

The Role of Women in Technology and How to Encourage Young Girls to Enter the Field

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ABSTRACT

Women have been underrepresented in technology since the introduction of the field. In the past, women were not thought of as being as capable as men in science, technology, engineering, and math. Though more people today think that women are as capable to perform these jobs as men, it is still the case that women are outnumbered by men in the technology industry with less than 20% of bachelor's degrees in computer science being obtained by women. Even fewer of those women who earn a degree in computer science remain in the technology workforce. The purpose of this research is to determine ways in which young girls can be encouraged to pursue the field of technology by identifying commonalities among women in tech, specifically to what encouraged them along the way. This research was conducted by interviewing women at different stages of their technology careers to determine ways in which young girls can be encouraged to pursue the field of technology. Additionally, a literature review was conducted to supplement the interview data. The expectation of this study is that there will be one or more common factors among the women interviewed that relate to what drew them to technology. These similar encouragements may result from motivating teachers or parents, or perhaps from the negative comments spoken by influential adults.

1. INTRODUCTION

1.1 The History of Women in Technology

As a result of the way history has been recorded, it seems as though many computing achievements have been made by men over the years. The truth, however, is that women have played substantial roles in the world of technology throughout history.

Sadly, the story of minorities being over-looked, underappreciated, and excluded from science, technology, engineering, and math fields is a common one. Despite common historical logs, women were key to the beginning and success of software development.

Around 1842, Augusta Ada Byron Lovelace invented the first programming constructs at a conceptual level. She created ways to store sequences of computer operations/instructions and informational values. Today, this looks incredibly similar to what programmers know as subroutines/functions. She additionally found a way to relate numbers and the operations performed on them in order to manipulate numbers and perform arithmetic. Again, modern programmers know this concept as data types and operators. Also widely known and used throughout software development are arrays, contiguous blocks of memory used to store information. Lovelace created the concept when she traced the current operation being performed using upper indices in her table for Bernoulli numbers. More than just inventing fundamental computing concepts, she was the first person to understand the potential of using technology to create a computing machine [6].

Another breakthrough in technology, the ENIAC, was first programmed by six women. The women were Kathleen McNulty Mauchly Antonelli, Jean Jennings Bartik, Frances Synder Holberton, Marlyn Wescoff Melzer, Frances Bilas Spence, and Ruth Lichterman Teitelbaum. The ENIAC was the first electronic computing machine in the world. More specifically, the ENIAC was a parallel machine with digit trays that carried the numbers, program trays for carrying program symbols, and components that were doing the calculations [6]. The women who programmed this machine not only had to develop a method to route data and program pulses through the machine, they also had to exert physical strength and stamina, in

addition to intellectual power, because this process involved physically manipulating dozens of cables and digit trays and around 3000 switches.

Especially in the beginning of computing history, it was thought by many people that computers were reserved for use by mathematicians and scientists. Women have been credited in making a fundamental impact in the ease of use of computers, which has rendered them the common and crucial tool they are today. This involved making computers capable of performing everyday tasks, like payrolls and inventory. The computer designed in order to accomplish these tasks for commercial users was the UNIVAC. One developer on this project was Betty Holberton, also a developer on the ENIAC project. She was partially responsible for one of the world's first practical applications of software. Additionally, Holbert's code utilized a C-10 instruction set which utilized more than just 0s and 1s for commands thereby making them easier and faster to program. Another facet of computing advances that made the use of computers easier was the capability to sort objects. Holberton also invented the Sort-Merge Generator that produced a program to sort and merge files. Today compilers are crucial in the process of software development, and her contribution is regarded as the first precursor to compilers. This was deemed the prestigious accomplishment of "the first major software routine ever developed for automatic programming" [6].

Grace Murray Hopper is one of the more well-known women in the history of computing. Hopper recognized the need to make programming more efficient by eliminating machine code, the series of 0s and 1s that the computer directly responds to in order to accomplish tasks. It is because of Hopper that modern computer scientists do not have to write code in binary and can instead use high-level programming languages that look more like the English language. Hopper was discouraged from this idea and was told repeatedly that it was impossible, because

“computers could only perform arithmetic, not write their own programs” [6]. Despite the negative comments she heard for years, she developed the A-series compiler which paved the way for high-level computing languages. Today, COBOL (Common Business Oriented Language) is the well-known and widely used programming language for business operations. This language is a direct descendant of Hoppers FLOW-MATIC language. The creation of FLOW-MATIC gave computer scientists the courage to develop the CODASYL Executive Committee, which overlooked the development of COBOL and other languages in the future. Three initial members of this committee were women: Betty Holberton, Jean Sammet, and Mary Hawes. Also, from this achievement, FORTRAN (formula translation language) and MIT’s algebraic translator were produced as scientific programming languages. Largely thanks to Grace Hopper, programmers today are able to write programs much faster and much more powerful than anything previously considered to be possible.

At MIT, Judy Levenson Clapp worked on the Whirlwind, one of the world’s first real-time computers. Here she developed an air defense system that received radar input to track flying aircraft and direct courses for aircrafts. This is especially important because this was the first application ever developed that was nonnumerical. Additionally, this was the first system ever created that required a visual display. This display was used so users of the software could see the aircraft tracks as they were being calculated by the machine in real time [6]. A gun was created to be aimed at the display and produce current information about the airline being pointed at. Judy Clapp also made an incredibly poignant statement regarding the culture of men in technology at that time. During this time the keyboard was invented, and she recalled men refusing to use it because they did not consider themselves to be typists, as they considered that to be a woman’s job. This is because the keyboard resembled a typewriter which was stigmatized to be the tool of

a secretary. Clapp is quoted saying, “In order to use this gadget, you had to type, and the men said, 'We're not typists. We're not going to use this!' And here was this wonderful capability and one of the largest deterrents to it is the resistance to typing. I remember we finally convinced our Vice President of Information Systems to get a computer. He got his computer and called me to come up and see him using it. I walked in and he was leaning back on his desk with his secretary in front of the computer. He was dictating and she was typing! So, you never realize how culture can stop things from moving on” [6].

One of the unique aspects of the time that programming became necessary is that most of the men were overseas serving in WWII. This gave women the opportunity to be resources for programming the computing machines previously invented. Previously, these intelligent women had never been permitted to use their mathematical talents. Adele (Millie) Koss, one of the first programmers on the UNIVAC stated that her computing job was wonderful, exciting, creative, and rewarding.

1.2 Why We Need Women in Technology

The inclusion of women in technology is crucial, in part, because, in the same way that most women cannot provide the viewpoint of a man, most men cannot supply the viewpoint of a woman. As seen in section 1.1, women have been credited with amazing technological advances throughout history. In addition to the monumental progress in computing at the hands of women, the viewpoints provided by women in tech can also alleviate more minor problems. For example, early speech recognition software struggled to understand and recognize the voices of women because they had not been widely involved in the production of the tool [4]. Original airbags injured women and children more often than men because they were designed and tested with the body of a man in mind. [4].

Additionally, an article written in 2017 refers to research produced by the Kauffman Foundation that showed that technology companies being led by women earn, on average, a 35% higher return on investment. The same article lists businesses run by women that have launched as a result of the entrepreneurship program at Imperial College London, a public research university in London, England. These businesses include Lys, a wearable sensor developed by Christina Peterson that tracks light exposure to help regulate the user's circadian rhythms, Oorja, a company led by Clementine Chambon that provides off-grid communities in rural parts of India with electricity, and Momoby, a company created by Ana Luisa Neves which is creating a finger prick test that will revolutionize the care pregnant women in developing countries receive by providing early notice of diseases known to negatively impact pregnancy [4].

1.3 The Current Underrepresentation of Women in Technology

While the number of women in engineering and science fields is growing, men continue to outnumber women. This is especially prevalent in upper levels of these professions. Something interesting must happen in between high school and college, because elementary, middle, and high school boys and girls take science and math courses in approximately the same numbers and report leaving high school feeling prepared to pursue a STEM related major in college. However, more men than women actually end up pursuing a science, engineering, or math related field [2]. By graduation, women are outnumbered in almost every engineering and science field. Some STEM fields including engineering, physics, and computer science face a dramatic difference in the number of women earning degrees versus men. One statistic showed that an estimated two out of every ten bachelor's degrees in these fields are awarded to females [2]. This declining trend is even more drastic in graduate school and in the transition to the workplace.

Trends in schools are beginning to improve. The same report that listed the above statistics states that there are now only three boys for every girl scoring above 700 on the math portion of the SAT at age thirteen as opposed to thirteen boys for every girl back in 1980 [2]. Additionally, an article produced from North Carolina Women in Technology, NCWIT, disputed a number of statements made by 60 Minutes that made it sound as though efforts to diversify computer science have failed. This article stated that this was far from the truth and provided statistics supporting this claim. A graph was provided that illustrated the number of female Advanced Placement, AP, computer science test takers has increased steadily since 2000. In 2018, more than 10x the number of girls took the AP computer science exam nationally. Another graph showed, despite the claim made by 60 Minutes that the number of women and girls pursuing technology is going down, that the number of women who received undergraduate degrees in computer science in 2017 had increased by thirty-seven percent since 2000. The reason the share of undergraduate degrees in computer science held by women has held constant at nineteen percent the past several years is because the number of men earning these degrees has increased as well [3]. This NCWIT article also addresses the fact that there is a lack of radical progress being seen in the workplace. This is true because it takes time and intense collaboration to change societal attitudes and educational systems [3].

1.4 The Purpose and Significance of This Study

The purpose of this research is to understand the current climate of women in technology and, from this gained knowledge, identify ways in which girls can be reached at a young age to encourage them to pursue the field of technology. It is important to attract and retain more women to science, technology, engineering, and math roles in part because these fields are crucial to the national economy [2]. More women in the STEM workforce will greatly enhance creativity and innovation due to

the contributions of female perspective and having more hands and brains on deck to solve difficult problems.

2. LITERATURE REVIEW

In preparation for this study, research was conducted from previous studies. This was done in order to get an idea of what questions to ask in interviews, to understand past and current statistics, and to understand how other research in this area might have been conducted. It was important to gather information about the history of women in technology, the stereotypes surrounding women and how they have/have not changed, the rates at which young girls and women are being educated in science, technology, engineering, and mathematics disciplines, and how implicit and workplace bias still play a role in the lives of women in tech.

In this research, it was found that there has been much done to improve the STEM education young girls receive. For this reason, the question regarding each subject's earliest exposure to technology was asked. The goal of this question was to expose how these successful women in tech remember being introduced to the field and how this experience may have been different for older versus younger subjects.

One report states that even people who denounce the thought that girls and women are not as capable of succeeding in math and science as boys and men are often guilty of holding such beliefs at an unconscious level [2]. These unconscious beliefs are also known as implicit bias. While everyone has implicit biases, they can be more prominent in "majority-group" environments which many tech companies are.

Similar to the Kalahar article referenced in section 1.3, another source goes on to say that the number of women earning computer science degrees has increased along with the number of women in the computing workforce, even though the percentage

of women in the workplace has remain stagnant [5]. This, again, is due to the fact that the number of men in the workforce have increased as the number of women has increased. This article also mentions that stereotypes have played a role in this problem, mentioning both the depiction of women being helpless when it comes to technology and the depiction of the male nerd hacker. I think that the latter is more of a problem. I do not think that today women are told as often that they are incapable of excelling in tech, but I do think the stereotype of nerdy men dominating the industry is still prevalent and deters women from wanting to pursue computing. As mentioned in section 4.7, this did actually deter one woman interviewed from wanting to pursue technology. Additionally, this author claims that computing knowledge used to be seen, and is sometimes still seen, as privileged. She has seen this manifest itself in the form of some teachers striving to weed out newbies and only work to enhance the knowledge of those already exposed to computing. When this article talked about how the number of women can be boosted in the computing industry, the author stated that all children should be learning some coding language like a second language. The author mentions that this is an ideal world scenario, but it still shows how crucial it is for coding to be introduced to children as young as early elementary school.

Another article, written by Anneke Jong, titled Leveling the Playing Field: How to Get More Women in Tech states that the main issue that has led to the disparity in the number of women to men in computing is that young girls have not coded before [1]. It opens with anecdotal evidence about why it is crucial for young girls to be introduced to programming. The first is about a young girl who was fortunate enough to be sent to a coding camp in the eighth grade. At first, the young girl did not know what she was doing was computer science, she just knew that she liked making things. Seven years after this experience, she became a computer science major at Stanford University. The second anecdote is about another young girl who

was introduced to programming at nine years old by her parents. Until she took computer science in high school and her teacher encouraged her to pursue the field, she did not know that people did programming for a job. Now, she is a software engineer at Twitter and credits her family's encouragement and the exposure to computing as a career in high school with her success. This article claims something found in the interviews conducted for this research: that early exposure to computing is critical in captivating the interest of women and maintaining their desire to program as women [1]. This article also stated something that especially resonated with me. Jong said that there exists a competitiveness in computing classrooms that has the potential to intimidate young girls and women who have not coded before. Many women claim that, even in introductory coding classes, it often seems that the boys have programmed before. This article lists statistics that female AP computer science enrollment is as low as fourteen percent, which makes it "the most gender-skewed AP class in the country" [1]. The solution to this problem is that computer science must be taught to middle school girls. This would prepare young women to enter college competitively in a computer science degree. Otherwise, women are at risk of perceiving feeling behind in such a degree as a failure and quit to pursue something else. As mentioned in an interview conducted for this research, young kids are sponges and could learn a programming language like they could a foreign language and would carry this with them for life.

3. METHODOLOGY

3.1 Process of Obtaining Subjects

The process of obtaining subjects took approximately 3 weeks. First a list was compiled of potential participants, initially including men. After discussion, however, it was decided that only women would be asked to participate in the interviews to provide more focus on trying to identify a commonality between women regarding what influenced them to pursue technology. The list then included

women involved in technology from many different industries and generations. Including women from different technology sectors and of different experience levels was important to gather information from a wide variety of viewpoints. Some of the women chosen are soon-to-be college graduates already hired for a software engineering role upon graduation. Some women are computer science professors. Some women are involved in the technology sectors of the banking industry. Some women are c-suite executives at software companies. One woman is a retired secretary turned software engineer from the 70s.

Once the list of women was finalized, each was contacted personally by either myself or someone on my behalf that knew the potential subject better than I did. Each woman received a brief introduction about the research and a very informal question of whether or not they would be interested in learning more about participating in the study. If they said yes, they were sent a formal email describing the purpose of the research and the procedure that would be conducted. They were also sent a letter of informed consent for them to read and respond with their consent. Once I received a response of consent, that individual was then scheduled for an interview. Additionally, the subject interview data was recorded by interview order and not associated with an individual.

The hypothesis for this study is that there will be a commonality found among the women interviewed that might be helpful in connecting more young girls to the field of technology. It is suspected that the main driving force that encouraged these women to pursue technology was either a support group paired with their own determination, or someone who was convinced they could not succeed.

3.2 Questions Asked and Why

The questions for each interview are the same for each subject to maintain consistency throughout the research. This was important so that comparison between answers from various subjects would be feasible. The list of questions can be found in the Appendix. The first questions of the interview are general questions about the subject's entry into the field of technology. For women about to enter the field, these questions gathered information about when they will enter their first technology job, where this first job will be (geographical location and company type), and what they expect to be doing in this role. For women either currently in the field or retired from the field, these questions refer to their first job in technology. From then, I ask women currently in the field where their current job is and what their role in that position is. I chose to ask women currently in the field where their first job was and where their current job is so I could understand how each woman grew and changed throughout her roles.

These initial questions were followed up by questions regarding expectations. I chose to ask about each subject's expectations when entering her first technology role and if those expectations were correct or not. For this research, I was especially interested in expectations regarding the type of environment they would be working in. For example, I wondered if the women anticipated working for all/mostly men and if they were worried about that.

One of the most important questions asked throughout the interview process is if the subject had any encouraging role models throughout their process of becoming a woman in technology and what they remember about the individual(s), if they had one, that was encouraging. This question is directly in line with a hypothesis of the study: that currently successful women in tech likely had influential role model(s) who encouraged them along the way.

3.3 General Conducting of Interviews

Each participant was given the option of conducting the interview either in person or over the phone depending on the subject's location and availability. Email interviews were not utilized due to the security concerns that would result from the subject's name being on her answers. Some interviews were conducted over lunch and included over an hour of discussion, while others lasted thirty minutes or less over the phone. A limitation of this study related to the occasionally shorter interview time is discussed in Section 5.1.

The first couple of interviews conducted followed very closely with the questions found in the Appendix. However, as interviews went on, some of the information learned from previous subjects influenced follow-up questions. As I conducted more interviews, I learned how to better stimulate conversation and gain more in-depth information.

4. INTERVIEWS/DATA COLLECTED

4.1 Interview One

The first interview conducted for this study involved a younger woman, whom will be referred to from now on as Sub1, in technology who will soon be officially entering the technology workforce as a front-end software engineer. Sub1's initial entry into the technology industry was an internship as a software test engineer. For this first internship, she wrote automated test scripts in Java to test the user interface of the company's website. She currently has a second internship with the same company as a software engineer. In this position, she is doing application programming interface (API) work, front-end development, and implements functionality of the website by connected field elements to the backend database. Additionally, she stated that five out of her six superiors are male, the one female is the project manager, and that she is the only female on her direct team of nine.

As she entered the first internship at this company, she had the expectations that the coding aspect would be difficult because she doesn't feel that she has learned the most useful languages in school. She was wary about having to learn a lot very quickly while being put under pressure. Additionally, she expected people in the tech industry to be quiet and introverted. She also anticipated that she would have a problem sitting in a desk all day. However, the expectations she had that worried her the most were that upper management would push her to try and justify their decision to hire her, and that she would be representing women in technology so she would have to outperform her coworkers. Some of her expectations were correct, while others were not. For example, she did have a lot to learn upon her arrival to the internship, but people did not put as much pressure on her as she expected and were overall understanding of her needing time to learn. Additionally, it was confirmed that many of her coworkers are introverts, but they get along well together because they have that common personality trait. She was also correct in her assumption that she would be one of a few women amongst many more men. She said that she is often the only female in the room and that she often feels the men try to act more chivalrous than normal and all try and open the door for her. She doesn't mind this interaction; it just highlights the already obvious demographic in the room. Most unfortunately, however, was her experience of sexual harassment in the workplace that resulted in the loss of employment for the involved man. In this situation, he would message her across a chat application making increasingly inappropriate comments. He also often tried to leave with her after work and invited her out despite her repeatedly telling him no. She felt uncomfortable from the beginning but was terrified of causing a scene at her first internship at a company she otherwise liked. However, feeling empowered by the #MeToo movement, Sub1 brought the incident to the attention of her supervisor who then involved human resources and

other supervisors to look into the event. She will be returning to this company as a full-time software engineer soon.

As a young girl, she remembered video games being her first introduction to computer science and technology, even though at the time she did not equate video games with computer programming. The first time she remembers relating video games to computer science was when she was eighteen and a freshman in college. When she made this realization, she switched her major from psychology to computer science. She dropped out of college, though, but began attending a different school to earn a degree in computer animation. Upon graduation from the second school, she returned back to the first school where she earned a bachelor's in computer science. She said that her role models throughout this process were her mom, dad, and two older brothers. She said her dad hardly made it through high school, but she watched him struggling to get by but still put her through school. He encouraged her and she credits him with her "go for it" attitude. Her mom, on the other hand, is a traditional college graduate and inspired Sub1 to stick with college even though she dropped out the first time. However, not with any bad intent, her mom would buy her Barbie dolls despite her taking interest in the old computers her dad would buy her brothers to dissect and learn about. In addition to her parents, her older brothers were an encouragement to her because they entered the tech industry before her and were excited when they found out that they would have her to talk about programming and other tech concepts. She said that they never questioned her abilities and told her from the beginning that she was capable. They even offered to help her learn new languages and offered her welcome technology industry advice.

When I asked her if she had anything else to tell me that would help with my research, she offered the following. She said that she never felt like she couldn't succeed in technology, she actually said she always felt smart enough. She does

think, however, that it is common for women to stumble into something like computer science and end up liking it because they enjoy a challenge.

4.2 Interview Two

The second interview conducted was with a recent computer science PhD graduate, Sub2. Sub2's graduate research, and current work, focusses on integrating computer science into K-12 education both in the United States and in Africa. To accomplish this in the United States, she works with middle school and high school teachers to integrate programming activities. She knows the importance of getting computer science activities into core school subjects like biology and math. She also focusses on helping discouraged, underprivileged, and minority students involved in technology and programming. In Africa, she helps integrate Android tablets into the classrooms to replace their traditional textbook with eBooks. She does this because most classrooms only have one textbook, so students do not have individualized access to the material. The tablets are also important because it gives the students access to online biology and chemistry labs that they would not have otherwise.

More specifically, her research dealt with the creation of development materials for AP computer science teachers in high schools because they often have little to no experience with programming. This results in the students in these AP computer science classes not being able to complete projects or labs with any substantial benefit because the teachers often do not know enough computer science to grade the assignments with meaningful critiques. Sub2 gave an example of a programming project where the student has to build a wall of bricks. The assignment cannot be graded to teach the students because two students may get the same grade even if one of them demonstrated real understanding of programming concepts by using loops to lay the bricks and the other student hardcoded each individual brick, not demonstrating true understanding. The implementation of her programming course

materials would help the teachers in these classrooms because Sub2 builds the support materials from college programming classes. This means that the students get a real learning experience that will prepare them for school while the teachers get formulated programs and lesson plans all accompanied with premade grading rubrics.

Since she hasn't entered the technology industry in the traditional sense, the questions I asked Sub2 were more geared towards getting an education in computer science. She revealed that an expectation of earning a degree in computer science involved being able to do whatever she wants for a job. She saw a PhD in computer science as an open door to working wherever she wanted, doing whatever work she wanted. She said she knew that a traditional office job was not for her.

Sub2 said that she did not specifically remember an event that sparked her interest in technology, rather she had never considered any other career path. This is interesting, because her parents never wanted her touching technology as a child because they were afraid that she would break it. Nonetheless, she felt drawn to a computer science class noted on a high school course catalog she was presented when she was about to finish middle school. She signed up to take the class freshman, sophomore, and junior year, but it was cancelled every time because not enough students signed up. Her senior year, though, it was finally offered despite the fact that she was the only student who decided to take the class after the school guidance counselors threatened to fine any student who took the class but later decided to drop it. Sub2 felt strongly that the guidance counselors wanted to deter every student who wanted to take it. She ended up taking it online with a room proctor for the fall semester because they couldn't hire a teacher for the class since she was going to be the only student. She shared the room with students who just got out of jail, but she attended the class every day. For the spring semester, the school

forgot to ask someone to proctor the room, so she held herself accountable each day to complete the assignments and attend. When it was time to apply to college, she knew that she wanted to pursue technology, but did not know the difference between computer engineering, computer programming, and computer science. She chose to major in computer science because that was what her online class had been called, and she ended up loving it. When she got to school, she learned that she enjoyed helping other people understand subjects like computer science, so she tried to major in computer science and minor in education. However, her undergraduate school did not offer this combination. Instead she added a minor in science technology and society.

Sub2 stated that she did not have any encouraging role models along the way. However, she does recall that her earliest exposure to computer science was her grandfather's ancient computer and the DOS terminal. She remembers the book full of terminal commands for things like opening the file manager and playing solitaire. Her step-dad, on the other hand, would stop playing his video games when she walked into the room because he did not want her to help him or get involved. In college, she was stereotypically one of the only females in her computer science classes. For example, she took a Java class with around 150 people and she was one of two females in the class. This did not phase her though; she was just happy to take a coding class with other people because she had been used to coding in lonely environments. Not only was she happy in college, she excelled and credits some of her skills to teaching herself her AP computer science class in high school. She recalls feeling important in her classes because her absence was felt when she wasn't there. The other students became reliant on her because she was very talented and took the pressure off of them in class by answering all of the teacher's questions.

When Sub2 was asked if she had any additional information to share that would be helpful with the study, she shared that one of the most profound commonalities she has found among young girls is that they often want to help people and do not see computer science as a way to do that. For example, Sub2 has heard from young girls across the globe that they want to be doctors, or veterinarians, or physical therapists. She heard some girls say that they want to influence society by being fashion designers, bakers, or toy makers. Sub2 never wants to discourage the dreams of young girls, it is not the point to encourage girls to pursue technology and miss out on their passions. However, she did encourage girls to connect their passions with computer science. For example, she encourages girls who love animals to get involved in developing the technology veterinarians need to save animals every day.

4.3 Interview Three

The third interview conducted was with a young woman, Sub3, about to enter the tech industry at a bank. Though she is not entirely sure what this new job will entail, she knows she will be doing some sort of work with data analytics on capital markets. Her expectations and hopes going into this role include wanting to be treated like a full-time employee and less like a student or an intern, expecting to work on a team and less individual school-like work, and she anticipates getting involved in backend development work. Similar to Sub1, she is worried about not knowing the topics she will need to know and worries about how fast she will have to learn under pressure. Additionally, she expects to be working for mostly men. She has this expectation because her dad works for the same company and works with all men. She is also used to this demographic from previous Research Experiences for Undergraduates (REUs) and school. For Sub3's first REU, she expected research to be more interesting than school, but she was disappointed when she instead sat at a desk all day. At this REU there were two other females and six males, and her professor and PhD student were males. For her second REU, she had a more realistic

set of expectations because she had experienced a similar situation before. She did, however, have a negative experience. Sub3 had the opportunity to attend a workshop and did so. She was the only female REU student in attendance but was shamed by her male professor at the end for not asking any questions, even though none of the males had asked questions either. Her professor insinuated that she must have been confused because she was a girl, and that since she was a girl, she needed to learn how to assert herself. Sub3 remembered feeling humiliated and like an outcast among her male peers.

Sub3 did not remember a specific event that captured her interest in technology but did remember discussions with her supportive dad who encouraged her to pursue the field of technology. Her dad, a database administrator, initially promoted computer science but she was not interested at first because she did not feel like it suited her. She did concede to take an AP computer science class in high school and greatly enjoyed the challenge of it and the instant reward of completing a programming assignment.

As previously mentioned, Sub3's dad was the most encouraging person in her life. She thinks that he is inspiring because he handles the stress and difficulty of his work with patience. She says that he encouraged her from the beginning to pursue the field and she still calls him with homework or program questions.

Sub3 said something that related to the profound statement made by Sub2. She said that her friends pursuing degrees to become physicians' assistants and doctors ask her if she is pursuing computer science for the money. This relates to the statement Sub2 made about girls not pursuing technology careers because they do not associate them with directly helping people. Her friends do not mean harm when they ask questions like this, but it shows a disconnect that people have with technology

careers that they do not have with careers directly associated with the health care system. Sub3 additionally feels that young girls do not want to be pushed towards computer science just because they are girls. She does not think anyone wants to feel like they are being encouraged just to meet a quota, instead of because they are actually talented and valued.

4.4 Interview Four

The fourth interview conducted was with a data implementation director. The interview with Sub4 is one of the few conducted in person. Sub4 entered the technology industry through an internship in 2013 as an actuarial analyst. Her first full-time job after the internship was at a large retail store as a fraud analyst to help with business intelligence. Here, she was responsible for an algorithm that determined the validity of credit cards. Currently she is more involved in the banking world working with data implementation and writes specific Extract, Transform, Load (ETL) schematics for various data sets depending on the needs. She especially enjoys her position because she gets to be heavily involved with technology while also getting to work with people inside and outside of the company more than in other tech positions.

Sub4's expectations entering her current position were realistic because of the lengthy interview process she went through to earn the position. The company was very clear about her future roles and they were accurate. However, she remained cautious as she entered this new role because she had such a negative experience at her job at the large retail store as a data analyst. While she was at this job, she experienced severe sexism and described the atmosphere as a "boy's club" of the worst kind. Sub4 said that she had to turn down many passes made at her by the men she worked with and for. One event she remembered in particular was when she tried to voice a thought in a meeting and afterwards her boss said that she humiliated

him and belittled him because she dared say something that contradicted what he said. Because of her difficult past experiences, she was apprehensive about her current position, but she has been pleasantly surprised. Her current technology company is comprised of approximately 50% female and 50% male. Her current boss is female and many of the other strong leaders are women. She even works closely with an all-female development team and this is not a rare occurrence at her current company.

When asked about her inspiring role models, she mentioned her mom and her high school precalculus teacher. It was just her and her mom growing up because her father had passed away when she was young. Even though her mom did not graduate from high school, she was incredibly encouraging of anything Sub4 wanted to pursue and was incredibly impressed when she began to take an interest in technology. Her mom instilled in her a “you can do anything” attitude and often talked to her about her talents for school. Despite the fact that she did not have her dad around for most of her later childhood, her mom talked about how he was incredibly gifted in math and science. Her female high school precalculus teacher was the first person who let her know that she was smarter than average and had a talent for math. Because of her, Sub4 was moved into AP classes and transferred to a governor’s school in her district for advanced math and science. This was a pivotal time in her life where she was introduced to programming and fulfilled her dream of being accepted to the Florida Institute of Technology to pursue her dream career of working for NASA where she had previously had an internship. Unfortunately, her mom could not afford the tuition or the plane ticket to get her to Florida. For this reason, she attended a different school and majored in physics with a minor in statistics. She always knew she would end up in the STEM field, her path was just different than she had anticipated it would be.

What peaked her interest in technology was different than what has inspired other women that participated in the study. Sub4's dad was an explosives and plane technician in the military before he passed away early in her life. When she found out that he was gifted in mathematics and science like she was, she felt that continuing to pursue technology would help her remain close to him. She began doing household science experiments as a child along with other STEM related activities and this carried her excitement about technology throughout her life.

Sub4 shared additional information that she thought would be helpful with this study. She said that she has felt that some men are overconfident because they were seldom told that they are incapable of pursuing certain fields. She has seen men who were 80% qualified go for a position while women 95% qualified for the same position not apply. She believes that this trend she notices among men and women results from the repeated occurrence of the word "no" to young girls, but she feels that this did not impact her life because of the way her mom raised her. She decided from a young age that she would not allow the negative statements from others to deter her from pursuing whatever she felt called to. However, she does not downplay the negative impacts that still linger from hearing others, mostly men as she got older, tell her that she was incapable of succeeding in technology. Additionally, she shared her thoughts that if young girls were introduced to technology at a young age, they could excel at it. She related this to the ability young children have to pick up playing a musical instrument or a new language at very young ages.

4.5 Interview Five

The fifth interview conducted was with a woman, Sub5, who entered the technology industry in 2010 as a design engineer for a nuclear power plant. In this role, she used AutoCAD software to design plans. From there she moved into an operations role where she was trained to run the nuclear power plant. In this position, she was

responsible for the programmable logic controllers that commanded the automatic valve openings and automatic breaker strips throughout the plant. She also worked with the program logic for various indicators such as those that monitored water level and water pressure. Following this position, she moved to a different company where she did SAS programming to develop economic models to be used for statistical analysis. She especially enjoyed this position because the work was applicable to more operations. This was in contrast to how the languages she used throughout the nuclear power plant were specific to the companies who made those products. Currently Sub5 is the vice president of engineering for a pharmaceutical company. In this leadership role she programs much less than she used to, but she uses her knowledge of programming and computing to solve problems and guide her team. She is thankful for her past experiences in computing because she now has a unique skill set among executives who often lack programming experience.

Sub5 had various expectations as she entered the world of technology. One of these expectations was that it would be similar to school in that she would learn a topic and then have problems specific to that lesson to practice. She learned instead that the real world was not like this at all. She realized quickly that she had not been taught what she needed to solve all issues, that people are learning and solving foreign problems on the go. She was also surprised that once someone solves a new problem, they become an expert on that topic even if they are young and new to the industry. When asked if she had anticipated working in a male-dominated field, she said that she was raised by a strong mom who taught her that there are strong women sprinkled throughout any job and to not be intimidated working for men.

The first time Sub5 remembered being exposed to computer science and technology was when her mom, a computer scientist, would take apart computers and show her the insides of them as a young girl. She also remembered playing games on a DOS

computer system. The time she remembers technology captivating her, however, was in college when she took an engineering course. One of the types of engineering she got to focus on was biomedical engineering and she distinctly remembered being amazed by the imaging technology. She was fascinated by the potential to improve medical treatment and, for the first time, experienced the connection between computer science and bettering the world.

Sub5 does not remember any role models, aside from her mom, until she was further into her professional career. As mentioned before, Sub5's mom was a computer scientist. Even more inspiring, though, was her mom's accolades as magna cum laude in computer science from Vanderbilt University. Seeing her mom as a strong woman in technology for her entire life was incredibly empowering and encouraging for Sub5. Once she further advanced her professional career, she had mentors, though they were not involved in technology. Three of these mentors were female, a communications specialist, a lawyer, and an accountant. Her fourth mentor, however, was a male involved in technology who hired her for her first job. She credits him with being a critical ally in her professional development because he was a powerful man in the tech industry, and he saw value and talent in Sub5.

At the end of the interview, Sub5 shared information she thought would be helpful to the research. She stated that it is important to remember that people experience various levels of exposure to technology depending on their situation growing up. This is important to note because computer science does not seem to be a topic that people often decide they want to do on their own accord. Because of this, Sub5 feels that it is critical for people, especially women, to give extra effort to "introduce people to the sport". In a world so digitized and automated, she thinks that having some computer science experience is a critical skill to have any sort of business success.

4.6 Interview Six

The sixth interview was conducted with a woman, Sub6, who entered the tech industry straight out of school. Her main focus was and remains on the user perspective regarding technology. She went through sales and was selling technology. She, as a user of the technology, could sell the products from the perspective of the user. She sold technologies to small and large companies in New York City. Currently, she is an author and technology entrepreneur. She runs several companies and entrepreneurial endeavors, helping large corporations better manage Information Technology access and optimize how they acquire their technology. She stays up-to-date on technology and therefore is able to manage technology on behalf of corporations and provides financing on technology purchases. She focuses on selling technology solutions in the cloud space and data centers, as well as on security. Sub6 also describes herself as a strong believer in the ideal that “service is the rent you pay for the privilege of living on this earth” by Shirley Chisholm. Stemming from this belief, in addition to her previously stated technological endeavors, she is an active advocate for the increased participation of people of color, women, and young girls in technology. She has won many prestigious awards as a woman in technology including one award by President Barack Obama.

When asked about her expectations and assumptions she had upon entering the technology industry, she had much to offer. Sub6 stated that she expected to give it all that she had to succeed and that large corporations would expect the same of her. She also expected that because of her work ethic, she would succeed at any task she was given. She was apprehensive when asked to go into sales because she had never sold anything before. However, she received excellent training, learned to knock on every door, and won Rookie of the Year at the company. She also stated that she didn’t think much about what her experience in a male-dominated industry would be but thinks more about it today. As an owner, she still works with other companies

and serves on several boards of directors. She has learned to be a lot more selective with who she works with and who she hires. When asked about what specifically she looks for when making these decisions, she said that she looks for whether they value diversity and actually demonstrate that value. She wants to see individuals, companies, and senior leadership of companies embracing diversity in tangible ways. In addition to this, she is also more selective about the conferences and summits she agrees to speak at. She stated that if she doesn't see anyone who represents her perspective then she doesn't go. She says that we all have choices as consumers and our choices need to be more intentional and support what we want them to support.

When asked about an event that sparked her interest in technology, she said that she “grew up in the dark ages” and did not have access to any technology other than a typewriter. She established an affinity for typing and was placed in a typing class in high school. Back then, she said she was geared toward roles in security and needed a typing skill to lean on. Sub6 said, despite her success in technology, she never took a computer science class.

Sub6 listed two role models who encouraged her along the way. One of these role models is her sales manager from her first job who is an African American woman. She said that this role model was interested in Sub6's professional development and wanted her to look the part to help her succeed. Sub6 bought a strand of pearls from her collection and still has it. She also helped her buy silk shirts and bow ties to follow the dress code. Sub6 and her mentor knew that as a woman, and especially as a woman of color, her appearance and the first impressions she made were crucial. She knew that people were not always fair and would discriminate based on how she looked before she even had the chance to speak. Another mentor of hers was an African American male branch manager. He took interest in her and went above and

beyond to ensure her success. Sub6 said that this person gave her first opportunities as a salesperson, despite a psychological profile she took that stated she would not be a good sales person.

When asked if Sub6 had any information to further help my research, she provided many good ideas. She said that her book is all about embracing the changing faces of technology. She felt compelled to broaden the conversation of intentionally looking beyond the image of what society says a computer scientist should look like, like “Sheldon” she said. She wants people to embrace that a technologist can look like anyone. Sub6 also stated that she feels like everyone recognizes the importance of necessary inclusion, but company numbers sometimes do not reflect improvement even if the company is talking about it. She listed that companies like this are Google, Apple, and Facebook. Another interesting statement Sub6 made is that she feels that the United States is trying to do better in enforcing computer science classes in the education system like other countries, but it will take a while for this to reflect in the industry. In the meantime, though, she said that companies need to identify women and underrepresented people and bring them into technology. This will require money, time, and intentionality. Sub6 said that we need every company, not just technology companies, to get involved in this effort and this is yet to happen. She said there are major companies still not at the table talking and, until this happens, we won’t see the momentum shift. Sub6 also wanted to make sure that it is known that women, specifically women of color, have not been involved in technology not because they cannot do it or are broken and needing help, but because they lack access. Women become successful because women refuse to be denied and it needs to be made easier for women and minorities to get into high paying, flexible, good jobs. A bridge needs to be built for young girls so they know they are smart enough and can do it, although it will be hard. Sub6 also stated that she knows that girls have a desire to help people, so it needs to be made clear to

them that their desire to do good is going to be accelerated if they learn how to use tech. They need to understand that everything runs on code. Additionally, they need to see more women visibly successful in these roles because this will help them see themselves in the roles they aspire to have. This means that women have a duty to become visible to young girls.

4.7 Interview Seven

Interview seven was conducted with a woman, Sub7, who is currently a senior vice president of a major company where she has risen through the ranks. She entered the tech industry in 2002 as tech support at the same company she now helps lead. Other titles she has held at this company are project manager, director of professional services, vice president of professional services, and senior vice president of relationship management.

Sub7 stated that she had many expectations and assumptions heading into the tech industry at a large software company. She thought that it would be “cool” to work at a software company, which she followed up with “cooler than it actually is.” She had assumptions about what she affectionately calls “the nerd herd” whom she thought would be introverted individuals who sit in dark caves and code and she did not want to be a part of it. She has a passion for customers and an aptitude for technology, but she did not see herself as a programmer. She said that she did not anticipate working for/with mostly men, however this is what she has experienced since 2002. She said that men were dominant in all roles and that her bosses have all been men except one woman on the executive team. Sub7 said that only in the past year has the company become intentional about diversity and now the chief information officer is a woman (which she is thrilled about). She also said that there have been three incredible women in senior tech roles. Sub7 also said she is thankful that she has not had any negative experiences working with men and that all of her mentors up until last

year were all men who behaved appropriately towards her. She said it probably helped that she has a “middle school boy sense of humor” and she is not easily offended. She did state, however, that the last year the company has done a lot of inclusion and diversity training. Throughout this experience, she said that she felt naïve and learned that she should have felt offended at times. Now she realizes that there are many subtle things that show sexism. Still, though, she claims that nothing inappropriate happened to her, but that she now recognizes the male bias that was happening.

She remembers recognizing her aptitude for technology in middle school. She attended a summer school program for fun where she took a coding class and wrote games at a basic level and at home, she wanted all the gaming systems. She loved computers and technology and anything that involved them, and she continued taking the basic coding classes her school offered. The experiences probably impacted her when she was in her twenties when she decided to change her career from teaching dance to something in technology. Initially, she didn’t know what she would change her career to, but technology felt like the right avenue. Once she decided on technology, she attended school to get certifications. One of the things she learned here is that she loved taking computers apart and putting them back together.

When Sub7 was asked if she had any inspiring role models, she listed four. The first she mentioned was the man who taught her summer school coding class in middle school. She credits him with helping her gravitate towards technology. She also listed her parents. She stated that her dad passed away when she was fifteen and was not involved in tech, but she was able to see him work hard as a police officer. She said her mom was overall a very encouraging person and she had a strong relationship with her. She said that her mom taught her to only tell the truth and to

accept nothing less. She said that no one told her she would not be able to pursue her dreams. She got the job at the company she has been at since 2002 because of her customer service experience, but she was given a chance in technology because her male boss saw that she had an aptitude for technology and saw her drive since she had been attending school to learn about tech. This boss knew that she was not pursuing a career in development and that she loved working with customers, so he helped her find a path where she could be involved in technology while also maintaining relationships with the customer base. Sub7 said that she formed relationships with two of the tech founders at her company and they were very supportive of her. She also said that her boss helped her narrow her scope. She said it was incredibly helpful for someone to be blunt with her and ask her what she wanted so she could be successful at it without trying to focus on too many things.

When asked if she had additional information that she felt may be helpful in this study, she stated that she still remembers the times that people, especially men, took time to teach her. She did not know any SQL when she joined the company, but she loved learning and solving problems and did not want to have to send everything over to the developers to do. When her coworkers and bosses saw this drive, they taught her what she needed and wanted to learn. She was encouraged and supported when she showed an interest in learning new things. She feels, though, that there is less tolerance for this now in bigger companies but encourages people to find a person who is willing to teach them what they want to learn. She stressed the importance of taking notes and doing your homework once you find this person, so the same questions need not be asked repeatedly. It is important not only to find a good teacher, but also to be a good learner.

4.8 Interview Eight

Interview eight was conducted with a woman, Sub8, who is now retired from her tech job. She entered a government technology role in the early eighties where she was a Fortran developer. She worked in the defense departments where she wrote software to either analyze data coming from weapons systems or display data for analysis. She worked with different customers to get all requirements for systems, wrote the software to create the systems, and then followed through to completion and taught the users how to correctly interact with their new systems. She did this for ten years and then she moved to an area where she performed more managerial tasks and stopped programming. In this position, she managed the people who were doing the data analysis. She retired as a supervisor where she managed a team of software engineers.

Sub8 said that when she was majoring in computer science in college, she did not know what she would use her degree for. What she went to school for and what she ended up doing for a career were very different from each other, except for the languages she learned. She said that she grew up in a small town and lived a sheltered life, but this changed when she began working. When asked about her expectations as she entered a government tech position, Sub8 said that she felt like she would have to learn all over again. She said that math was more important back then in computer science and that she felt like she didn't take the amount of math necessary. Despite her feeling unprepared, she said that the people at work were nice and helped her along the way. However, she said that the men there were often older and had never seen a cathode ray tube and felt like she should work on a keypunch instead. She did say something surprising, though, which was that she worked with quite a few women who were not secretaries. Though college was more of a 50/50 split, Sub8 said that there were times when she worked in an office where nearly every person working there was female. She said, however, that this began to change

in the last ten to fifteen years. When asked why this was, she said she was not sure. She did say, though, that she went to a briefing with a female city leader speaking and she mentioned that women need to be interested in technology when they are young girls because, if they aren't, by the time they are teenagers it is likely that they will not gain interest in it. Because of this, young girls need to be made excited about engineering and computers. Following the trend of the last ten to fifteen years that she noticed, by the time she retired it was nearly all men in the office.

Sub8 remembered when she first became interested in technology around the age of fourteen or fifteen. She stated that a very good family friend, a female computer science major, would tell her about working on the programs she had to do for school. Sub8 liked the way she was excited and, from then on, would tell people that she was going to major in computer science because that was what she knew from the family friend. She said that she did not grow up in a family of technical people, most of them were educators, but seeing this family friend come home excited (and sometimes crying from frustration) made her want to pursue the field. Additional experiences she remembers that solidified her interest in technology were the coding classes she took in college. She had great teachers who had previously worked in industry and then returned to teach. This was important to her because it provided her with practical applications on how the coding skills she was developing could be used in the real world.

Sub8 mentioned two main role models throughout her technological development. One of them was a college instructor. Sub8 said that this role model took her under wings and guided her and was one of her main inspirations, especially since not many people had even heard of her major. Her other main role model was her mom because, even though she did not know anything about computer science, she supported whatever it was that she wanted to pursue in college as long as she could

take care of herself with it. In addition to these positive role models, Sub8 also had negative experiences on her journey. Her guidance counselor in high school tried to dissuade her from pursuing technology. Sub8 said this was likely not malicious, but rather because the guidance counselor did not understand the field. Sub8 also said that she was told by some people that she would go to college and end up with a baby instead of an education. However, Sub8 said these things did not discourage her and instead made her more determined to succeed.

Information that she added to the interview that she thought would be helpful in this study includes that she thinks STEM classes in school are good, but we need to encourage more young girls to participate in them. To do this, she suggested getting the girls excited by building robots in hopes of keeping their attention into their teen years. Setting the mindset early that they can do anything they set their minds to is crucial.

4.9 Interview Nine

Interview nine was conducted with a woman, Sub9, who entered the technology industry twenty-five years ago. Her first tech job was part time as a help desk analyst which she had as she was going to school full-time for computer engineering. She felt that a help desk job was a great opportunity because it helped her understand a company's hardware and software and how they work together. After graduation, she was a contractor at an insurance company where she analyzed data and monitored network systems. After a year at this job, Sub9 got a job as a programming system analyst where she learned how to navigate through the analyst IT professional area. Here, her managers helped her be creative and do what she knew how to do.

Since 2015, Sub9 is a program manager at a company that introduces, reinforces, and engages young kindergarten through twelfth grade students with hands on technology experiences. To do this, she either goes to schools or school kids travel to their facility. They create lesson plans from an engineering perspective to teach everything from hardware to software. They involve robots and programming in the lessons so the students can write the code, build the machine, put the two pieces together, and then watch them function. Languages they teach students include JavaScript, PHP, and Python. Python is especially good because it is a language that is fairly easy to understand so students can focus more on the concepts and less on syntax. Sub9 says that the company she works at will work with all students, no matter the age group, type of school, or location.

Sub9 discussed that the students she sees are mostly male, which was not surprising to her because tech is still a male-dominated industry. She thinks that girls do not want to look too manly or not be accepted, which may deter them from taking computing classes. She has noticed that, in her workshops, the boys want to answer questions first even if they end up being wrong. Sub9 stressed that minority women are key, and it is especially crucial to get these women involved in tech.

Sub9 had expectations as she entered these roles. At her data and programming analysis jobs, she expected that her position would be difficult. She also expected that, as a woman and especially as a black woman, she would have to work harder to be promoted and would have more to prove. At these positions almost all of her superiors have been male except her direct supervisor. More recently, especially since beginning her current job, she has had more female coworkers and superiors. She wanted to make sure it was clear, though, that many of her male bosses allowed her to experience and explore areas she wanted to work in. Some female bosses tried to promote this too, but since growth has more flexibility for males, females are

more often competing against each other. I think that a reason males may be seen to have more growth opportunities is because there are fewer barriers to entry, especially for tech positions. Though it was not malicious, Sub9 felt that females are all trying to advance their careers and therefore spent less time trying to help her explore areas she wanted to work in than her male bosses did.

When Sub9 was 18, she remembered having friends majoring in computer science and other tech fields in college. She remembered them using Fortran and talking about coding, but she had no interest in this because she abhorred syntax. As a younger girl, she spent time in her dad's mechanic shop where she helped him fix cars. This instilled a love of hands-on tinkering in her, which later on translated to her loving the hardware of computers. When she was first introduced to how software could make hardware move, she was completely amazed. Knowing that eventually her code would make something move and function helped reduce her hate of syntax and she learned various programming languages.

An event that further sparked Sub9's interest in technology was when she attended a workshop while she was in college. Though she was in school to pursue a career in computing, this experience opened her up to a different perspective on technology. She was a member of IEEE and they had sent members to participate and explore the competition and format. At this workshop, she saw young students (around the third grade) working with robots and other gadgets. This experience, which stuck with her, made her wonder how many kids do not get these opportunities and how this might impact their eventual career choices.

Sub9 recalled several role models who encouraged her throughout her journey. One of these was a male college professor who was hard, rough, and mean. She said that he instilled within her a good work ethic, something her dad had done also. He gave

her more determination to succeed even though he originally did not think she would successfully complete the degree because she was a female. After he saw her and the other female in the class persevere and perform in class, Sub9 and this professor became friends. From him, she learned how to think outside the box and to think logically and step-by-step about problems. He encouraged her and the other female in the class to break barriers. Her other main role models were her parents who were both supportive and proud of her, despite not knowing the details of technology. She remembered her mom encouraging her to pursue whatever job she wanted. Now, her parents know that she teaches kids to code and fully support this endeavor.

Sub9 shared additional information to help in this study. She said that a very small number of minority women are in support and networking groups that help integrate girls into technology. It is likely that this hinders minority girls feeling like they could pursue the field of tech because they might not see many women like them succeeding in the industry. She also said that when young people hear someone say technology, they seem to immediately think of a computer scientist and fail to recognize all of the other career possibilities that stem from technology. Young students, especially girls, need to know that technology, computer programming, and software are behind every career they might want to pursue.

4.10 Interview Ten

Interview ten was conducted with a woman, Sub10, who entered the technology industry in 1978 as an operating systems programmer upon her graduation from undergraduate school. When she first entered this role, she was supporting an older machine which was a common role for new employees at the company. In order to support this older machine, she wrote code in a type of Assembly language (the specific type will be left out to preserve the anonymity of the company). Throughout her whole time at this company, Sub10 stayed in data management as a systems

programmer working on different areas of the operating system. One role she specifically discusses was managing stress tests. In this role all of the new hardware and software would be tested individually. Once all individual pieces seemed to be functioning correctly, she and her team of interns would try and break each piece testing various cases. Once this was complete and the system was either not broken or the pieces that broke were fixed and retested, the system was tested as a whole. After her time at this company, Sub10 went back to school to get her PhD. Her PhD research focused on sensor networks, which consisted of little sensors all around that had to communicate with each other. Her goal was to make this more efficient since communication was, at the time, the most expensive part of using computing resources. To do this, she blended database, data management, and networking. She then proposed collecting the data in a fuzzy database, which is a database based on possibility rather than probability and can equal more than 100%. She additionally built a simulator and learned about how gasses flow (which is strongly based on possibility) to translate this knowledge to her research. After Sub10 finished her PhD, she went into academia and became an associate professor of computer science where she has taught introduction to computer science, introduction to programming in C++, operating systems, and networking and research in networking.

Her expectations entering industry in the 1980s included that she would do well, be taken as an equal person to her colleagues, and work hard and get the same rewards as others when they work hard. She, unfortunately, found that this was often not true. Sub10 stated that her expectations were often proven untrue through subtle events. For example, she noticed that it seemed like whenever a woman was promoted, people assumed that she knew someone or that someone had helped her. Whereas when a man was promoted, he had worked hard and deserved it. She also stated that the conversations people have can impact his/her psyche, so she started to believe that she was being marginalized and treated unfairly, as were her female

counterparts. She said that if she or another woman had an idea to be implemented, it had to be worked around the men. She elaborated that this meant that a woman had to have a man introduce her idea because if a female introduced the idea it would fall flat. She also said that, depending on the man who introduced the idea, the woman may or may not ever receive credit. Sub10 gave an example of this regarding a friend of hers who worked in cryptography and solved an incredibly difficult problem. A higher-up at the company called her male teammate to congratulate him on a hard job well done while he never acknowledged Sub10's friend, even though the man who was congratulated corrected the boss on whose work was really to be celebrated. When asked how many of Sub10's superiors have been male, she said that it was more than ninety percent and almost all of them were white men. Regarding her coworkers, she said that there were still many men, but a much higher percentage of women here than in upper level positions. She said that, back then, women were expected to leave the workplace once they had a family.

In college, Sub10's interest in technology was sparked. She originally was a math major but took a computer course in Fortran and loved it. She noticed that, unlike math, there is a component of instant gratification when a program works. This was also her first exposure to computer science. It helped her realize that there were not as many opportunities for math majors and decided that, if she stuck with programming, she would have more choices for a career. Because this first programming course inspired her to continue with computer science, she was able to land a job at the company she remained at until pursuing her PhD.

She stated that in college she did not have many role models or mentors, but her parents were very supportive. Sub10 came from a very science-oriented family where most people were engineers or physicians and therefore did not experience

much discouragement from those around her. She said she met women in industry that she wanted to emulate but would not necessarily call them mentors.

At the end of the interview when Sub10 was asked for any helpful additional information regarding this study, she said that instead of women continuing to ask for “their fair share of the pie” they need to instead work on “creating a new pie”. She said that one factor that needs to go into this new pie are modern paternity and maternity leaves. An additional comment she made was that there needs to be a focus on socially relevant programming to engage young people, especially girls, in computer science.

4.11 Interview Eleven

Interview eleven was conducted with a woman, Sub11, who grew up and attended school in India and entered the tech industry after graduation. She earned her bachelor’s in computer engineering in 2007 and landed a job at a major tech company in India. Originally, she was almost placed in a support area but said she would rather do development because that interested her more. Here, she started with SQL and then moved to .NET and Visual Basic where she focused on development, especially with databases. After leaving this job, she moved to New York and joined a company as a contractor where she made SQL reports. Upon leaving this position, Sub11 moved to a company in North Carolina where she has been now for two and a half years as a SQL reporting analyst where she does data warehouse management. She considers the data modeling and design of databases and generates reports. Sub11’s career goal is to become a data warehouse architect where she would create data warehouse designs that are flexible and comfortable for data utilization. Her entire career has revolved around data and database design which she has enjoyed because it allows her to keep diving deeper into these technologies.

As she entered the technology industry, Sub11 expected that she would deal with challenges in the workplace, though she knew that women can overcome these difficulties. She assumed that there would be more men than women in technology because it is the same in India.

In high school, Sub11 was mainly focused on biology and computer science. In India when a student finishes high school there are two main streams to go down. One of these streams is medicine and the other is engineering. She initially wanted to pursue medicine and lab work, but she started learning computer science after her dad encouraged her to go to engineering school. There was also a technology boom as she finished high school and she saw a lot of her family members working on computers. Sub11 felt that, if she struggled, she would be able to receive help from her dad and many of the family on her dad's side of the family since a majority of them were engineers.

Sub11 listed two projects that were very inspiring to her throughout her journey. One project she listed was a student information system for the college she attended. For this project, she built upon someone's previous work and used .NET and an access database to finish it. The project was very appreciated across the campus. The second, and much larger project, she listed was one where she and her mentor developed a system to translate Tamil to English. Tamil is a language more than two thousand years old spoken by Tamils in southern India, Sri Lanka, and elsewhere. This project was so massive because Tamil is an incredibly difficult language with no direct translation to English, so there was currently no way for Tamils and English-speakers to communicate. She loved this project because she, as a native Tamil speaker, knew how valuable this could be. When she left school, this project was completed and working. This project made her think of exploring other technologies and drove her to attempt other difficult projects.

Sub11 listed several inspiring role models. Three of them are women at her current company who are inspiring because they are great decision makers and project managers. She also listed her female chemistry teacher in high school who would talk about how women can do anything, and she would be very encouraging of people. Sub11 also respects these women because she was able to see them be successful in the workplace while also successfully managing their families. Sub11 strongly dislikes the idea that women can no longer pursue meaningful careers after marriage and having children. She, as a married woman with two children, says that if someone likes something and feels driven to pursue something, then they should go for it. She also said that her mom was encouraging because she was a working woman who was very supportive of her. Sub11 said that her family gave her everything she needed to be successful.

4.12 Interview Twelve

Interview twelve was conducted with a woman, Sub12, who entered the technology industry directly out of college. Before her entry into the tech industry with a full-time position, she worked at a mom and pop shop in Detroit where she was hired to help engineers address issues with cars in real time. The original process to do this was to call customers thirty, sixty, and ninety days after they purchased a vehicle to get their reviews and help them address any problems they may be having. This was soon deemed an inefficient process though and then ended up traveling around to set up call centers and networks and train employees. Upon her graduation from college, Sub12 left this company landing a job supporting applications. Though this was not what she wanted to do, she knew the opportunity of working with customers directly and learning how to troubleshoot systems was her first entrance into technology and took advantage of the opportunity. Sub12 realized that there were people at this job who knew Linux and Unix which were tools she wanted to learn. The people who

knew these technologies took time with Sub12 to teach her how to run scripts and reboot boxes using Linux and Unix. After this job, Sub12 earned a very technical job at a bank performing vulnerability scans and analyzing system configurations. One reason she particularly liked this job is because it heavily involved the logic and processes of the business. She liked thinking about the question of “what is the business actually doing.” Once she learned about the systems and what the goals of the business were, she would write flow charts of these things in order to thoroughly test the systems. At this job, she went into information technology audit in a compliance role. After this, a role as a privacy officer came up. At this point, Sub12 had a great mentor (the chief information security officer at the company) who encouraged her to apply for the role. Sub12 earned the position and took on the responsibility for three years. In this position, she would work on privacy and maintaining consumer data. She worked closely with the chief information security officer to make sure the right controls were being used in storage and transit. If there was a breach of security, Sub12’s team had the responsibility of notifying customers and regulators. Currently, Sub12 is the chief information security officer at a major software company. In this role, Sub12 defines what data needs to be protected and then encrypts the data, transmits it securely, and then makes sure that the perimeter security is in place.

Though Sub12 currently sits as an executive at a very successful software company, her dreams were not always to enter the world of technology. When she began college, Sub12 was originally a pre-med student to become a doctor. However, during her junior year of college she decided that she did not like studying for the MCAT and did not want to attend eight more years of school. Because of this, she changed her major to computer science since it was the quickest path to land a job after college. She had previously taken programming classes at college, but she disliked the syntax rules involved. What she did like, however, was the

troubleshooting and real-time problem solving used in data centers. She very much enjoyed hands-on work such as unplugging and rebooting servers and crawling around on the ground working with wires, cables, and the physical aspects of the machines.

Sub12 had expectations as she entered the technology industry. One of these assumptions was that she would work for all men which was true. Sub12 stated that all of her direct managers have been male, and a vast majority of her coworkers have been male as well. Her team consists of fourteen people and the three females on the team were hired by her in the past year.

An event Sub12 remembers sparking her interest in technology was when her parents purchased their first Commodore computer. She remembered that to boot the computer she had to take out the floppy disk, insert again, and then type a command in the terminal. She also said that her dad had a friend who loved the computer and knew a lot about it and would come over to teach her about it. He taught her new games and would come over when the computer had a problem that needed to be fixed.

Sub12 listed her parents, especially her mom, and her French teacher as inspiring role models. Sub12's parents are both Hungarian immigrants. Before immigrating to the United States, her mom was a successful electrical engineer. When she got here, however, she could not get a job because the industry was so male dominated, so she went back to school and became a nurse. Though this was a sad experience for her mom, Sub12 admired her mom for this because she was strong and independent enough that she was able to reinvent herself. Sub12's French teacher was inspiring to her because, though she did not learn any French in these classes, her teacher would always stress how important it was that his students were able to get jobs and take

care of themselves. Sub12 had always known that she did not want to be a stay at home mom and that she did not want to be dependent on anyone. She learned that you get out what you put in to situations and to take every experience as an opportunity to learn.

When asked if there was any additional information she would like to share to help with the study, Sub12 shared that right before this interview a group of high school students came to her work for a mobile application competition, of which she was a judge. She said that these students had prepared mobile applications to win a competition and receive feedback. Sub12 was inspired to see how excited and nervous they were to present their designs and ideas. She stated that these students asked for direct feedback, so the judges were candid. Sub12 stressed how important direct feedback is and that it is crucial that emotion is taken out of it so that individuals can understand that not every negative comment is said with ill-intent. Sub12 also said that later in the week she would be giving a ten-minute talk to STEM schools about technology. She said that today, more than ever, girls know that they can grow up to do whatever they want to without boundaries.

4.13 Interview Thirteen

Interview thirteen was conducted with a woman, Sub13, who entered the technology industry before graduation through internships. She participated in internships at a well-known technology company from the summer after high school through the last summer of graduate school. Upon earning her PhD, Sub13 did aerospace research for the government under top-secret clearance. She designed software engineering solutions for three very well-known organizations. After spending nine years performing in these roles, Sub13 moved into academia at a historically black university. Here, she taught classes including introduction to programming, elementary data structures, mobile application development, and computer science

education track classes about diversity in computing, assessment, and teaching diverse learners. Currently, Sub13 is in her fourth year at a university in South Carolina where she has taught introduction to computer science, introduction to programming in C++ one and two, C#, and programming tools.

As she entered the world of technology, Sub13 felt prepared both academically and non-academically. She felt prepared non-academically because she knew how to deal with implicit and explicit bias and marginalization. Part of the reason she felt prepared in these areas was because her mom was a programmer as well, so she grew up hearing about her mom's experiences with such treatment. She also felt that her experiences throughout her internships and graduate school prepared her to enter industry because, not only was she one of the only women in her programs, she was the only black woman. When Sub13 first started interning up until her entrance into graduate school, all of her managers had been black and had been very intentional in diversity departments. When she entered her internships she was one of the only black people. Once she entered her government job, she was the only black person in the department of ten people and one of only two women. Sub13 thinks that one of the reasons this was the case was because her company required all employees to have their master's degrees to be on senior staff. Due to this criterion, in addition to the positions being in a STEM field which already minimized historically disenfranchised people, numbers of minorities were very limited.

An event that sparked Sub13's interest in technology revolved around her mom being a programmer. Not only did Sub13 grow up hearing about her mom's work as a software engineer, her mom also purchased a new computer every couple of years which Sub13 got to help put together and play with. To her, computers and computing were normal parts of life for as long as she could remember. When she started middle school, she began programing thanks to a combination of out-of-

school programs she participated in and her mom's influence. She remembers getting tired of playing games that came on the computer, so her mom decided to teach her the beginnings of making her own games. Her programming journey continued in high school when she took her first programming courses. Here she learned Basic and Pascal, however she did not take AP computer science her senior year because she decided she wanted to major in business because it was "sexier than computer science."

Sub13 said that she has had a village of people supporting her throughout her journey. In this village are her mom, dad, god mother, and graduates of historically black colleges and universities. She credits seeing so many black people representing engineers, educators, attorneys, and developers as being one of her greatest inspirations and motivations. On the other hand, she remembers her direct report at her internship assuming she was only there for the money. She remembers finishing a project early and telling this man that she was done, and he said, "Do you want another project or do you want to just collect the check?" She did not appreciate his implications, for which he later gave a half-hearted apology. She also remembers having classmates in graduate school who did not think she knew anything because she was the only black female in the department. Although not as often, she said this unfortunately still happens at times.

Sub13 gave additional information she felt would be helpful in this study. She said that it is important to differentiate between historically disenfranchised groups and those who are not. Though all women are absolutely still underrepresented in technology, Sub13 stated that black women, Latina women, and Native American women are far more underrepresented and undergo more struggles than white women. She said that in addition to talking about encouraging young girls to enter the field of technology, we also need to talk implicit bias, marginalization, race, and

automatic stereotypes based on race and ethnicity. She gave examples that since she is black and therefore feels she has to be more assertive she is seen as rude, and a Latina woman is “spicy” or “feisty” instead of just being allowed to be mad at something.

4.14 Cumulative Interview Summary

Throughout the process of conducting each interview and reflecting on them as a whole, there exist notable commonalities among the interviews. The most notable are that these women had good role models, especially female role models, to look up to. Some women also experienced negativity growing up as a girl taking STEM classes or even in their workplaces. Another notable commonality is that most of the women interviewed were introduced to technology at a young age, unless they grew up in a time before it was commonplace for most people to own computers. Something else that was commonly mentioned was that minority women and historically disenfranchised women need to be especially focused on when it comes to encouraging women to pursue the field of technology. Many women additionally mentioned that they enjoy the challenge of computing. Finally, one of the most important commonalities found among the women was that introducing the idea of socially relevant computing to young girls is crucial in capturing and maintaining their interest in technology.

Not surprisingly, the more good role models a young girl has growing up the better her chances that she would pursue a field that she enjoys. Whether a field is historically male-dominated or not, a girl who is supported by those around her is much more likely to pursue it if that is what she wants. Having people around who are encouraging and motivating, whether they understand what a girl wants to pursue or not, makes a huge difference in what a girl, or any child, feels like they can accomplish.

On the other hand, children having negative experiences of people telling them that they cannot accomplish something, especially on the basis of sex, is detrimental to confidence. In line with the hypothesis for this study, it seems that the women who experienced this sort of negativity often used it as fuel. It is important to mention, though, that there may be many women who are now not in technology because of such experiences and that would not be accurately reflected in this study. The women interviewed used it as fuel, seeing as they persevered and now have successful careers in technology.

It was a common theme among the women interviewed that they were exposed to technology at young ages, unless they grew up in a time where this would not have been the case. The ways the women were introduced to technology varied. Some women took middle school classes in programming and others had parents in the industry. These experiences shaped their interests as young girls. Some of the women even mentioned that technology was a very normal part of their lives because of how they grew up around it. It was for this reason that it never seemed abnormal or even special for her to be pursuing the field. This could be a crucial statement. There is a fine line that must be walked between wanting all girls to be exposed to and encouraged to pursue a career in technology and not making girls feel like they are letting down the female population for not wanting to. As mentioned by one interviewee, she liked technology because of the challenges and feelings of overcoming them, not because she wanted to be thought of as a strong or exceptionally smart girl. While it is important to introduce girls to technology at a young age, it should not be done in a way that makes it seem that they would be a disappointment if they chose to pursue another passion.

A number of women interviewed mentioned how important it is that there are special measures made to empower historically disenfranchised and minority women to

pursue technology. The viewpoints, intelligence, and strength of these women need to be valued and pursued in science, technology, engineering, and math related careers. While this is an incredibly important issue that needs to be addressed, it was out of the scope of this research and could not be done justice in the allotted time frame. As mentioned in section 7, this would be an ideal opportunity for further study.

An additional commonality among the women interviewed was that they enjoy the challenge of computing. Although science, technology, engineering, and math related disciplines are challenging, it is a common statement that the challenge is part of the fun. With computing especially, another large part of the enjoyment stems from the instant gratification of a working program. This was mentioned often at the same times that the enjoyment of the challenge of computing was mentioned. The gratification of working hard to solve a problem and persevering to completion is something that motivates many programmers to work through the frustration of a difficult problem. For this reason, it was not surprising that many women mentioned this feeling. This is not just specific to women and young girls, of course, but there should still be activities implemented in early elementary school that begin to foster the desire for feeling the satisfaction of solving a difficult problem.

One important commonality found regards socially relevant computing. A number of participants stated that they do not think young girls equate computer science to helping people and bettering the global human condition like they do with doctors, lawyers, veterinarians, physical therapists, or teachers. These women also stated that they believe young girls have an instinct to help people that makes their desire to go into the field of technology wane as they get older. The reason it wanes is because young girls are not taught how they can better the world as a computer scientist when, in reality, most innovations and breakthroughs that will save lives and the

planet stem from technological advances. One of the women interviewed sparked this conversation to be had in each interview following. Five women mentioned this in their interviews without prompting. However, if it was not mentioned independently, I brought it up in conversation to get their thoughts on the idea. All women agreed that it is important to introduce socially relevant computing to young girls.

5. LIMITATIONS OF STUDY

5.1 Time for Research

Many of the women interviewed are successful executives at their companies. Because of this, it was lucky if even thirty minutes could be spent devoted to this research in the form of an interview. It was important to be flexible with subjects who had less time to share for multiple reasons. One of the reasons is that these women have achieved great success in the field of technology, becoming executives and directors of teams. Another reason that their participation was important is that these women in high-ranking, busy positions most likely have spent more time in the field than others and would therefore have more experience and stories to tell regarding their journey to reach their career status. Due to their importance in the study, less than thirty minutes for the interview was accepted. However, it is important to note that very few women had this problem as they all went out of their way to find time in their schedules to help what they felt was an important cause.

Aside from the occasional lack of interview time, there is also the limitation that this research had a timeframe of one semester. The beginning of this research process involved obtaining Institutional Review Board approval which took a few weeks. After approval was received, interview subjects had to be contacted and those willing to participate had to read a letter of informed consent and respond with their official approval or denial. Once official approval was received, the scheduling

process began. Relating to the busy nature of these women, this could be a difficult process despite their willingness to participate. Had there been more time available to work on this study, more women could have been interviewed. This would have allowed a broader range of anecdotal evidence to be collected, further validating the results of the research.

5.2 Connections to Women in Technology

As a current student, connections to influential women in technology were slightly limited. However, women were referred to me by other connections I have. My mom, professors, and friends referred women in technology to me. Because of this, women across many facets of technology and of many different age groups and experience levels participated in the study. This was beneficial because it allowed a broader viewpoint to be collected. It also improved the viability of the results found from this study because commonalities spanned generations, backgrounds, and desired technology specialties, making the ways found to reach young girls likelier to succeed in the long-term and in many different environments.

5.3 Intentional/Unintentional Neglect to Share Certain Stories

While all of the women interviewed were happy to share their stories and to provide information that may help pave the way for the next generation of girls to enter the tech workforce, it is likely that some stories were left out of interviews because the subject forgot, or because the subject opted not to disclose some particularly painful or potentially damaging event. The subjects only disclosed the personal events they wanted to share and were never pushed to share more than felt comfortable. This was important to maintain each subject's confidence in the research and to help them feel comfortable while recounting their stories, however it could have resulted in accounts that may have been helpful for this study being left out. To account for this,

a literature review was conducted to study what women have gone through to become successful in technology. This research can be found in Section 2.

6. ARGUMENT

Many strides have been made in recent years to improve the number of women in the technology industry, but there is still room for improvement. Upon the completion of the research interviews, it seems that the best opportunities for improvement can be made in elementary schools and in homes. Almost all of the women interviewed said they were introduced to technology at very young ages. The women who did not follow this trend were those who grew up in a time where it was uncommon for everyone to have access to computers. Kids nowadays are used to computers and technology by early elementary school, so it would be feasible, helpful, and practical to introduce third, second, and maybe even first graders to programming activities. There are similar lessons to this being implemented in school, but it should become the standard in schools all across the country. This would not only further enhance the comfortability young kids have with technology, but it would also help mold young brains to be able to more easily think logically and in a step-by-step manner like programs require.

In addition to including programming activities in elementary school lesson plans, kids this age also need to be taught the ways that in which they could pursue a career in technology. One of the most important findings from the interviews was the need for teaching young kids, especially girls, about socially relevant computing. Almost half of the women interviewed said, one way or another, that young girls often lack interest in technology, specifically computer science, because they do not feel computer science can be used to save the world and help people. In today's world, most things run on code. To fix this problem, young girls need to be shown how they don't have to pursue medicine or some other field that is readily associated with such

admirable desires as they can pursue technology and provide the tools and tech necessary for surgeons to perform their jobs. Not only do girls need to be told that they can better the world using computer science, they need to be shown ways that this has already happened. Such examples include the moon landing, the beginning of the ability to 3D print functioning organs, and the creation of surgical robots and self-driving, fully electric cars. These revolutionary breakthroughs are saving lives and the planet and are the examples of socially relevant computing that young girls need to hear. This particular aspect of inspiring more girls to pursue technology is especially important to me because the reason I did not want to pursue computer science until I got to college is because I did not think I could positively impact the world like I desire to. Having the knowledge that I can use technology to literally save lives and the environment not only inspired me to consider programming, but also continues to motivate me to excel.

7. OPPORTUNITIES FOR FURTHER STUDY

The young girls currently being introduced to science, technology, engineering, and math will continue to progress through school and hopefully pursue the field in college and earn a degree to continue into the tech workforce. Additionally, it is very likely that more programs are implemented in education systems throughout the country and around the world that involve more girls in STEM. As the number of these programs rise, the number of girls that end up becoming women in technology should rise as well. Later studies should focus on the results of the programs implemented. In other words, once the young girls experiencing programs to help encourage them to pursue technology grow up and enter college or the workplace, studies need to focus on how the programs implemented were actually impactful and learn from them. This could illustrate what was successful about these programs and what could be improved upon. Additionally, these likely successful results could be used as further motivation for the next generation of young girls.

A number of women stated that historically disenfranchised and minority women need to be focused on and introduced to the field of technology even more heavily than other women. The reason for this is because historically disenfranchised women not only have the barrier to entry into technology of being a woman, they have additional obstacles to overcome that cannot be understood by a man or woman not in their situations. Though heavy research into this aspect of the issue was beyond the scope of this study, this is absolutely a crucial piece of the puzzle that needs to be studied. For this reason, I think this is one of the most prevalent areas to be studied regarding how women can be encouraged to enter the technology industry.

8. CONCLUSION

Women have been underrepresented in science, technology, engineering, and math throughout all of history. Though the numbers are improving as more women earn degrees in technology and enter the field of technology, women are outnumbered by men in the industry. As a woman about to graduate from college and begin a career in software development, this topic is important to me. To better understand the history of this issue, what measures have currently been taken to address it, and the current state of women in technology, interviews were conducted with thirteen women ranging from ages twenty-one to post-retirement. This process, in addition to conducting a literature review, provided helpful information about how women can be encouraged to pursue STEM fields. The ways in which the women interviewed were encouraged can help people now better understand what the young girls in our society need throughout their journey to feel empowered and intelligent. According to this research, there are some common factors among successful women in technology that can be passed on to the next generation of young girls to encourage them to pursue technology. When young girls have encouraging role models as they grow up who remind them that they are smart and capable, opportunities to

experience technology from an early age, the proper teachers who challenge them while also letting them succeed, and the knowledge of how they can positively impact the world with computing, it seems likely that they would pursue STEM. After conducting this research, the hypothesis stated in Section 3.1 was not necessarily incorrect but was also not necessarily correct. Instead, it seems that a combination of having good role models and understanding the massive potential for a STEM education, especially one in computer science, is what drives young girls towards the field of technology. From then on, the feeling of overcoming challenges and seeing how technology betters the world will keep them involved. Though many changes have been made in education systems and workplaces to increase the number of women in technology, it will take time for these changes to manifest themselves in the tech world and, in the meantime, such changes need to be normalized and enhanced to continue to improve the technology industry.

9. APPENDIX – This is the list of interview questions

1. When did/will you enter the tech industry?
2. Where was/will be your first tech job?
3. What did/will you do in this role?
4. Current company?
5. What is your current role and what do you do in this role?
6. What were your expectations or assumptions as you entered this role?
7. Were your assumptions correct? How so? How not?
8. What estimated percentage of your superiors, specifically in technology as well, have been male?
9. What estimated percentage of your coworkers, specifically in technology, have been male?
10. Do you remember an event that sparked your interest in technology? If you have one, what was it? How old were you?
11. Did you have inspiring role models who encouraged you? Are they mostly male or female? What do you remember about them that was encouraging?
12. What is the earliest exposure to computer science/technology that you remember? ***
13. Is there anything else you would like to tell me that you think would be helpful in my research?

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