6. *Betty Holberton*: Developed the "Sort-Merge Generator" for the UNIVAC I which produced a program to sort and merge files. This was a crucial first step towards using computers to write the programs and was therefore called, as Gurer (2002) says, "the first major 'software' routine ever developed for automatic programming," (118).
7. *Adele Mildred Koss*: Developed early sorting algorithms and the editing generator for the UNIVAC I which read specifications describing input file, records, the desired output format then produced a program to transfer one format to the other (Gurer, 2002).
8. *Anita Borg*: Developed and "patented a method for generating complete address traces used for analyzing and designing high-speed memory systems." She also founded the Anita Borg Institute for Women and Technology (Wikipedia).
9. *Mary Lou Jepsen*: Founded and is the chief technology officer for the One-Laptop-Per-Child (OLPC) program. OLPC is creating educational opportunities for poor children around the world by connecting them with laptops and programs that encourage learning (Wikipedia).
10. *Meg Whitman*: CEO of eBay since 1998. She took the company from approximately 100 employees to more than 9,000 employees globally (Kurtz, 2003).

Table 1 below shows Fortune's Most Powerful Women in High-Tech and Life Sciences Companies in 2003 (Kurtz, 2003). These women are just a few examples of how women in the past and continuing present have made significant contributions to the computing industry.

Table 1: Fortune's Most Powerful Women in High-Tech and Life Sciences Companies, 2003 (Kurtz, 2003)

Name	Top 50 Women Rank	Company	Fortune 500 Company Rank	Most Profitable Company Rank (where noted)
Carleton (Carly) Fiorina	1	Hewlett-Packard	14	
Meg Whitman	2	eBay		
Anne Mulcahy	4	Xerox	116	
Karent Katen	6	Pfizer	37	6
Betsy Bernard	12	AT&T	22	
Doreen Toben	17	Verizon	10	19
Patricia Russo	21	Lucent Technologies	141	
Judy Lewent	23	Merck	17	9
Ann Livermore	24	Hewlett-Packard	14	
Christine Poon	27	Johnson & Johnson	34	10
Myrtle Potter	29	Genentech		
Susan Desmond-Hellman	30	Genentech		

Susan Arnold	31	Proctor & Gamble	31	17
Deb Henretta	34	Proctor & Gamble	31	17
Ursula Burns	44	Xerox	116	
Louise Francesconi	47	Raytheon	105	

B. Today

Women today continue to be a part of the computing industry and make significant contributions, however they are still grossly underrepresented and many of their contributions are not known in mainstream culture.

Regardless of the improvements in gender stereotypes and attempts to make the genders equal, women still face certain cultural and other barriers that hinder them from choosing or remaining in Information Technology. Listed below are several of the most commonly identified barriers facing women:

1. *Promotion*: There are differences in criteria for promotions between men and women. If both man and woman are doing the same job, the man is more likely to get promoted (Riemenschneider et al., 2006, Roldan et al., 2004, Trauth et al., 2010).
2. *Managing Family Responsibility*: There are issues concerning children, home responsibilities and sharing responsibilities with spouses. For example, researchers have found that if a child is sick, the woman is more likely to stay at home to take care of him or her. In addition, since mothers are also responsible for picking up their child from school, they are more likely to miss "strategy" type meetings than men (Baroudi and Igbaria, 1995, Riemenschneider et al., 2006, Trauth et al., 2006).
3. *Work Schedule Flexibility*: This goes along with managing family responsibilities because if the work place was not very flexible, the woman would have to choose between family and work (Gallivan, 2004, Riemenschneider et al., 2006, Sumner, 2008).
4. *Lack of Consistency*: There is, many times, a lack of consistency regarding flexible hours, where one employee gets them and others do not. Another example is that there is a lack of a compensatory time policy (Agarwal et al., 2001, Kuhn and Joshi, 2009, Riemenschneider et al., 2006).
5. *Discrimination*: Along with general discrimination against women and stereotyping the kinds of roles women are expected to fill in the workplace, there is discrimination in pay as well. Men and women working the same position might not get the same amount of compensation (Adam, 2000, Adya, 2008, Kvasny, 2006, Riemenschneider et al., 2006).

Despite the barriers, women have made progress over the years. In comparison to several years ago, there has been a steady increase in the number of women enrolling in technical colleges pursuing a technical field. Figure 1 below depicts the number of Computer Science Bachelor's degrees granted over the last several decades in the United States. Disregarding the general trend of the market, it is evident that women continue to be underrepresented in this field (Roberts et al., 2002). Figure 1 shows the percent of doctoral degrees awarded to women, looking at years 1966, 1976, 1986 and 2000. Shown here as well is the steady increase of women in science and engineering fields (Kurtz, 2003).

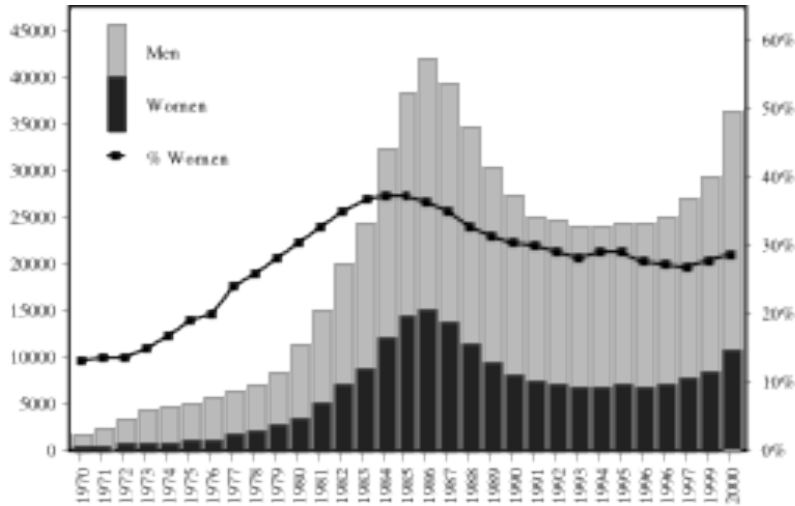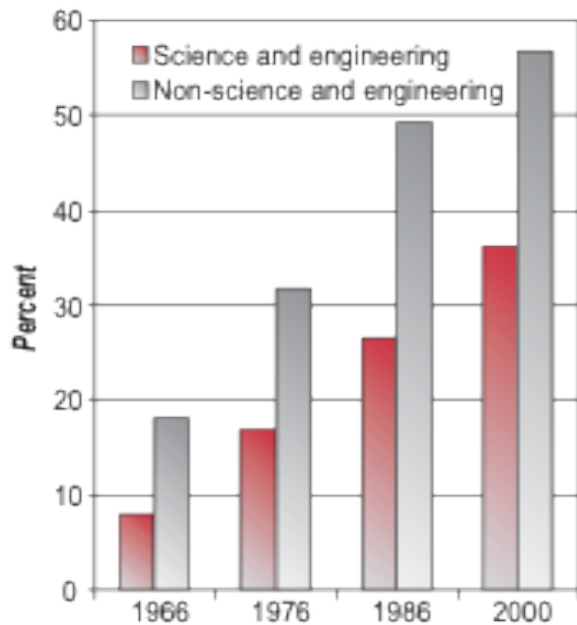*Graph 1: CS Bachelor's degrees granted (Roberts et al., 2002)*

Figure 1: Percent of Doctoral Degrees Awarded to Women, (Kurtz, 2003)

Field	1966	1976	1986	2000
Total: All fields	**11.6**	**23.3**	**35.4**	**43.8**
Total: Science and Engineering	**8.0**	**16.8**	**26.6**	**36.2**
Engineering	0.3	1.9	6.7	15.7
Physical sciences	4.5	8.5	16.3	24.5
Earth, atmospheric, and ocean sciences	3.0	9.7	17.0	30.4
Mathematics	6.1	11.3	16.6	24.6
Computer science	0.0	9.4	12.0	16.5
Agricultural science	1.4	6.3	17.3	29.1
Biological science	14.8	22.5	33.6	44.8
Psychology	21.5	32.8	51.2	66.6
Social sciences	10.5	21.2	33.6	42.9

Literature Review

A. Cultural Influences

Culture is a term that has various meanings and pertaining to this context, it is defined as "the set of shared attitudes, values, goals and practices that characterizes an institution, organization or group" (Wikipedia, 2011). Culture can be broken down into three major levels: family (individual), schools (institutional) and society. Culture plays a major role in defining an individual – their beliefs and attitudes towards certain things. Similarly, culture has a major influence on why women have chosen or been restricted from choosing a technical major.

Research has found that there are several different "groups" that influence women, as they become adults (e.g., Adya et al., 2005, Jackson et al., 1993, Turner et al., 2002). The first set that has a significant influence is one's family. The mother and father can affect a child's entire belief and value system. Close family members such as siblings and/or aunts and uncles that are a part of a child's life can also have similar affects.

The second set that has a significant weight is early education and schools. This includes the teachers and counselors that one may encounter while growing up. In addition, the availability of, in this case, computers or computer classes can also cause an impact. This includes availability of computers not only in a school environment, but also access to technology at home.

Last but not the least, the third set that has somewhat of an impression on an individual is society. Societal influences include mass media such as TV shows and their perception of the field of computing. Moreover, role models, whether accessible or known, can change a person's view on a certain field of work.

The remainder of this section presents a summary of prior research on how each of these groups influences women and their career decisions.

I. Familial Influences

Family can play a major role in defining an individual. Family does not have to be limited to just mother and father, but can be a favorite aunt or uncle or grandparents. Just the exposure to their careers or views on careers can change or define an individual's own career path.

Studies conducted by Jackson et al., (1993) suggest that women entering technology or science, that are traditionally known as male-dominated fields often come from families where both parents are educated and the mother is working (Jackson et al., 1993). In fact, according to Smith et al. (2000) "mothers with four-year degrees are more likely to influence career choices than mothers without such qualifications" (234).

A father is defined as a male parent, often seen as an authority figure. In Western culture, "patriarchy and authority have been synonymous" (Wikipedia, 2011), and in the later half of the century the authority of husband over wife and father over children became more apparent. Essentially, fathers play a defining role in a child's views and career choices.

Throughout the years, fathers have increasingly played a more active part in their daughters' lives and have been confidantes in decisions they make. Turner et al. (2002) has described fathers as "creating the opportunity for their daughters to learn about computing" (10). Fathers' attitude towards computing had a significant impact on women's life. For example, Turner et al. (2002) explained that many women in their research attributed their decisions to pursue a technology career on their fathers. One participant explained, "My father had the most influence on my decision to enter the IT field. His love of engineering and software development was infectious," (10). Not only are women affected by their fathers' own views on computing, but women have a desire to make their fathers feel proud of their accomplishments. In fact, one woman interviewed by Turner et al. (2002) said, "he sounded proud of me that I was interested in IT," (10).

Moreover, fathers influence their daughters by helping them make decisions regarding school and classes from early childhood. One of the interviewees in a study by Adya et al. (2005) claimed: "If I didn't have my father who sat down, and you know, helped me choose the subjects, then I might have chosen the wrong subjects," (234). The traditional role of fathers to help guide their daughters has a major impact on the daughters' career decisions.

Another way that fathers unknowingly influence their daughters' career choice is by simply being in the technical field. Many women would not know of the kinds of jobs that are involved in technical fields unless their fathers did not have a technical career. Fathers' talk about their work or projects that they are working on might interest their daughters to do similar things.

A study done by Turner, Bernt and Pecora (2002) in Ohio University showed that out of the women in technology that were asked to provide their parents' occupations, "27% of the fathers held jobs that could be considered technical, with technical being interpreted as jobs in engineering, computer science, mathematics, physics or chemistry," (4). This is

significant because according to the U.S. Bureau of Labor Statistics, 5.1% of the work force was considered "technical." The proportion of fathers in technical majors is more than five times the proportion in the general workforce. This shows that the fathers' career choices could be an important factor in women's career decisions.

Other close family members that can make an impression are siblings, more specifically older siblings. Most children look up to their older sibling, almost idolizing them and wanting to be just like them. Studies conducted by Banks et al. shows that "older brothers can influence the entry of girls into traditionally "masculine" careers" and girls who have sisters lean towards choosing "feminine" careers (Adya et al., 2005).

Ia. Family Encouragement

Many women would not have chosen a technical field unless their family approved of them doing so. The fact that a woman received the "go-ahead" from her family regarding a certain decision, in this case, career choice gave the woman the confidence to pursue this field.

In 2000, Trauth and her colleagues conducted several studies where she interviewed women to investigate what the individual influences were for women choosing an IT career. One of their participants particularly highlighted how family can influence career choice. Namely, Mitul, a woman who was educated in India, as Trauth et al. (2002) explains, "attributes her participation in the IT field to her parents, husband and in-laws," (106). In 1985, when she had to choose her career, her parents were supportive of her decision to study engineering. After she was married and had kids, her in-laws and husband encouraged her to resume work. In the culture she is part of, if they had not been supportive of her work, she would not have been able to continue. The above analysis demonstrates how positive family influences, and specifically fathers, can encourage women to pursue careers in technical fields. Likewise, family impressions can restrict or discourage women from choosing a technical field.

Ib. Family Discouragement

Gender differences play a significant role in families discouraging daughters to pursue science or engineering degrees because they believe those to be more male rather than female occupations. For instance, Barker and Aspray (2006) explain, "fathers often provided their sons with computers and spent time 'tinkering' on the machine with them," (33). Women did not have similar bonding experiences with either parent.

The different ways sons and daughters are raised shows that parents believe some careers to be fit for a woman and other for a man. For example, Riemenschneider et al., (2006) explain "traditionally, little girls are taught to be caregivers and nurturers, while boys are taught to be competitive and tough," (3). There appears to be a distinction for some parents that science or technical careers are not suitable for their daughters and therefore, they discourage them from pursuing those degrees.

Trauth et al. (2008) also suggest "families placing high value on females holding IT careers are another key factor affecting the increasing number of women studying IT," (8). Other

studies from other cultures show similar conclusions: Turkey (Ecevit et al., 2003), Brazil (Medeiros, 2005) and China (Li and Kirkup, 2007). Simultaneously, there are families that have strong beliefs that there are gender specified careers. Regardless, the research strongly indicates that family has a major impact on women choosing IT careers, whether it is to encourage or discourage them.

II. School/Early Education

When children are young, their minds and thoughts are still developing. In this period of time, teachers and counselors can be a great influence in shaping their beliefs (Adya and Kaiser, 2005). A teacher is defined as a person who provides schooling and the role of a teacher is to educate his or her students to the best of their ability (Wikipedia, 2011). Often times, a teacher becomes a role model, someone the student looks up to or idolizes. Their choices and values may consequently affect those of their students. A counselor is defined as a provider of guidance regarding academic, career, college and personal/social competencies (Wikipedia, 2011). The advice given by counselors can also play a major role in the decisions made by students.

There can be many reasons why women pick technical majors and reasons why they do not, but high school and college teachers and counselors seem to have a significant impact in their decision making process.

IIa. The Affect of Teachers and Counselors
In 1991, a study conducted by Dick and Rallis looked at 2,000 high school students and found that "teachers had a strong influence on girls' choices of career," (237). Many women surveyed by Turner, Bernt and Pecora (2002) claimed, "school experiences were an important influence" (14). These women also cited that they took the encouragement or discouragement they received from their teachers both in high school and college very seriously and were greatly impacted by it (Turner et al., 2002).

Looking specifically at the study conducted and women surveyed by Turner, Bernt and Pecora (2002), several conclusions can be made regarding the affects of high school and college and professors on women choosing technology as their career/major. The question asked was about significant people that either encouraged or discouraged the respondent. The results are shown in the following graph:

Graph 3: Significant People Encouragement (Turner et al., 2002)
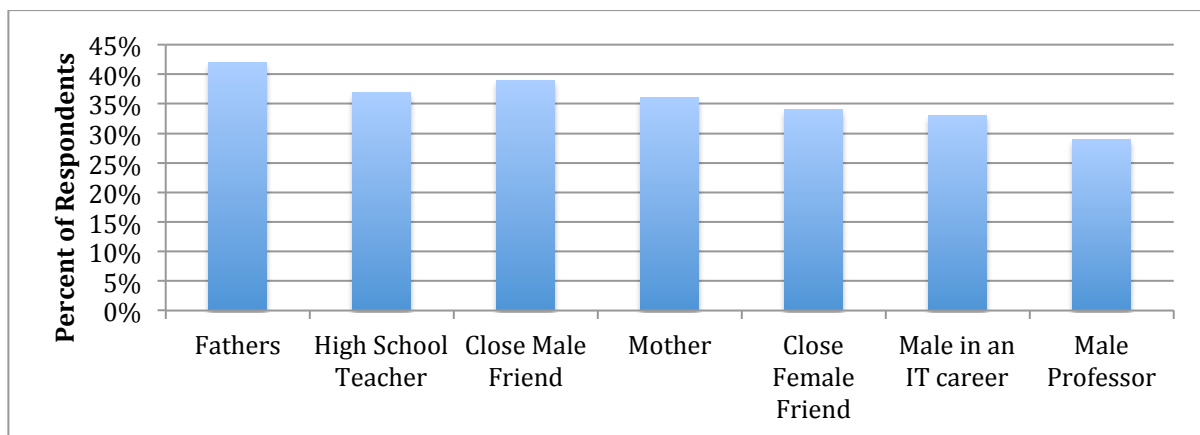
A key finding of Turner et al. (2002)'s work is that guidance counselors, professors and teachers, have affected women – whether in the form of discouragement or encouragement. Graph 3, demonstrates that though fathers and close male friend played a large role, 37% and 29% cited high school teachers and male professors, respectively as playing an encouraging role. Observing the following graph, Graph 4: Significant People Discouragement, it can be seen that guidance counselors and high school teachers are the most popular choices. This shows that regardless of how teachers and counselors affected students, they definitely played a major role in girls' choices.

Graph 4: Significant People Discouragement (Turner et al., 2002)
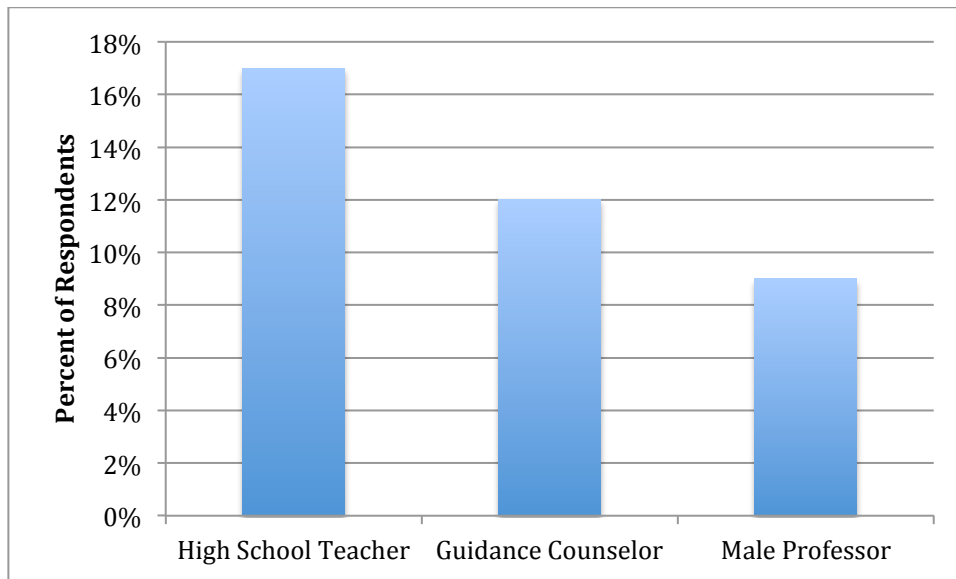
Discouragement and encouragement received from teachers
Adya and Kaiser (2005) claim that teachers have been known to "influence gender stereotyping of roles and choices through their interaction with students," (236). Some studies have found that teachers can give students the idea that boys are generally better at computers, and more interested in computers, and thus, give priority to boys over girls. This is the case for both male and female teachers. They also go on to say that "the enthusiasm of boys, their spontaneous questions and responses, and their overwhelming presence in computer labs discourages girls," (236).

Another study conducted by Gurer and Camp (2002) describes what discourages girls who are interested in computing. Their findings show that often times, boys control a large part of the teacher' time in computing classes and leave little attention for girls. This causes girls to be frustrated when they are left to solve the problem. This, in turn, may cause girls to be intimidated by the field of computing or become uninterested.

While studying teachers of minority students, Gurer and Camp (2002) discovered that teachers often call on boys rather than girls to answer computing questions. By doing this,

teachers may be relaying the message that girls are not "good enough" or "smart enough" to answer these types of questions and thus discouraging girls from choosing the field of computing.

Although teachers may gender stereotype, they are also many women who agree that their teachers, as Trauth et al. (2002) claim, "strongly encouraged them to do well, and who made sure they had confidence to succeed," (109). Many women specifically cited teachers that taught math or science and some that taught computer science.

In general, according to Turner et al. (2002), female professors were described as "very encouraging and wonderful role models," (9). Male teachers were also credited with proving opportunities and giving confidence to women to pursue a career in Information Technology.

Discouragement and encouragement received from counselors
Counselors are another aspect of high school and college that can affect a students' decision to study a particular career. Full-time counselors actually spend a very small percentage of time on occupational and job counseling. For instance, the National Center for Education Statistics found that, as Adya and Kaiser (2005) say, "career and occupational counseling ranked fifth out of eight functions typically performed by high school counselors," (237). This highly limits the amount of counseling that girls actually end up receiving from their counselors.

Moreover, most middle school and high school counselors feel more comfortable guiding girls to more traditional fields. Some researchers suggest that this could stem from the fact that counselors may not even be aware of technology fields due to their own background on technology or lack thereof (Freeman and Aspray, 1999).

High school counselors also tend to help girls select colleges that are not "technical" due to the skewed ratio of boys to girls. They encourage girls to select medicine or something in the arts as their major. This serves to discourage girls from choosing or even considering a college that has technical degrees. This hinders future exploration into computer science or other technical degrees that may have occurred had they selected a more technical college (Freeman and Aspray, 1999).

IIb. Availability of Computers
Along with family and school/early education influences, another aspect that can have a major influence on women selecting or not selecting technical majors is the availability of computers whether at home or at school. On the one hand, this is a critical factor because if women are not exposed to computers, they may not become aware of the various fields of work available in that area. On the other hand, if they are exposed to computers early on, they are more inclined towards or at least not intimidated by technology. If women are exposed to and have available computers to work on or simply use early on, they are more aware of the different types of work involved with a technical career field. Undoubtedly, the availability of computers has an impact on whether women pick technical majors (Selwyn, 1998).

Technology access at school

There are some schools that offer a wide variety of computer courses and others that offer no computer courses. This most likely has an affect on the students because if they never take any computer-related classes, they will never know what the field is really about. If there are courses available, the student can then try working with computers and see whether it is something they want to pursue. In fact, one woman surveyed by Turner et al. (2002) claimed that she first "ran into computers in school and discovered I (she) enjoyed them," (11).

The survey results also showed that along with getting exposure to computer classes, computer games and science fiction were also deemed influential. For example, one woman talked about her experience with an older brother who was a computer science major. He made her a computer-generated picture to color and she had the desire to learn how to do similar things.

Research suggests that many minorities attend schools that are not equipped with sufficient computers and thus, they have no experience and confidence when using computers. In many situations, the way the student uses the computer has to do with the way teachers encourage or discourage the student. The teachers of these minority students have low expectations and thus, do not require their students to use computer programs that will help develop problem-solving skills and the technical education needed (Brinkley et al., 2005).

Moreover, the technology access at school suffers from gender stereotyping. Many times, the boys get to use the computers more than girls. This gives boys more opportunity to become knowledgeable and familiar with computing technology and girls are unable to gain that education (Brinkley et al., 2005). Most people begin to get more comfortable and familiar with technology as they gain more experience with it. Many schools introduce computers around middle school where students often use computers for email and homework. However, boys tend to take over as "hosts", or the ones who show others how to use computers, and girls as "guests", or ones who step back and let the hosts use the computers, where girls admit they are less knowledgeable and give boys the chance to gain more experience (Brinkley et al., 2005).

In hopes to provide fair access to higher learning, schools need to provide unbiased access to IT. Many high school level students will never have the opportunity or incentive to choose IT as a career or be able to develop those skills if they have little or no access to computers during their schooling years (Brinkley et al., 2005).

Technology access at home

In a study conducted by Turner et al. (2002) of 275 women ranging from 22-64 years of age, around 50% of women claimed that their first experience with computers was at school but about 23% of women reported that their first usage of computers was at home (Turner et al., 2002). Regardless of whether students gain access to computers and technology at school, technology access at home is a crucial factor in influencing students

to pursue a technical field. By having computers at home, students can get a sense of the "fun" things one can do on a computer as opposed to developing programs or using the computer for homework. This can help develop an interest for IT that just access at school cannot.

Similar to technology access at school, technology access at home as well suffers from gender bias. Since having a computer at home when one is younger builds familiarity and parents are more likely to buy boys computers, they may become more comfortable using computers rather than girls (Frenkel, 1990).

According to a survey conducted by Verbick (2002), the number of girls that have access to a computer at home is significantly lower than the number of boys. This is largely due to the fact that computers are typically located in the boy's bedroom instead of an open family area. This restricts the girls from being able to use the computer when they want but rather gives boys first priority.

According to a study conducted by Cockcroft (1994), not only did boys have more access to computers at home (25%) in comparison to girls (12.7%), the ownership of the computer was also skewed towards boys. The graph below shows how the ownership is distributed.

Graph 5: Ownership of Computers at Home, (Cockroft, 1994)
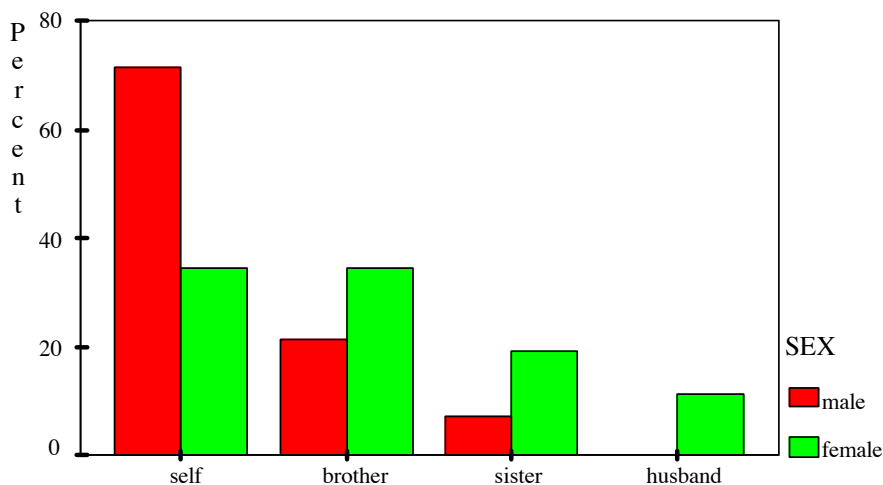
Research conducted by Adya and Kaiser (2005) shows that at home, boys typically use computers more frequently than girls and are more likely to own computers. Their usage of computers is more for social purposes as opposed to when girls use computers. It was discovered that even when girls and boys played together on computers, girls would let boys continue the play themselves (Adya and Kaiser, 2005).

Moreover, on one hand, boys demanded more power in terms of functionality and speed of the technology that allows them to explore the technology more in depth. This, in turn, encourages them to often have a more positive attitude towards IT in college. Girls, on the

other hand, tend to stay unfamiliar with technology and thus have an intimidation towards technical fields (Adya and Kaiser, 2005).

Another interesting observation made by Adya and Kaiser was that boys use the internet for a wide variety of activities including news, weather, sports and so on while girls tend to restrict their use to email and educational resources (Adya and Kaiser, 2005).

Technology access at home proves to be significant in women's feelings towards technology. The more of an access they have, the more comfortable they feel and more inclined towards an IT career.

III. Social Influences

Social influences, as defined by Wikipedia, occur when other people affect an individual's thoughts, feelings, ideas, beliefs or actions. Social influence can take many forms such as conformity, socialization, peer pressure, obedience, leadership, persuasion, sales and marketing. Social influences can play a major role in defining an individual and how they perceive the surrounding environment.

When considering women and their decisions to choose technical majors, there are two distinct forms of social influences that may affect them. First, mass media plays a critical role in women's career choices. Television shows, movies, and games can fall under this category. Not only are women affected by the specific shows but also by how others view the shows and perceive a career in technology as a result. The general perception of a technical field largely affects women's career choices.

Another major influences for women is role models. A role model is generally defined as any person one looks up to, emulates and takes opinions of in high regard. In terms of women in technology, role models become crucial. This is due to that fact that there are not many women in technical fields. Most of the famous and well-known people in the technology field are men (e.g., Bill Gates, Steve Jobs, Mark Zuckerberg). In this situation, it becomes difficult for women to find an example to look up to or for whom to follow in the footsteps of. Many women in technology who have role models, give a tremendous amount of credit to those role models for helping them choose and remain in a technical field of work (Adya and Kaiser, 2005).

IIIa. Mass Media

In 2009, $29.9 billion[3] were earned in box office sales for movies around the world. There are 32 million people that are considered frequent moviegoers (those who watch a movie once a month or more). Of those 32 million people, the graph below shows the divisions by age and gender. As depicted, females in almost every age group tend to be more frequent moviegoers than males. In addition, looking at the age group 12-17 and 18-24, they alone account for 12.3 million out of 32 million. What is important to note is that this age group individuals who are at the points in their lives where they are making career and future life decisions. Given these penetration rates, it can be argued that movies have a major affect on children and their choices and beliefs.

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[3] Source: http://mpaa.org/policy/industry

Graph 6: Frequent Moviegoers (millions) by Age and Gender, (http://mpaa.org/policy/industry)
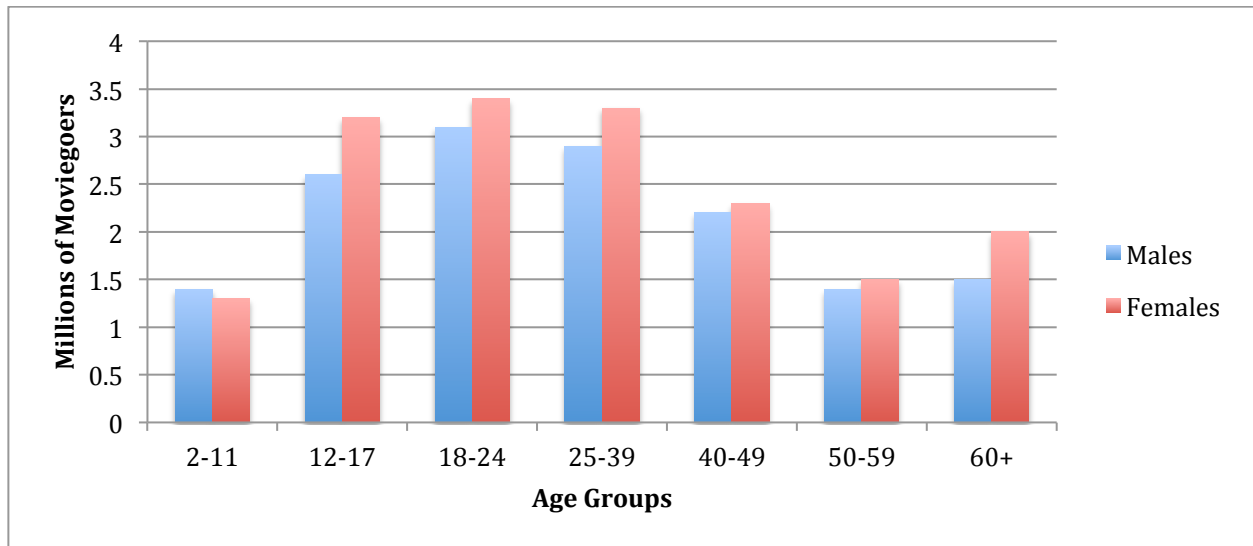
According to Nielson television ratings, there are 115.9 million television households in the United States alone. Moreover, the number of viewers within in the 18-49 years old age range is considered more crucial than the total number of viewers put together. In fact one commercial during the popular medical drama, *Grey's Anatomy*, costs about $419,000 (Wikipedia).

The takeaway from looking at these statistics regarding the large market that the movie and television industry have is that many people, more specifically, women, can be tremendously affected by the television shows and movies viewed. Societal influences as such can often cause misconceptions about IT and IT professionals. In a study conducted by Newton, some girls view IT professionals as Brinkley (2005) describes as "unwashed males with no social skills" (25). Moreover, girls have gone on to say that IT has always seemed "geeky" and for nerds, or men only.

 "The Office" is a prime time television show about office workers that serves as a good example of societal views of "geeky" professionals. It is described as a "mockumentary" that documents the exploits of a paper supply company in Scranton, Pennsylvania (imdb). The main characters are Michael Scott, the head chief, Jim, Dwight, Ryan and Pam, the receptionist. The characters are shown as nerds for the most part and the one female on the show is given the least intelligent job – the receptionist. Though the show is a comedy, it depicts the stereotypes generally associated with the IT profession and the gender bias that exists. Many girls can watch this show and be discouraged because the office workers are shown as mostly male and intelligent. In comparison, girls might think they are not as intelligent or capable of doing the same job as the males. Additionally, minorities are rarely included in these television shows discouraging minority women especially. As a result,

girls feel they may never succeed as an IT professional and choose a non-technical career field.

Along with television shows and movies, magazines also illustrate similar messages regarding women in technology. Most young girls prefer to read magazines such as, *Seventeen* and *Cosmopolitan* that focus mostly on fashion and superstars (Adya and Kaiser, 2005). These magazines never encourage women to pursue technical majors but rather more 'glamorous' careers.

The influences of computer games
Computer games are another form of mass media that affect women in technology and their career choices. They are usually a child's first experience with computers and can play a large role in determining future interest and enjoyment in using computers (Gurer, 2002). Yet, most games in the past have been designed and geared towards boys. These games are mostly violent, consisting of loud music and aggressive behaviors. Moreover, women usually play submissive roles and portray a fearful creature whereas males stand powerful and dominant (Gurer, 2002).

Most girls tend to prefer games that are collaborative and about creation depending on their personalities. They usually prefer games with a story line and female characters that are independent and brave. It was not until 1996, that Mattel introduced the first video game for girls, "Barbie Fashion Designer" where girls could design clothing (Adya and Kaiser, 2005).

On the one hand, being exposed to negative experiences with computer games early on can discourage girls to consider computers as a source of fun or entertainment. Boys, on the other hand, become quite comfortable using computers. This causes girls to be intimidated by technology. In summary, mass media including television shows, movies and computers game can play a critical role in women's decisions to choose technology as their field of work.

IIIb. Role Models
A role model is defined as an individual who one looks up to and reveres. A role model is someone one aspires to be like. A role model can be someone one knows and interacts with on a daily basis or someone famous such as a celebrity or a renowned scientist. Role models can often influence career choices (Adya and Kaiser, 2005). Teen role models are usually popular celebrities that promote a certain lifestyle and image. They mostly influence occupations in music, sports or movies (Adya and Kaiser, 2005).

A role model in the IT field is someone who has innovated and advanced great technical ideas and products. Bill Gates and Steve Jobs, the founders of Microsoft and Apple respectively come to mind. However, when examining role models for women in IT, it becomes a bit harder to come up with names quickly. Although women in computing history have made several noteworthy contributions and continue to do so today, they are just not as renown as men in computing. Having role models of the same gender can be

crucial to prove that it is possible to fulfill responsibilities and duties associated with a certain gender and still be able to have a career in the IT field.

Case study: Barbies
Barbie is a fashion doll manufactured by an American toy-company named Mattel, Inc. Barbie was launched in March 1959 and has been a very popular figure in most girls' lives (Wikipedia). In fact, Mattel claims that over a billion Barbie dolls have been sold worldwide in over 150 countries which amounts to approximately two Barbie dolls being sold every second. This shows the magnitude of the affect Barbie dolls can have on young girls around the world.

Barbie dolls are given adult roles and young girls can visualize themselves as the career the Barbie doll has. There were several careers given to Barbie dolls throughout the last 50 years or so ranging from a surgeon to US Navy to McDonald's cashier. However, it was not until this year, 2010 that Barbie doll was finally given a technical career.

Computer Engineer Barbie will be the 126th career for Barbie. She is designed to wear a neon-colored T-shirt with a binary code pattern, carries a laptop, smartphone and a Bluetooth headset. The career was chosen through online voting for the first time.

Looking at the profound affect Barbie dolls have on young girls and the fact that it was not until 2010 that a Barbie with a technical career was launched, shows how hard it is for young girls to find appropriate role models to encourage them to pursue technical fields. Most girls that are in a technical field claim that a role model influenced them to choose an IT career. If more role models were "available" to young girls, then maybe more young girls would pursue a technical field (Adya and Kaiser, 2005).

The influences of role models
Role models, despite being scant, have played a critical role in influencing women in technology. Most career choice role models are known to be either familial or educational (Adya and Kaiser, 2005). The role models are not required to be in technology but rather, just strong, independent women.

In research conducted by Trauth et al., role models were named as one of the significant people that influenced women's decisions. More specifically, one participant, Laura, had two strong aunts as role models. In general, when women encountered female role models "they saw IT as a 'gender-friendly field'" as opposed to when they experienced stereotypical male behavior they viewed IT as a "man's world" (Trauth et al., 2008). Moreover, a mother is also an essential and assumed role model in a daughter's life. The role of a mother limits the daughters' career interests and choices by not exposing them to all the possible careers available. Studies have shown that if the mother is in a technical field or is adept at using technology, the daughter is more likely to be interested in technology (Turner et al., 2002).

Studies conducted by Gurer and Camp showed that middle and high school girls that have had female computer professors perform better than those without them (Brinkley, 2005). Additionally, female teachers were admired and one woman specifically cited her female computer science professor as Turner et al. (2002) describes as "very encouraging and a wonderful role model" (9). By having teachers that encourage them by providing unique opportunities to show their computer skills, young women gain confidence to pursue a career in technology.

As described above, role models that influence a woman's decisions in choosing an IT career are mostly family such as mothers and aunts or educational, such as professors in college or teachers in middle and high school. Moreover, women that had such role models were more inclined towards a technical profession due to the encouragement they received.

Another type of role model that can affect a woman in her decision is a successful career woman. However, it can be argued that women do not have a high profile within the IT industry (Todd et al., 2005). In fact, most magazine advertisements show men operating the computers or using the technology while women simply take instructions or are in the background if they even appear in the advertisement. Even though women have made many contributions to computing and technology, there is a severe lack of role models from the industry.

Professional organizations such as the ACM committee on Women in Computing (ACM- W) made a video titled, "Women in Computing," (Todd et al., 2005). The video featured talented female computer scientists who work in several different and diverse industries that have made significant contributions. Encouraging more women to enter the IT industry is what the committee wanted to achieve by producing this video.

Role models whether its those that women encounter early on in life or later, on a regular basis or not, and whether it's someone they know or a famous person play a major role in their decision to pursue a career in technology. There is a lack of role models for women in technology due to the low number of women that are in technology currently and have been in the past. Further, women who have made inputs are not as well known as the men. Nonetheless, women those are able to find role models in technology claim that it is one of the major influences affecting their career choice.

B. New Programs

Over the years, technology has evolved to become a critical part of not only our lives but also all fields of work and industries. There have been several noteworthy men and women that have made significant contributions. Nonetheless, the fact remains that women continue to be underrepresented in comparison to men. Not only are fewer women at a management level in the IT industry, but also fewer women are choosing technology as their major or career choice. There are only 5.1% of women at chief executive positions in the 500 largest companies (Wirth, 2002). This number has almost doubled since 1996. This increase can be partly attributed to the new programs that are emerging in colleges, work places and nationally.

I. College Groups

Many universities are now creating groups specifically formed for women in technology - a society where women can share experiences and seek help when needed. These groups are great ways to help women cope with pursuing a technical major, which often times can prove to be quite difficult. By being connected with other women that are experiencing similar difficulties or hurdles, women can gain solace and learn how to deal with their problems while continuing to major in a technical field of study. The two groups mentioned below are two that are Carnegie Mellon chapters of national foundations representative of all universities with similar chapters.

Women at School of Computer Science, or better known as Women @ SCS, is a group of women at Carnegie Mellon University formed to support women studying computer science. They hold several tutoring and mentoring session with local middle schools to encourage and show young girls that women can also pursue a technical field. Moreover, they host a "Big Sister, Little Sister" program where each incoming freshman computer science major that is a woman is paired up with an older woman in computer science that acts as somewhat of a mentor.

Society of Women Engineers (SWE) is another group formed at Carnegie Mellon University that involves all women that are studying engineering fields. Their mission statement is to provide a support network through various social and professional events that benefit students, the university and the community. They hold "Middle School Day", "High School Day", an annual ball, and participate in university-wide events such as Booth and Technical Opportunities Conference. Society of Women Engineers is a national group that also exists at several other universities: Massachusetts Institute of Technology (MIT), Stanford University, Georgia Institute of Technology and many more.

II. Work Groups

Working in the IT industry where men clearly dominate the women in numbers can be challenging for women. As a result, there are several initiatives formed at many workplaces

to help women cope with being in the IT workforce. These groups help women stand up against the men despite the overwhelming difference in numbers.

One example of such a group created at a major technology company, Microsoft, is Women Employee Resource Group (ERG). The group was founded in 1990 and more than 12,000 women employees are currently members of this group. The group's initiatives include diversity, employee development and information sharing and connection. One remarkable initiative created by ERG is "DigiGirlz Day." DigiGirlz Day was created in 2006 that focuses on "educating youth and exposing them to emerging technologies and career opportunities in the information technology industry" (Microsoft.com).

III. National Science Foundation (NSF)

The National Science Foundation (NSF) is one of the largest organizations that, for the past decade, has been supporting projects designed to improve and provide opportunities for women in computing (Wardle and Burton, 2002). NSF primarily focuses on increasing the number of women studying towards technical degrees specifically in graduate schools. They have now expanded their area of effort to figuring out what the underlying factors are for the gross underrepresentation of women in technical fields.

In the late 1992, NSF developed a monumental policy in Computer and Information Science and Engineering Directorate (CISE). According to Wardle (2002), the new effort brought together a workshop where experts from "academia, industry and government were invited to produce ideas for expanding opportunities for women in computing" (27). The ideas produced during this workshop were developed and put in to place with funding from CISE. Some of these programs still exist due to their success ratio.

The Information Technology Workforce Program is another initiative that stemmed from the NSF to encourage women in technology in March 2000. This particular program is a competition that awards grants to, as Wardle (2002) says, "study a wide range of research topics" (29). The topics included social networks in the IT workplace, IT as a career choice in terms of women and so on.

NSF has over the years and continues today to create awareness for the underrepresentation of women, encourage women to pursue technical fields and conduct research primarily focused on how programmatic efforts are successful.

Women in technology continue to be outnumbered by men in technology due to several factors. However, due to the increased awareness, there are several programmatic efforts in place to encourage young girls to pursue a career in the IT industry such as those by the college groups, workplace groups and NSF. College and workplace groups also serve to provide a support network for women already in a technical field. With the help of these initiatives, more women will hopefully be encouraged a technical major and continue on to work in a technical field.

C. Summary

There are many cultural and social influences that affect women's decisions or choices. Family plays a major role in women choosing a technical career. Studies show that if the father or mother is in a technical field, the encouragement they receive is often the primary reason many women choose to enroll in an IT field.

School and early education also serve to influence women's experiences with computers when they are younger which in turn, helps them decide their career. Exposure and availability of computers are major factors that can either make young women comfortable with using computers or inversely be intimidated by them.

Finally, social influences such as mass media and role models have an adverse affect. Television shows, movies, magazines and computer games all portray men as the primary workers in the technical field and women in the background. They perceive the IT industry to be full of geeks and nerds – the kind most women do not want to be associated with and thus discouraging them from pursuing a technical field.

Therefore, there are more factors that discourage rather than encourage women from choosing a technical field. Several groups are spearheading new programs and efforts to encourage women to choose technical fields. Starting with university groups and work place groups. There are also national level programs awarding scholarships and giving women the opportunity to pursue a degree in information technology.

Research Design

The literature review section explained pertinent research involved in women in technology and the cultural influences and new programs affecting them. The research design section explains the methodology of the research conducted. In doing so, the section describes the study's research questions, the theoretical foundations and the procedure of the data collection and analysis.

A. Research Questions

The main questions intended to answer with research and data are:
1) What kind of cultural influences affect a woman's choice to pursue a technical area of study?
    a. How to familial influences encourage or discourage this pursuit?
    b. How do school and early education experiences:
        i. With teachers and counselors encourage or discourage this pursuit?
        ii. With availability of computers (in the home or at school) encourage or discourage this pursuit?
    c. How do social influences encourage or discourage this pursuit in terms of:
        i. Mass Media?
        ii. Role Models?
2) What kind of new programs have been created to assist women in technology?
    a. College groups
    b. Work place groups
    c. National groups

B. Theoretical Foundation

The basis of the research and the approach that was employed is called the "social construction" theory. Under social construction theoretical lens, it is assumed that women make the decision to either choose a career path given societal and cultural influences. It is these influences that play a part in career choice rather than inherent or innate characteristics. These influences include those of family and school – classes, teachers and advisors while growing up. In addition, social media and the perception of others may also play a large role in the decisions made by women. This is essentially a "nature vs. nurture" argument, in which it is believed that nurture plays a larger, more significant role than nature.

C. Procedure

Given that the research questions are focused on human behavior, decision-making and the theoretical framework is based on social construction lens, a data collection process that was flexible and open-ended was used. Research was comprised of two sequential parts: online surveys and interviews. The sections below provide a more detailed overview of each of these parts.

I. Online Survey

In the first phase of the data collection process online surveys were developed and administered. The main goal with these survey questions was to get a high level understanding of who or what influences a woman in technology.

The survey questions were based on two main resources: 1) the study's research questions; and 2) the results of the literature review. The survey was designed with four major sections. The first section was background. The goal of this section was to gather the age, race and hometown information of the participant. The next section gathered information about the participant's interactions at Carnegie Mellon. Specifically, the respondent were asked to share their major, graduation year, reasons for why they chose Carnegie Mellon and more particularly, their major and what non-major related interests and hobbies they have. The third section in the survey was centered on influences. This included questions on school, family and computer exposure. Lastly, there was a miscellaneous section with questions on extra curricular activities, knowledge of famous men and women in computing, and the social perception of the technical field. At the end of the survey, respondents were also asked if they would be willing to participate in a follow-up interview. The survey questions are included in the appendix (see Appendix: Survey).

Online surveys were chosen because of the ease of distribution and results aggregation (i.e., survey respondents can quickly be solicited online and results are electronically captured). The survey was built and deployed using Survey Console, an online survey service provider (See Appendix: Survey Console).

Recruitment messages (see Appendix: Recruitment Letter for Surveys) and links to the survey were sent by email to women studying technical degrees at Carnegie Mellon University through three different ways: Information Systems Freshman, Sophomore, Junior and Senior class lists, the Computer Science Women @ SCS distribution list and the Society of Women Engineers distribution list. Surveys were distributed in late October through mid-December 2010.

Approximately 200 survey requests were distributed and 37 women participated in the survey. The graphs below show a distribution of graduation years and ages of the respondents that answered the survey. There were approximately eighteen seniors, nine juniors, ten sophomores and one freshman.

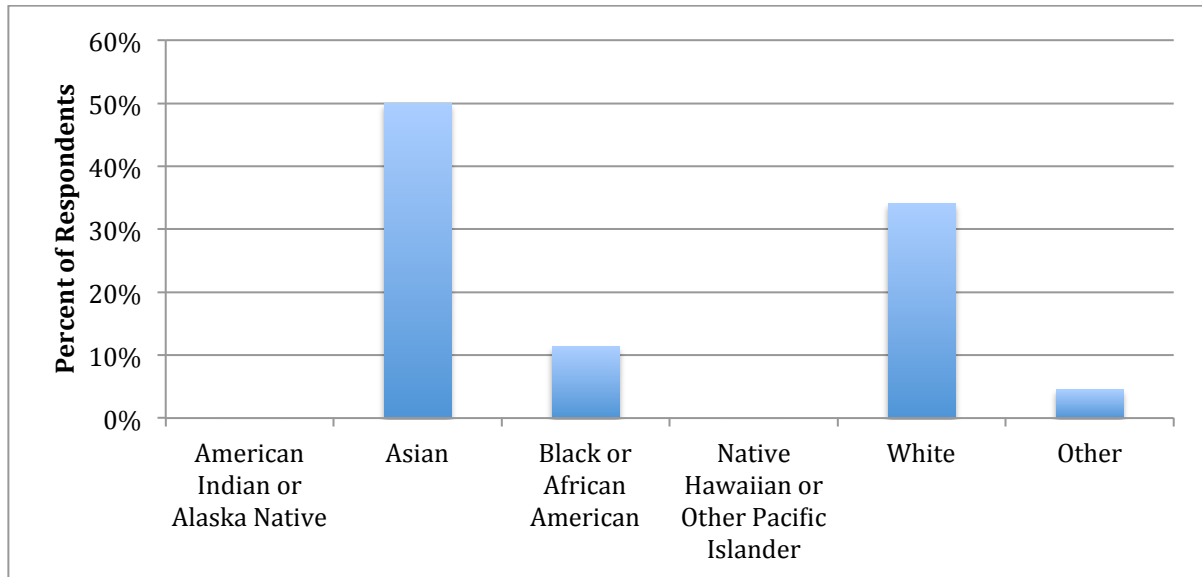*Graph 7: Graduation Year of Respondents*
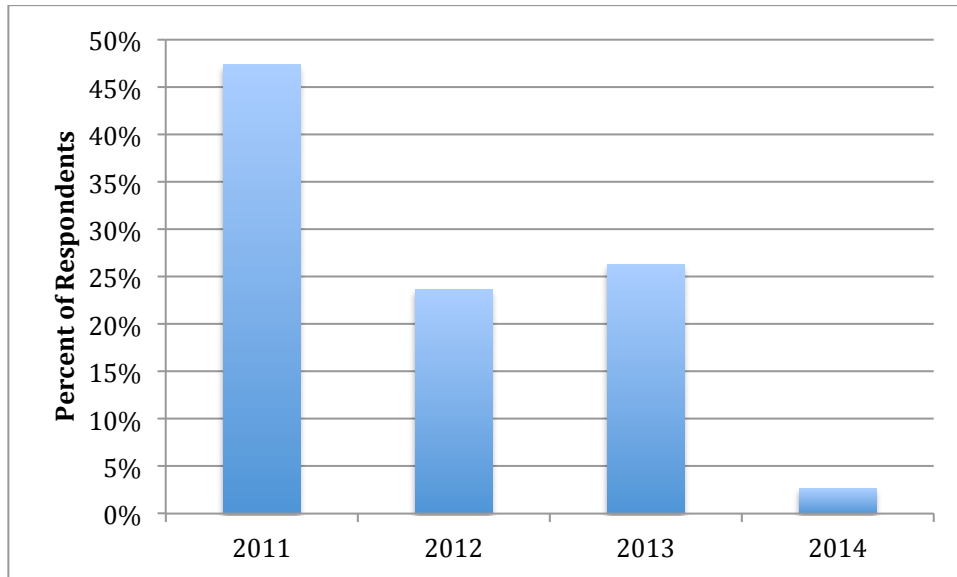

Graph 8: Age of Respondents
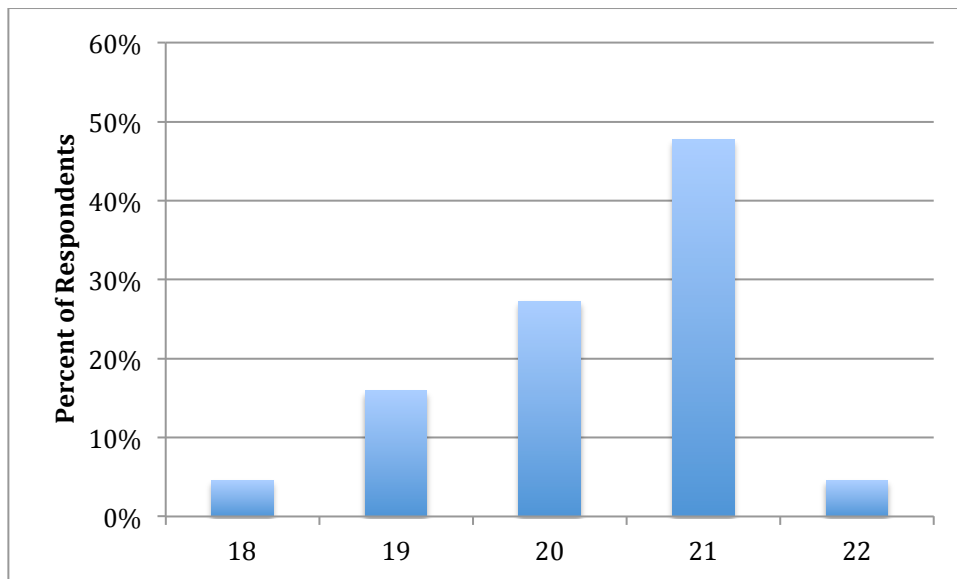
The following graph shows the distribution of the race/ethnicity of the survey respondents. There were approximately 22 of Asian descent, 15 White, 5 Black or African American and the rest in "Other."

Graph 9: Race/Ethnicity of Respondents

Participants were also asked hometown states, which the graph below breaks into U.S. and International due to the variety of responses received. There were 34 respondents from within the U.S. and 10 International.

Graph 10: Hometown of Respondents – US or International
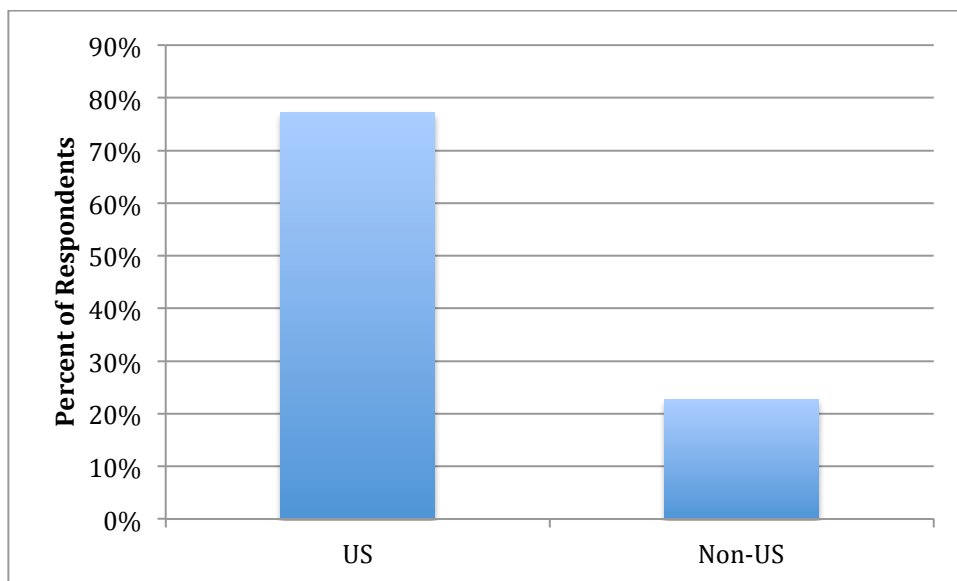
The surveys were analyzed using both quantitative and qualitative measures. After the survey data was collected, graphs were constructed using Microsoft Excel to explore the results. Trends and basic participant statistics were identified and investigated using bar graphs. Open-ended responses were evaluated by simply reading them and making appropriate conclusions.

II. Interviews

After the administration of the online survey, the second phase of the data collection process was governed – the interviews. Interviews were chosen due to their open-ended nature. Interview questions mainly consisted of follow-up questions to the surveys to get a more in-depth analysis of previous answers received. The interview guide/questions asked is included in the appendix (Appendix: Interview Guide).

As a pre-emptive measure, survey respondents were asked to leave their email addresses if they were willing to participate in a brief interview. Of the 37 women who completed the survey in phase one, ten of these women volunteered to participate in follow-up interviews in phase two. Once all the surveys were collected, an email (see Appendix: Recruitment Letter for Interviews) was sent to the list of volunteers to schedule interviews throughout February 2011. In total, ten interviews were conducted. The following graph shows the break down of the graduation years of the interviewees. There were eight seniors, one junior and one sophomore.

Graph 11: Graduation Years of Interviewees
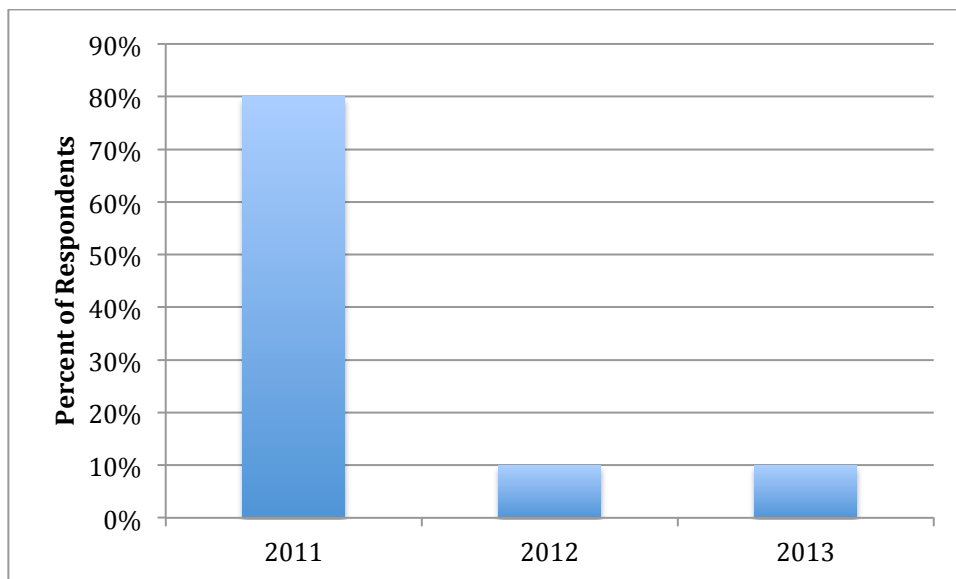
The following majors were included in the ten interviewees: Information Systems, Computer Science, Mechanical Engineering, Biomedical Engineering, Electronic and Computer Engineering, Statistics, Economics, Human and Computer Interaction, and Business Administration.

The interview responses were analyzed qualitatively by first, recording the interviews, and second by listening to the recording and taking notes. Standard qualitative analysis techniques, open and selective coding, were applied. The responses were mainly used to supplement the data collected through the surveys. Direct quotes were taken to provide a more in depth analysis on the some of the trends seen in the survey responses.

Findings

The research design section outlined the way the data was collected using surveys and interviews. The findings section describes the different trends found in the data and the subsequent results of the study. A quantitative and qualitative analysis was conducted on all the responses. The findings section is divided into seven major trends: Majors, Family in Computing, Access to Computers, High School Advisors' and Teachers' Influences, Extra Curricular Activities, Famous People in Computing and Public's Perception about Computing. The remainder of this section describes each trend in more detail.

A. Major Information

As part of the data collected, one important question that was asked in the survey was regarding the survey respondent's major and reasons why they picked the particular major. The graph below shows the breakdown of the majors of the survey respondents.

Graph 12: Majors of Respondents
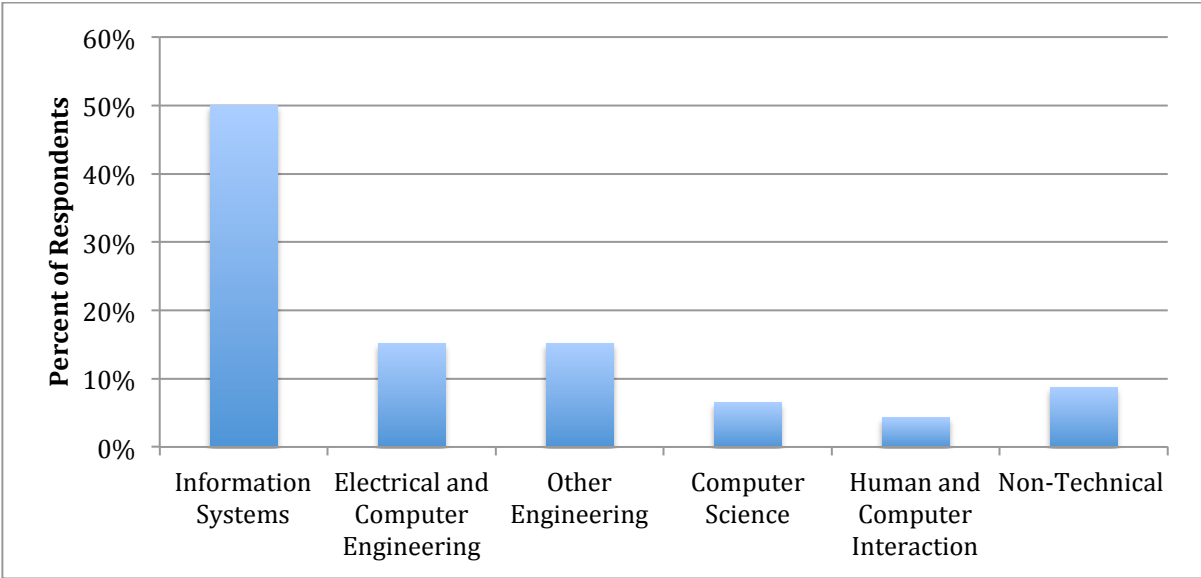
From this graph, it is clear that a majority of the survey respondents were Information Systems majors (approximately 23 respondents). A follow-up interview question asked about majors was reasons why the respondent chose the particular major. After reviewing all the answers, it was discovered that a majority of respondents picked the major because they had an interest in the subject – such as programming. "I like code and math…", "I've studied web development on my own and I'm really interested in a career in web developing…", and "I always liked computers since I was younger…" are a few responses received that demonstrate the preceding idea. There were also a few respondents who picked the major because of future job stability. This indicates that a majority of women in technology have chosen to be in technology due to their interest in the subject and not because of other factors such as parents or future.

B. Family in Computing

As part of the data collected, another interesting question that was asked was whether the respondent had any family in computing and if so, who. This is a thought-provoking observation to note because it shows that family plays an important role in a woman's career choice. Of the 37 women that responded to the survey, 60% had at least one family member in computing. Although conclusive remarks cannot be made by looking at this number, it can be said that family appears to play a role in the decision-making process. The graph below shows the break down of which family members were listed by the survey respondents as being in technology.

Graph 13: Family in Computing of Respondents
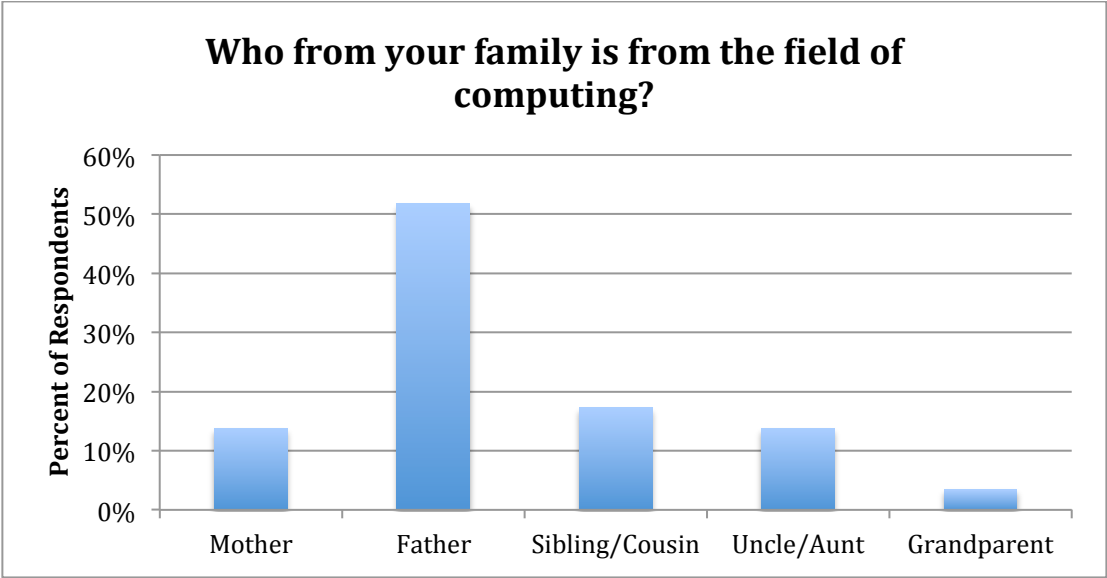
From this graph, it is evident by far that, most women in technology listed their father as the "family in computing." In fact, 15 out of 29 respondents listed "Father" and the next most popular choice was "Sibling/Cousin" which five respondents chose. A similar conclusion was drawn after looking at the interviews as well. For example, interviewee Christine, senior Information Systems major, claimed that though her father was a computer engineer, he was not her influence. However, he played a major role in exposing her to computers starting at an early age. Another interviewee, Anna, senior Information Systems major, talked about her mother and aunt being from the computing industry and playing a major role in her decision to choose technology. Nina, a junior Information Systems major, had no family in computing but was exposed to computers at a very early age. This shows that though having family in computing is an influence, there are many women who are in technology that do not have family in computing. Another interesting observation to notice when comparing US versus non-US, half of the Non-US respondents had families in computing while most of the US respondents did as well. From the surveys and interviews it can be seen that family, whether it's a mother, father or uncle, is a factor in a woman's career choice.

C. Access to Computers/Classes

Access and exposure to computers at home and computer classes in school may both be significant factors in a woman's decision to choose technology as her field of study. To investigate these topics further, there were several survey and interview questions designed. To start off with, there was a question regarding how many computers the respondent had access to at home while growing up. The graph below shows the distribution of how many computers per respondent.

Graph 14: Access to Computers

How many computers did you have access to in your home while growing up?

(Bar chart — x-axis: Number of Computers (1–6); y-axis: Percent of Respondents (0%–40%). Approximate values: 1 = 26%, 2 = 37%, 3 = 21%, 4 = 5%, 5 = 8%, 6 = 3%.)
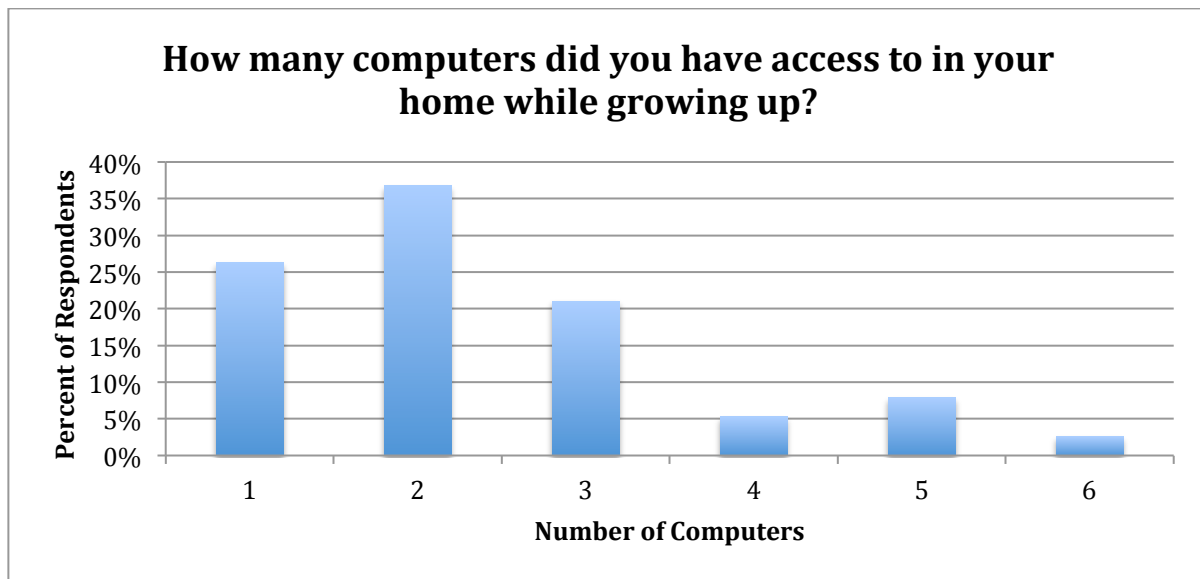
From this graph, it is obvious that most of the respondents had access to two computers at home (around 14 respondents) . While the locations of computers did not vary much within the US and Non-US, a fascinating observation was that only US respondents had access to laptops. Moreover, there were quite a few respondents that had access to four or greater than four computers just at home. This access to computers indicates that most of these women had exposure to computers from an early age and were, in most cases comfortable with computers due to this exposure. For instance, interviewee, Jenna, senior Mechanical Engineering major, attributed her main influence for picking her major, Mechanical Engineering; to the exposure to computers and hands on experience she received as a child. Another question regarding computer usage at home asked in the survey was about the location of the computer. The graph below summarizes what the responses were.

Graph 15: Location of Computer(s)

Where was the computer located in your home?
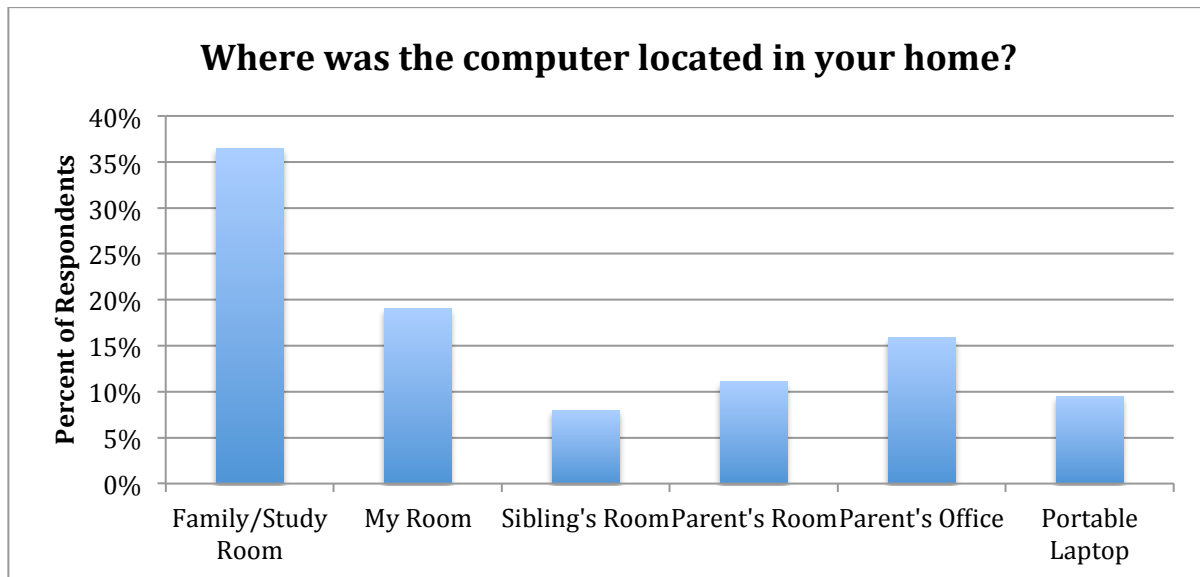
From this graph, it is clear that a majority of the respondents (approximately 23) identified Family/Study Room or My Room as the primary location of the computer in their home. This shows that most of the women answering the survey had unlimited access to computers since it was mostly located in a common area, their room or was laptop in some cases. This is explained by interviewee, Anna described how she first used a computer in kindergarten and due to unlimited access to computers in a common location at home, self –taught herself HTML and by fifth grade, she had started designing her own websites. Pam, a senior Economics major, claimed that because the computer was located on her brother's desk, he had more access to it than she did. Therefore, she ended up using the computer less and less until she got her own computer. Location of the computer is as important as access to the computer as it encourages women to use the computer as they wish and become comfortable with it.

Another aspect to access to computers is the number and types of classes available in elementary, middle and most importantly, high school. The graph below depicts how many respondents had taken computer classes before college and how many had not.

Graph 16: Percentage of Respondents that took computer classes

Did you take any computer classes during your school years?
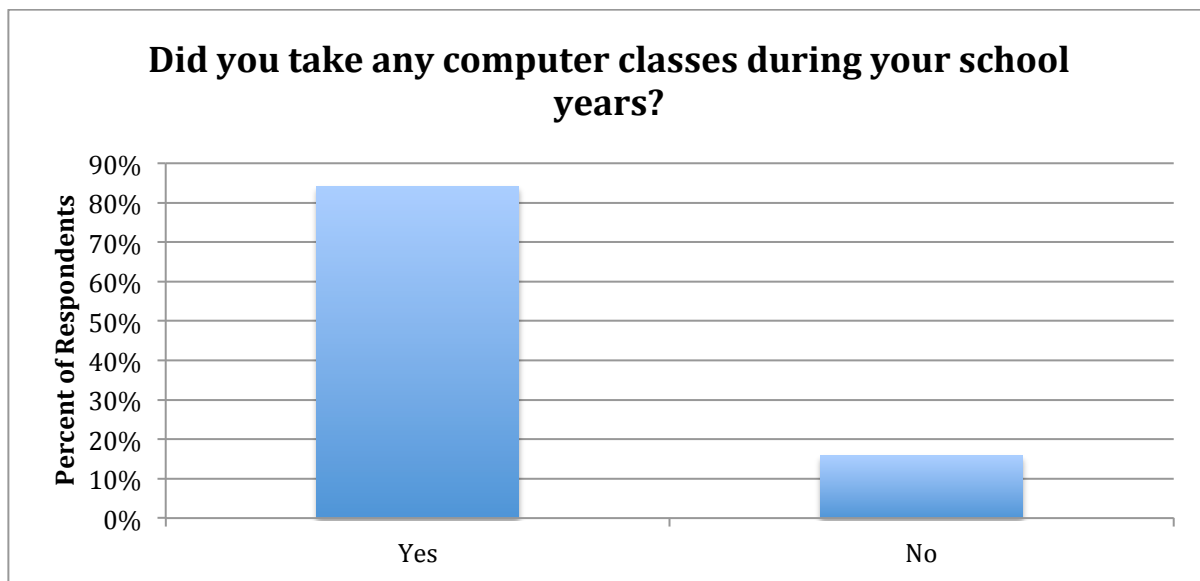

As shown from the graph above, more than 80% of the respondents had taken computer classes prior to entering college. This shows that a part of the reason why women chose technology is that they had experienced technology before and had an interest to pursue it further. Some of the types of classes taken by survey respondents were: basic computer skills and basic programming (HTML, Java, C++, Visual Basic). When asked whether the computer classes taken were required, most of the interviewees claimed that they had chosen to take them after an initial exposure because they had developed an interest and wanted to see whether they wanted to continue with it. Isabella, a senior Computer Science major, attributed her interest and love for computer programming to classes she took in high school. Patricia, a senior Information Systems major, did not take any classes in middle or high school related to programming, though they were offered. However, she knew that she loved technology and wanted to pursue it as her career. Therefore, computer classes in school years served as a "trial" for most not all women to see whether they wanted to choose technology as their degree.

D. High School Advisors/Teachers Influence

High school advisors and teachers can play a significant role in a woman's life. A scale was devised from Strongly Agree to Strongly Disagree to see how meaningful the high school advisors' or teachers' influence was. From this graph, it is evident that almost an equal number of respondents chose "Disagree" and "Strongly Agree." This shows that each respondent's experience with high school teachers has been fairly different. The graphs below both demonstrate the answers received.

Graph 17: High School Teachers Influence
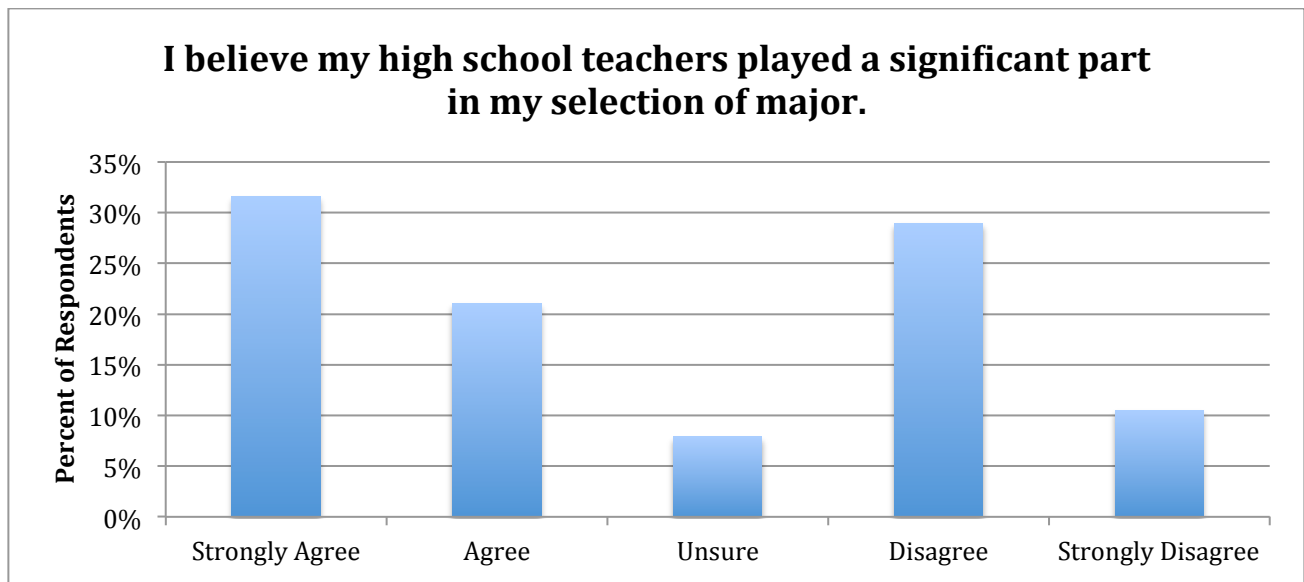
Interviewee, Megan, senior Electrical and Computer Engineering major, exclaimed that it was her Electronics teacher that influenced her to choose Electrical and Computer Engineering. She continued on to say that, the teacher was an amazing speaker and had great communication skills, both of which she did not expect from an Electronics teacher, but it was precisely these qualities that made the teacher so influential. Mona, a senior Information Systems major, claimed that her main influence was a teacher she had for an introductory programming class. Since he was so engaging and excited about programming, it made her feel encouraged to take more computer science courses. Many of the other interviewees simply remarked that the though the computer classes were mainly full of boys, their teachers did not exhibit any bias. Thus, high school teachers seem to play a very significant role in some women's selection of major.

Graph 18: High School Advisors Influence

I believe my high school advisors played a significant part in my selection of major.
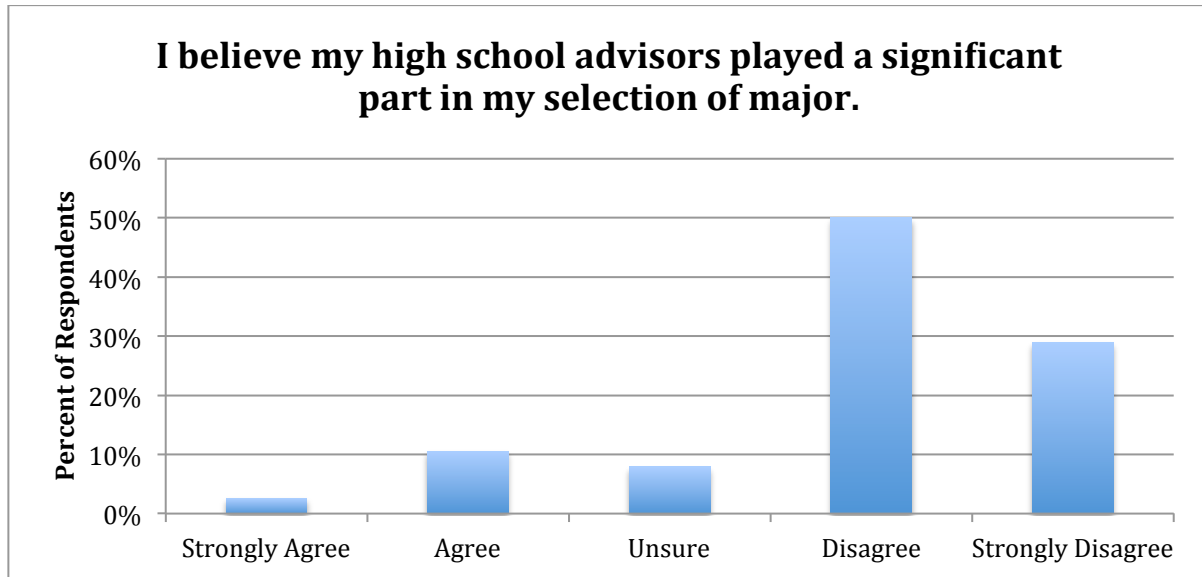
Looking at the graph above showing whether high school advisors played a significant role, it's evident that most of the respondents chose either "Disagree" or "Strongly Disagree." This shows that most respondents though they consulted their high school advisors, they did not really factor into the women's selection of majors. Similar conclusions were drawn from the interviews. Most interviewees claimed that they met with the advisor once or twice a year and did not discuss what major to pursue but rather how to apply for colleges and what the chances were to get into certain universities.

E. Extra Curricular

As part of the data collected, a question was asked about academic based extra curricular activities. Respondents were asked whether they were involved in any activities and if they were, which ones. The graph below shows that about half the women were involved in extra curricular activities and half were not involved.

Graph 19: Extra Curricular Activities
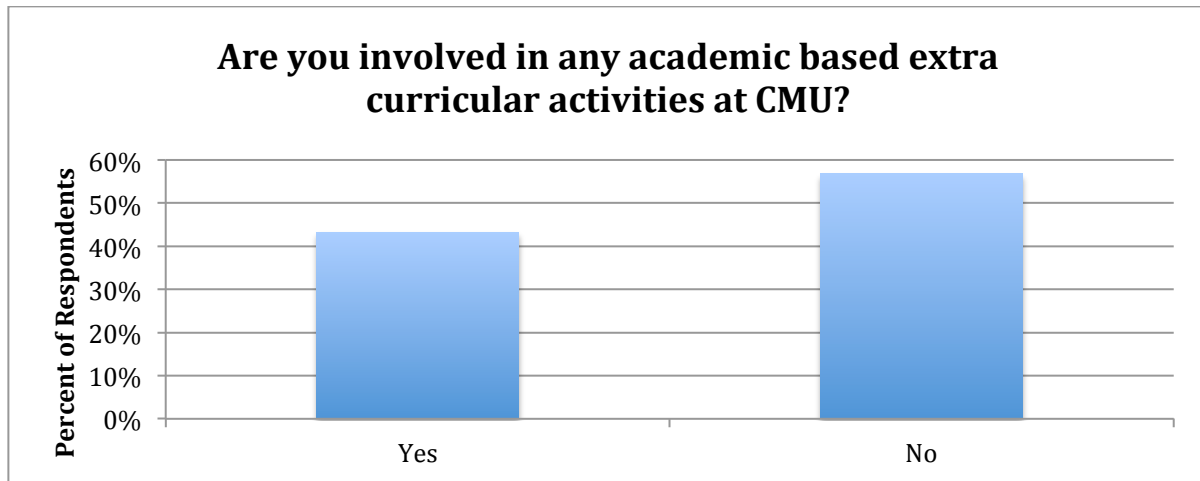
Some of the activities listed included: Society of Women Engineers, Women @ School of Computer Science, Greek Organizations, Philanthropic Organizations and so on. One of the interview questions was regarding any technology-based extra curricular activities. Approximately half the interviewees claimed that they were not involved in any technology-based activities outside of school and classes. The other half of the interviewees have been and are involved in computer clubs and audio-visual technology clubs. Taylor, a sophomore Information Systems major, talked about "Computer Club" that she was a part of when she was in high school as her main influence and exposure to technology. Patricia, on the other hand, is not involved in any academic-based extra curricular activities. Since the extra curricular activity data is divided evenly, no conclusive observations relating women and technology can be made.

F. Famous People in Computing

Another fascinating question asked on the survey was about famous people in computing. This question had nothing to do with the influences that lead women to select technology as their field of study but was interesting to see whether respondents knew famous men and women in computing and if they knew one more than the other. The graph below shows the number of women that responded with one name, the number that responded with two names and totals for men and women.

Graph 20: Famous Men and Women in Computing
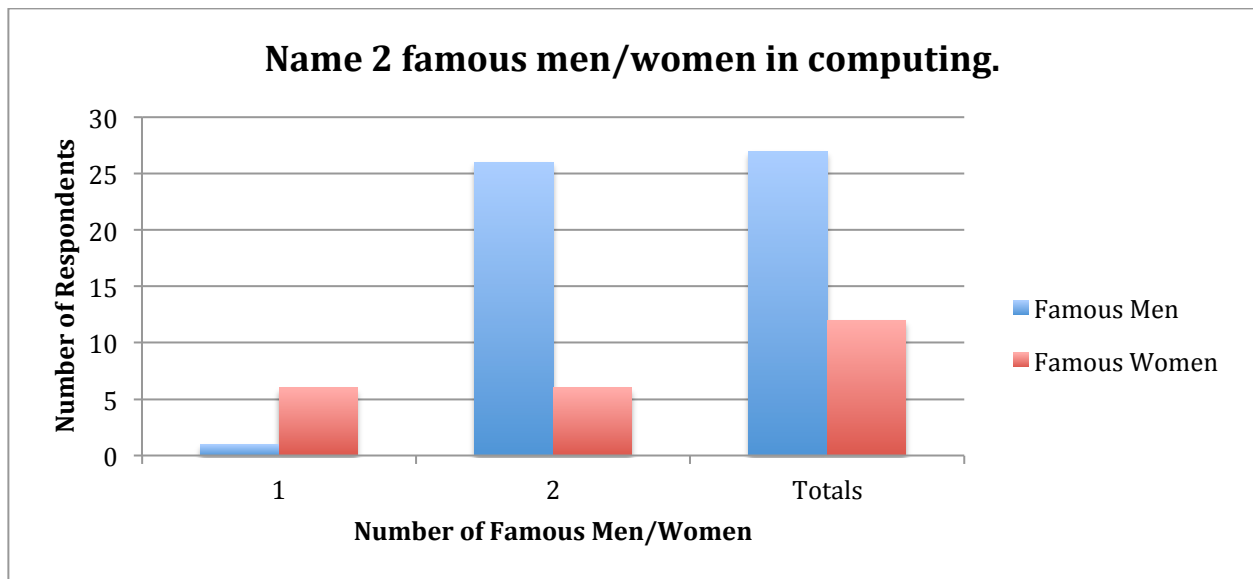
As depicted from the graph above, there were significantly more responses for famous men in comparison to famous women and almost all of those women knew two famous males. This shows that although women are picking technology, they are still unaware of famous women in computing. In fact, out of 18 seniors, only five were able to answer at least one name and only two were able to respond with two names. Even though there are not many women in computing, the few that were named have made significant contributions such as Anita Borg, Ada Lovelace and Grace Hopper. Most of the men that were named were Steve Jobs and Bill Gates.

G. Public's Perception of Computing

As part of the data collected, a question that was asked on the survey was what the respondent thought the public's perception is about the field of computing. This was a noteworthy question because this shows whether the advances that women have made in technology have actually changed the public's opinion. Most of the responses from US respondents were along the lines of "nerdy/geeky" and "male dominated." There were nine non-US respondents out of which seven mostly said something about it being a "smart, stable field." This shows that regardless of the advances made by women, the computing field is still perceived as male-oriented.

Conclusion

After conducting this research on women in technology, a few recommendations can be suggested to help encourage women in pursuing technical degrees. Here are some of the following:

1) Parents should give unlimited, or at least equal computer access to all kids in the household.
2) The computer should be located in either a central location or if it is in one of the kids' bedroom, all kids' should get equal access.
3) Parents should be open to whichever major their daughters want to pursue.
4) Schools should offer technical electives and work on making at least one technical course required.
5) Teachers should make sure that they do not come off as biased towards any particular gender.
6) Counselors should encourage women to pursue technical majors and suggest technical schools for them when asked.
7) Social media should create television shows or show women working in technology.
8) Social media should stop stereotyping all IT professionals as "nerdy" or "geeky".

There are approximately 10 million information technology professionals, yet women comprise only 32.4% (Gartner, 2004) of this figure. In fact, in the United States, they account for less than 30% of the IT professionals. Hence, the purpose of this study was to determine the various cultural influences and programmatic efforts affecting women in technology.

There are many cultural and social influences that affect women's decisions or choices. Family plays a major role in women choosing a technical career. Studies show that if the father or mother is in a technical field, the encouragement they receive is often the primary reason many women choose to enroll in an IT field. The women surveyed and interviewed in Carnegie Mellon University reinforced this theory as approximately 60% of the respondents had at least one family member in computing.

School and early education also serve to influence women's experiences with computers when they are younger which in turn, helps them decide their career. Exposure and availability of computers are major factors that can either make young women comfortable with using computers or inversely intimidated by them, as described by the interviewees.

Finally, social influences such as mass media and role models have an adverse affect. Television shows, movies, magazines and computer games all portray men as the primary workers in the technical field and women in the background. They perceive the IT industry to be full of geeks and nerds – the kind most women do not want to be associated with and thus discouraging them from pursuing a technical field. As for role models, the respondents were able to name two famous men in computing much more easily than two famous

women. This shows that women are still unaware of famous women in computing and their accomplishments.

Thus, there are more factors that discourage rather than encourage women from choosing a technical field. Several groups are spearheading new programs and efforts to encourage women to choose technical fields. Starting with university groups and work place groups. There are also national level programs awarding scholarships and giving women the opportunity to pursue a degree in Information Technology.

Works Cited

Adam, Alison. "Gender and computer ethics." *SIGCAS Comput. Soc* 30.4 (2000): 17-24. Print.

Adya, Monica, and Kate Kaiser. "Early Determinants of Women in the IT Workforce: a Model of Girls' Career Choices." *Information Technology & People* 18.3 (2005): 230-259. Print.

Adya, Monica. "Work alienation among IT workers: a cross-cultural gender comparison."*In Proceedings of the 2008 ACM SIGMIS CPR conference on Computer personnel doctoral consortium and research* 30.4 (2008): 66-69. Print.

Agarwal, Ritu, and Thomas W Ferratt. "Crafting an HR Strategy to Meet the Need for IT Workers." *Communications of the ACM* 44 (2001) : 58–64.

Ahuja, M K. "Women in the Information Technology Profession: A Literature Review, Synthesis and Research Agenda." *European Journal of Information Systems* 11.1 (2002) : 20-34.

Barker, L, and W Aspray. "The State of Research on Girls and IT." *Women and Information Technology: Research on Underrepresnetation*. London: The MIT Press. 3-54. Print.

Currie Little, J. "The Role of Women in the History of Computing." (1999) : 202-205. Web.

Dick, Thomas P., and Sharon F. Rallis. "Factors and Influences on High School Students' Career Choices." *Journal for Research in Mathematics Education* 22.4 (1991) : 281-292.

First, Scores Among, and Sophie Cockcroft. "The Effects of Gender and Computer Access on Computer Literacy." n. pag.

Freeman, Peter, and William Aspray. "The Supply of Information Technology Workers in the United States." 1999. Web.

Frenkel, Karen A. "Women and Computing." *Communications of the ACM* 33 (1990) : 34–46.

Gallivan, Michael J. "Examining IT Professionals' Adaptation to Technological Change: The Influence of Gender and Personal Attributes." *ACM SIGMIS Database* 35 (2004) : 28–49.

Gürer, Denise. "Women in Computing History." *ACM SIGCSE Bulletin* 34 (2002) : 116–120.

Gürer, Denise, and Tracy Camp. "An ACM-W Literature Review on Women in Computing." *ACM SIGCSE Bulletin* 34 (2002) : 121–127.

Igbaria, Magid et al. "An Examination of Gender Effects on Career Success of Information Systems Employees." *Journal of Management Information Systems* 11 (1994) : 181--201. Print.

Jackson, Linda A., Philip D. Gardner, and Linda A. Sullivan. "Engineering Persistence: Past, Present, and Future Factors and Gender Differences." *Higher Education* 26.2 (1993) : 227-246. Web.

Kuhn, Kristine, and K. D Joshi. "The Reported and Revealed Importance of Job Attributes to Aspiring Information Technology: A Policy-capturing Study of Gender Differences." *ACM SIGMIS Database* 40 (2009) : 40–60.

Kurtz, Jennifer A. "Mothers of Invention: Women in Technology." *Indiana Business Review* (2003): 1-4.

Kvasny, Lynette. "Let the Sisters Speak: Understanding Information Technology from the Standpoint of the 'other'." *ACM SIGMIS Database* 37 (2006) : 13–25.

Riemenschneider, Cynthia K et al. "Barriers Facing Women in the IT Work Force." *ACM SIGMIS Database* 37 (2006) : 58–78.

Roberts, Eric S, Marina Kassianidou, and Lilly Irani. "Encouraging Women in Computer Science." *ACM SIGCSE Bulletin* 34 (2002) : 84–88.

Roldan, Malu, Louise Soe, and Elaine K Yakura. "Perceptions of Chilly IT Organizational Contexts and Their Effect on the Retention and Promotion of Women in IT." *Proceedings of the 2004 SIGMIS Conference on Computer Personnel Research: Careers, Culture, and Ethics in a Networked Environment*. New York, NY, USA: ACM, 2004. 108–113.

Selwyn, Neil. "The Effect of Using a Home Computer on Students' Educational Use of IT." *Computers & Education* 31.2 (1998) : 211-227. Web.

Smith, Lola B. "The Socialization of Females with Regard to a Technology-Related Career: Recommendations for Change." *Meridian: A Middle School Computer Technologies Journal* 3.2 (2000) : n. pag. Web.

Sumner, Mary. "An Investigation of Work Family Conflict Among IT Professionals." *Proceedings of the 2008 ACM SIGMIS CPR Conference on Computer Personnel Doctoral Consortium and Research*. New York, NY, USA: ACM, 2008. 127–133.

Todd, Kim, Lori Mardis, and Patricia Wyatt. "We've Come a Long Way, Baby!: But Where Women and Technology Are Concerned, Have We Really?" *Proceedings of the 33rd Annual ACM SIGUCCS Fall Conference*. New York, NY, USA: ACM, 2005. 380–387.

Trauth, Eileen M et al. "Taking Stock of Research on Gender and the IT Workforce." *Proceedings of the 2010 Special Interest Group on Management Information System's 48th*

Annual Conference on Computer Personnel Research on Computer Personnel Research. New York, NY, USA: ACM, 2010. 171–178.

Trauth, Eileen M, Jeria L Quesenberry, and Haiyan Huang. "Cross-cultural Influences on Women in the IT Workforce." *Proceedings of the 2006 ACM SIGMIS CPR Conference on Computer Personnel Research: Forty Four Years of Computer Personnel Research: Achievements, Challenges & the Future*. New York, NY, USA: ACM, 2006. 12–19.

Trauth, Eileen M. "Odd Girl Out: An Individual Differences Perspective on Women in the IT Profession." *Information Technology & People* 15.2 (2002) : 98-118. Web.

Trauth, Eileen M., Jeria L. Quesenberry, and Haijan Huang. "A Multicultural Analysis of Factors Influencing Career Choice for Women in the Information Technology Workforce." *Journal of Global Information Management* 16.4 (2008) : 1-23. Web.

Turner, Sandra V., Phyllis W. Bernt, and Norma Pecora. "Why Women Choose Information Technology Careers: Educational, Social, and Familial Influences." 2002. Web. 24 Apr 2011.

Verbick, Tabatha. "Women, Technology, and Gender Bias." *Journal of Computing Sciences in Colleges* 17 (2002) : 240–250. Print.

Wardle, Caroline, and Lawrence Burton. "Programmatic Efforts Encouraging Women to Enter the Information Technology Workforce." *ACM SIGCSE Bulletin* 34 (2002) : 27–31.

Wirth, Linda. "Breaking through the Glass Ceiling Women in Management." *Luxembourg: International Labour Office*, (2002) Print.

Appendix: Survey Console

Appendix: Recruitment Letter for Surveys

Dear Student,

I am a senior Information Systems student investigating cultural influences and new programs affecting women in technology. As you know, women are underrepresented in technical majors, not only here at Carnegie Mellon University, but also globally. I would like to conduct some research about why women are picking or not picking technical majors. More specifically, I would like to examine the cultural influences including social stereotypes that affect their decisions. Moreover, I want to study the new programs and groups being formed specifically for women in technology, including groups on campus, such as "Women@SCS" and "Society of Women Engineers (SWE)" as well as the concept of role models to see their effect.

I would like you to complete an online questionnaire to help gather information about you and your choices. The questionnaire will explore the following areas: 1) background information 2) past education information 3) current education 4) extracurricular activities. The questionnaire will take approximately 15 minutes to complete.

Your participation is voluntary and survey responses will be strictly confidential. Data from this research will be reported only in the aggregate. Your information will be coded and will remain confidential throughout this entire process. Non-participation will not result in any penalty or adverse affect.

The link to the questionnaire will be emailed to you and will need to be completed by [INSERT DATE]. Please let me know if you have any questions or concerns. Your participation is much appreciated. Thank you very much for your time and support.

Thanks,

Pooja Shah
Information Systems
Carnegie Mellon University, Class of 2011

Appendix: Recruitment Letter for Interviews

Dear Student,

Earlier this semester you completed an online questionnaire about your background, past education, current education and extra curricular activities. Based on this questionnaire and your willingness to participate, you were selected to take part in a short interview about yourself. The interview will further explore topics similar to the questionnaire. It will take approximately 15 minutes to complete.

Your participation in this interview is voluntary and responses will be strictly confidential. Data from this research will be reported only in the aggregate. Your information will be coded and will remain confidential throughout this entire process. Non-participation will not result in any penalty or adverse affect.

After your acceptance of this interview, I will follow-up with possible interview dates and times. Please let me know if you have any questions or concerns. Your participation is much appreciated. Thank you very much for your time and support.

Thanks,

Pooja Shah
Information Systems
Carnegie Mellon University, Class of 2011

Appendix: Survey

Dear Student, I am a senior Information Systems student investigating cultural influences and new programs affecting women in technology. As you know, women are underrepresented in technical majors, not only here at Carnegie Mellon University, but also globally. I am conducting research about why women are picking or not picking technical majors. More specifically, I am examining the cultural influences including social stereotypes that affect their decisions. Moreover, I am studying the new programs and groups being formed specifically for women in technology, including groups on campus, such as "Women@SCS" and "Society of Women Engineers (SWE)" as well as the concept of role models to see their effect. I would like you to complete an online questionnaire to help gather information about you and your choices. The questionnaire will explore the following areas: 1) background information; 2) past education information; 3) current education; and 4) extracurricular activities. The questionnaire will take approximately 15 minutes to complete.

Your participation is voluntary and survey responses will be strictly confidential. You can withdraw from participation at any time while completing the survey. Data from this research will be reported only in the aggregate. Your information will remain confidential throughout this entire process. Non-participation will not result in any penalty or adverse affect. Your participation is much appreciated. Thank you very much for your time and support.
Thanks,
Pooja Shah
phshah@andrew.cmu.edu7
32-331-0133Information Systems
Carnegie Mellon University, Class of 2011

Gender
  1. Male
  2. Female

Age?

Race/Ethnicity:
    1.   American Indian or Alaska Native
    2.   Asian
    3.   Black or African American
    4.   Native Hawaiian or Other Pacific Islander
    5.   White
    6.   Other

Hometown State:

Do you go to Carnegie Mellon University?
    1.   Yes
    2.   No

Why did you choose to study at Carnegie Mellon University, or the university you are currently studying at?

Major:

Graduation Year:

What are some reasons why you picked your particular major?

What are some other interests you have outside your major - why didnt you pick those as your major?

Is anyone in your family in the field of computing?
1.   Yes
2.   No

If so, who?

How many computers did you have access to in your home while growing up?

Where was the computer located in your home? (eg. My room, Family Room, N/A)

Did your school (elementary, middle, high) offer computer classes?
1.   Yes
2.   No

Did you take any computer classes during your school years?
1.   Yes
2.   No

If so, how many and what types of computer classes have you taken before college? (eg. Programming, Basic Computer Skills)

Pick the choice that most closely fits your views:

	Strongly Agree	Agree	Unsure	Disagree	Strongly Disagree
I believe role models played a significant part in my selection of major.	❑	❑	❑	❑	❑
I believe my high school teachers played a significant part in my selection of major.	❑	❑	❑	❑	❑
I believe my college professors played a significant part in my selection of major.	❑	❑	❑	❑	❑
I believe my high school advisors played a significant part in my selection of major.	❑	❑	❑	❑	❑
I believe my college advisors played a significant part in my selection of major.	❑	❑	❑	❑	❑
I feel that I would have picked my major regardless of the field my family is in.	❑	❑	❑	❑	❑

Are you involved in any academic based extra curricular activities at CMU?
1.   Yes
2.   No

If so, which activities are you most involved in? Name your position as well. (eg. Women @ SCS, big sister)

Name 2 famous women in computing:

Name 2 famous men in computing:

What do you think is the publics perception about the field of computing?

If you are willing to participate in a brief interview regarding similar topics covered in the survey, please provide your email address.

Appendix: Interview Guide

1) Background Information:
   a. Major
   b. Year

2) Family Information
   a. Who in your family is from the field of computing?
      i. If some, ask about what kind of positions?
      ii. Influences?
      iii. Did they encourage/discourage?
      iv. If not, how were you exposed to field of computing?
   b. Where was the computer located?
      i. How did that make you feel? Did you feel like you had unlimited access? Did you feel like a sibling – brothers have more access?
      ii. What were you using it for?

3) School Advisors/Teachers
   a. School counselor/teacher – advice on major/colleges?
      i. Did they encourage/discourage?
      ii. Why?
      iii. Were you influenced? Would you have picked the same major/college if not for them?
   b. Programming classes
      i. Class – mostly guys or girls?
      ii. Participation – equal – did you feel like the teacher was unbiased?
      iii. Professor – male or female?
      iv. Required?
      v. What kind of school – public? All –girl?

4) College
   a. What kind of programs related to technology have you been part of?

5) Future plans

Appendix: Interview Notes

Anna C.

Section 1: Background
- Major: Information Systems, pursuing MISM
- Year: Senior, Class of 2011

Section 2: Family
- Mom, Aunt (Mom's Sister): Aunt – Computer Programmers for CFTC and Census Bureau (both government)
- Influence: no pressure, but provided the opportunity, had computers since she was little and used the internet
- Originally wanted to go into political science, be a travel agent
- Encouraging: they were supportive and would have been for anything
- Decided to go into computers because when she was little she would design websites

Section 3: Computers
- Used a computer for the first time in kindergarten – where they taught you how to type
- Had a computer at home all the time because of mom, family computer in living room, unlimited access (only child)
- Designed websites starting in 5th grade, replaced it every 3-4 years
- Self taught – HTML, CSS – tutorials online (Sailor Moon fan sites)
- Started with fan sites, elementary school redesigns
- Used computers for chatting, email
- Played math blasters, Oregon trail – educational games

Section 4: School
- Chose to take these classes: wanted to try out programming
- C++ - Intro to programming – basic, not biased towards boys, but skewed more towards guys
  - Boys more than girls (90%) – only 3 girls
- Java – was terrible – teacher was really bad – had gotten fired from silicon valley and came back and decided to teach – could not teach – influenced her to never want to program again
  - Had biased towards boys – "girls cannot program – just project manage – did not understand technology" mean to the girls, buddy-buddy with the guys
  - Boys more than girls (90%) – only 3 other girls
  - He was the one that influenced her to not take Computer Science, pushed her into project management
  - Other girls in that class: one went to CS and Cal Tech – but dropped out, the other girl went to Cornell – mechanical engineering – also got influenced to not take CS.

- Web Design: too easy, she half-TAed it
  - Equal number of boys and girls (because it was basic)
- School: public school except more of a technology one (out of 3 - she picked this one due to her initial interest)
- All teachers supportive of technology major
- School Counselor: suggested CMU – wanted a strong technology and art background – but not particularly influenced her decision
- But was the one who opened her eyes to CMU

Section 5: College/Extra Curricular
- Technology Consulting in the Community – still keeps in touch with them/helps them with technology
- Continues to design web sites
- Use technology with everything and expects everyone to be comfortable with technology
- IS- good about not making it feel so male-dominated, although some guys think that girls cannot code
- MISM – worked on a team of all guys – when she went to meet the professor – the professor would disregard her opinion, not even look at her – made her feel terrible
  - As a female you are worth less
  - Culture thing: international Chinese and Indian kids doing that - mentality that girls cannot code

Section 6: Future
- Still interviewing for summer internship
- Project management related – has not decided exactly where – but some sort of corporation for a few years – intimate and challenging
- Go into the government or government contractor after a few years
- Somewhere in between – start a nonprofit or work with a nonprofit that does something with taking technology to other nonprofits
  - There are so many nonprofits that could do a lot with such simple technology but do not have the skills or do not know about it
  - Get IT professions to talk to nonprofits

Christine H.

Section 1: Background
-   Major: Information Systems, pursuing MISM
-   Year: Senior, Class of 2011

Section 2: Family
-   Father: Computer Engineer (retired now)
-   Father did not particularly influence her, but exposed her to computers

Section 3: Computers
-   Young age always had computers (main influence)
-   Used computers to play games, chatting (AIM), started typing up assignments
-   1 main one (family) – dad's office – shared (brother was younger, not using computers yet)
-   Started accumulating more –high school – got her own computer – always had access (in her room)
-   Parents: indifferent to what major she picked

Section 4: School
-   Programming classes: did not have any programming classes
-   Had a computer class – about word and excel, took that class – but was very easy for her
-   She chose to take it – was not her first choice
-   Teacher – she was not biased (did not have a background in technology)
-   More boys mainly because they wanted to play computer games
-   School counselor: different advisor every year – do not really talk to advisor – just for sending out transcripts
-   Junior year advisor – from Pittsburgh – excited about CMU, relayed back that female in technology good chances to get in (did not really encourage her)
-   Chose technology as her field even before that – previously wanted to do English, but she's practical and realized that technology is a lucrative field and interest

Section 5: College/Extra Curricular
-   Audio/visual technology group in high school – really enjoyed it (3 years)
-   CMU TV (IS majors – mess around with technology but also talk to people)
-   Really liked junior project: android app for scanning barcodes

Section 6: Future
-   After MISM – IT rotational program - see what functions of the company she likes best

Isabella M.

Section 1: Background Information
- Major – Computer Science & English
- Year – Senior, Class of 2011

Section 2: Family
- Father – works as an engineer, although his background is in Physics – working on black box data of airplanes
- Family was very encouraging to take CS, thought she would become an English major and starve to death

Section 3: Computers
- Got a laptop when she turned 10 (shared with her younger sister, had unlimited access)
- Mainly used computer for email, flash games and chatting

Section 4: School
- Middle School: Computer Science elective – loved it – basic programming (C++)
- High School: Basic Programming, Networking elective, Two Computer science – A and AB
- Highly skewed – boys way more than girls (3 girls, 1 girl in 20 people class)
- Really good friends with the CS teacher
- Got into CS in the beginning because she liked math and her favorite math teacher was teaching CS
- Chose to take the CS classes

Section 5: College/Extra Curricular
- Women@SCS
- Programming Competition in HS
- Programming team past 3 years

Section 6: Future
- Software Engineer, Code Monkey for Google
- Very excited, happy to be in technology

Megan P.

Section 1: Background Information
- ECE Major
- Senior, Class of 2011

Section 2: Family
- Father: Managing Director in a software company, not technology training, but work related to technology
- Cousin: Studied chemical engineering – worked very hard, Manasi also wanted to work hard
- 2 cousins that lived with her studied engineering – both of them worked hard and Manasi was greatly influenced by them – reason why she got into engineering
- Cousins now: 1 did masters at CMU, is now working for eBay (ECE), 2nd cousin: in Gujarat working as a consultant in chemical engineering.
- Family: Father encouraged her when found out about wanting to pursue technology

Section 3: Computers
- 1 desktop – located in parent's office
- 4 laptops (now)
- When growing up – did not have a laptop, but had unlimited access to PC

Section 4: School
- Advisor/Teacher did not exactly help with major/college selection
- Took two years of "electronics" – professor was amazing (clear and precise – usually engineers lacked communication skills – could easily communicate) – that's what influenced her to pick ECE
- Not a required class
- Class skewed – boys more than girls
- Teachers biased: did not happen
- Not intimated with # of boys
- "Junior college" (coed)
- Graduating class: 1000+
- Electronics class: 50 (35 boys/15 girls)

Section 5: College/Extra Curricular
- Involved in SWE/ women@ece (but not active)
- Engineering essay competition (nano technology)
- End of two years of electronics – had to build a project: sensor detecting doorbell – individual
- Does not understand why we need an organization just for women – sees no difference in men and women (skill level does not matter, interest does).
- ECE Capstone: Can Recycler – put in a can, the machine will crush it (10 cans in 2.5 minutes)

- Add-ons: Scan barcode for statistics, check if liquid left in can

Section 6: Future
- Education in India
- Possible Project: Khan foundation videos: tutorials online on any subject – use these videos to develop education in India – cities will be easy due to abundance of technology, rural areas will be a challenge, in English
- Not using circuits/programming
- Loved studying engineering – "pushing me to my limits"

Mona H.

Section 1: Background Information
- Major: Information Systems and Statistics (switched from Computer Science)
- Year: Senior, Class of 2011

Section 2: Family
- No one from family is from technology
- Family was encouraging – did not know anything about technology – did not know CMU – would have been equally supportive for other majors except did not want her to switch to Psychology – because of the $$

Section 3: Computers
- Computer – 1st grade onwards – located in the kitchen – got her own computer for 8th grade graduation (her room – unlimited access)
- Kitchen – sharing with her dad (financial stuff) and brother (playing games)
- Mainly used computers for games, email, homework, chatting

Section 4: School
- Public Magnet (Selective Enrollment) High School, 10th grade: introductory programming class – teacher was a great teacher/guy – pushed her to do AP Computer Science and Intro to ECE class
→ Main influence to get into technology: really excited about computer science, really engaged
- Not required but ended up in this class
- More boys than girls (not really a factor – he was not biased)
- School Counselor – not really, did not help
- AP Computer science teacher – had them play around with Alice after the AP test – found out about CMU that way (first exposure to CMU)

Section 5: College/Extra Curricular
- Switched to IS because CS was too much math and theory than expected
- Still wanted to be involved in technology – more about problem solving – finding a technical solution
- AV Tech
- Theta – Tech Chair- updated the website and dlist

Section 6: Future
- MISM (waiting to hear back)
- Boeing Technology internship (lot of stats as well)
- Wants to stay in technology

Nina I.

Section 1: Background Information
- Major: Information Systems and Human Computer Interaction
- Year: Junior, Class of 2012

Section 2: Family
- No one in the computing world
- Neighbors – first people on the street to get a computer (first exposure to computers)
- Family knew she would end up in technology because she loved gadgets
- Encouraging (indifferent to major)

Section 3: Computers
- Had a windows 98 – only child
- Located in a study – common area – mom's home office
- Had unlimited access
- Used it for mainly games, searching websites, chatting/email (HS), homework, French quizzes
- Had V-tech computer (there was programming…but did not follow it) used for games

Section 4: School
- Course called: Information Technology – learn Office, HTML, CSS (when she was 13-15)
- Influenced her decision to come into technology
- Required class
- Further classes – she chose to take
- More boys than girls
- Teacher – male - not biased
    o Really excited that she was in technology

Section 5: College/Extra Curricular
- No extra curricular technology activities
- Enjoying IS + HCI, learning that she does not want to do programming or systems development
- Information session on HCI got her excited
- Teachers here are not biased
- But is aware that some bias exists (classmates)
- "little representation of technical females"

Section 6: Future
- Interned with J&J and Boeing
- Planning on interning in a consulting firm (stay in technology)

Pam A.

Section 1: Background Information
- Currently: Economics Major,
- Previously: Computer Science Major
- Senior, Class of 2011

Section 2: Family
- No one from family is in computing
- Wanted her to come to CMU, thought that it was a good major – people are doing well in the field – so it would be good for her future
- Really for her doing CS and against anything else

Section 3: Computers
- Growing up: brother and her shared a computer, was in the shared bedroom
- Later on, got individual computers
- Had "computer time" – equal access, # of hours
- Over time – he began to use the computers more for video games and the computer was on his desk
- Used the computer mainly for word documents, play games (roller coaster tycoon, Sim city), email and chatting

Section 4: School
- Enjoyed programming classes in school and was good at it (9th -12th)
- Chose to take the class
- Boys vs. Girls (11 girls, 27 guys)
- Teacher was fair between the two
- Tutor – female – influenced her to do computer science – she was really good at programming and made programming fun
- Was very basic programming

Section 5: College/Extra Curricular
- No extra curricular activities
- Switched: realized that she liked coding not algorithms and theory
- Did not enjoy programming – enjoyed it in school/class but did not want to take it home
- Was sure did not want a job in CS, but thought it was a good thing to learn

Section 6: Future
- Nothing in technology
- Work with her dad in trading (use her Economics major)

Patricia S.

Section 1: Background Information
- Major: Information Systems/Business Administration
- Year: Class of 2011, Senior

Section 2: Family
- Father: Project Manager @ J&J, masters in computer science
- Early exposure to computers
- Mother: stay-at-home
- Family was very encouraging – though would have been as encouraging for anything else

Section 3: Computers
- Desktop in her room – 9-11 years old, unlimited access
- 1st laptop in high school
- Currently in the house: 1 desktop, 4 laptops between 3 people (mom, dad, and her)
- Mainly used computer for games and chatting when first got it

Section 4: School
- No CS/IS courses taken in middle/high school
- No programming experience until college
- No teacher/counselor influence whatsoever

Section 5: College/Extra Curricular
- No extra curricular programming related activities
- Enjoyed the programming classes taken
- Felt no skew towards guys vs. girls
- Had fun taking the two project courses – junior and senior
    - Liked looking up how to program certain things, researching online and trial and error

Section 6: Future
- Working in an IS/Business job – Information Technology Leadership Development Program at Johnson & Johnson

Taylor C.

Section 1: Background Information
- Major: Information Systems (switched between ECE)
- Year: Sophomore, Class of 2013

Section 2: Family
- Father: Journalist – writes about IT
- Encouraging – mother wanted her to go into technology more than her father (wanted her to go into business) – scientist so she believes women should do what they want to do even if its science or technology

Section 3: Computers
- Bought a computer – when she was 2 (dad's)
- Used it mainly for playing games
- Elementary School – living room – had limited access to the computer but activities were watched by parents
- Middle School (13 years old) – got her own computer in her room, unlimited access

Section 4: School
- Took no computer classes in school – there was no option for it
- Junior college – there was a computer/science option but she did not take it because other option offered a wider variety of career options, and it was just a higher level
- No school "counselor" – class teacher was basically that

Section 5: College/Extra Curricular
- Computer Club
    o How to make a website
    o Animation
    o Robotics
    o Workshops (week long or month long)
      → Teacher teaching: changed every time – were very competent – taught well
    o Competitions and Projects
    o Secondary School: All Girls (7th-10th)
    o Primary School: more boys than girls (1st-6th)
    o Gave special attention to girls – reverse discrimination

Section 6: Future
- Technology Internship: Goldman & Sachs
- Short Term: Learn technology – understand it and be able to use it
- Long Term: Business side – lead people (had a bad boss who did not know technology but was asking for technical projects)