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Introduction

The tech industry is a lucrative, growing field. However, it has one of the worst gender gaps with regards to women of any industry. According to the United States Equal Employment Opportunity Commission, women in tech are underrepresented by 12% when compared to all other industries (U.S. Equal Employment Opportunity Commission, 2016, p. 2). Researchers such as Sarah-Jane Leslie explain that the lack of women in tech is a problem at the middle/high school level (Leslie, 2015, p. 264). Rosemary L. Edzie from the University of Nebraska explains in a study that confidence gaps due to gender norms, a lack of resources, and limited support networks are the root cause of why girls aged 12-17 do not pursue higher tech fields (Edzie, 2014, p. 23). One particularly bad area is the Freehold Regional School District in New Jersey, of which less than 1% of female graduates pursue tech (Freehold Regional High School District, 2016, p. 4). As such, the plan of this project is to build a cohesive tech community among the female students at FRSD. This will be done through an afterschool 2-hour mentorship program, which aims to add skills aimed at beginners. The price of this plan, based on models discussed later, is about $1600. Funding will be provided through the Google Educational Research Grant, worth $250,000.

Problem & Population

This is a very serious and pressing issue within the industry. The National Center for Women in Information Technology conducts a national survey of hundreds of female tech-industry members, compiles data from educational, state, and company employment reports, and finds that only 18% of undergraduates in information technology (IT) and computer science-related fields (CSRF) were women (National Center for Women in Information Technology, 2012, p.16).. It further discusses that this number is decreasing steadily (National Center for Women in Information Technology, 2012, p.16). Dr. Mokter Hossain’s research from the US-China Education Review supports this theory – that the number of female students selecting computer science as a major declined by 43% between 2005-2007 (Hossain & Robinson, 2012, p. 444). Ellen Spertus from the MIT Artificial Intelligence Laboratory Technical Report (AITR) conducted a national study of over 60 educational institutions, 6 developmental psychologists, and hundreds of women in the field to determine why there are so few women in the tech industry. Her research noted that the cultural biases against women pursuing careers in IT/CSRF are deeply rooted in societal and educational institutions (Spertus, 1991, p. 1). She adds that women are conditioned at young ages to believe that computer science is for men (Spertus, 1991, p. 4). This ultimately has a drastic effect on the number of women who take math and computer science courses in high school, which not only reinforces the stereotype that women do not belong in IT/CSRF, but also puts them at a comparative disadvantage when pursuing such subjects at a postsecondary education level, as their male peers already have tech experience. Another hurdle to female enrollment and retention involves sexual harassment and discrimination at many tech companies. A striking example of this came to light in February of 2017, when Susan Fowler, an ex-software engineer at Uber (a taxi-tech company), alleged that the company allowed rampant harassment of its female employees (Kuchler, 2017). The same article details Fowler’s experiences of sexual advancements by a manager, and cites that the percentage of women engineers declined rapidly over 2 years. Trae Vassallo and colleagues from the Women in Tech initiative explain that Fowler’s experiences are not outliers (Vassallo et. al, 2017). Their findings gather insight from hundreds of women within the Silicon Valley tech community. The results of their survey are detailed below in Table 1.

Survey of women in IT/CSRF within Silicon Valley

Table 1.

|  |  |
| --- | --- |
| **NEGATIVE EXPERIENCE** | **PERCENTAGE OF WOMEN WHO HAD NEGATIVE EXPERIENCE** |
| Excluded from networking events because of gender | 66% |
| Experienced questions to male peers that should have been addressed to them | 88% |
| At least one unwanted sexual advance | 60% |
| Multiple unwanted sexual advances | 50% |
| Afraid of personal safety because of work-related issues | 33% |
| Not satisfied with course of action taken by management after reporting | 60% |

The most notable component of this literature is that women reported feeling more secure among female coworkers. This highlights the need for more women in the industry to serve as role models, whistleblowers, and leaders to show that they are capable of performing to the same level of their male peers. Indeed, the aforementioned report from Ellen Spertus at the MIT AITR concludes that this lack of women results in a vicious cycle that deters female newcomers to the field (Spertus, 1991, p. 5). She adds that it ultimately contributes to the chilling effect that hurts female participation in the tech industry. Furthermore, this problem creates an economic issue. The aforementioned Center for Women in Information Technology study cites that at current graduation rates, U.S. computing graduates can only fill about 30% of high-skilled IT jobs (National Center for Women in Information Technology, 2012). It corroborates that women remain an untapped resource for filling these positions.

Despite the seemingly obvious issues in post-graduate tech, research suggests that the problem manifests in early education. This makes the population young women at the middle/high school level. A report compiled by the Southern Poverty Law Center reveals that girls begin losing interest in pursuing IT/CSRF during middle school (Southern Poverty Law Center, 2012, p. 2). The same study furthers that cultural stereotypes of IT/CSRF being “men’s fields”, stereotypes that women aren’t good at STEM (science, technology, engineering, and mathematics), and an erosion of confidence in personal abilities are what deter young women from pursuing IT/CSRF. Kamla Modi and colleagues from the Girl Scout Research Institute provide what is likely the most startling statistic on female retention from grade-school to post-secondary education and beyond – 74% of high school girls across the United States are interested in fields related to IT/CSRF, but only 20% enter the tech industry (Modi et. al, 2012, p. 2). Their research also suggests that female students who are seriously interested in STEM related fields such as computer science appear to have better support networks and resources available to them. These include mentors, supportive parents and teachers, opportunities to meet people from STEM fields, and events/competitions/clubs that are related to their field of interest (Modi et. al, 2012, p. 10). Further results from the national survey of young women in middle/high-school are compiled and included in Table 2. These results compare answers between female students who are interested in STEM, female students who are not interested in STEM (NON-STEM), and the percentage disparity between the two groups.

Survey of young female students who are interested in STEM versus those not interested in STEM

Table 2.

|  |  |  |  |
| --- | --- | --- | --- |
| **SURVEY QUESTION** | **STEM** | **NON-STEM** | **% DISPARITY** |
| “Whatever boys can do, girls can do” | 97% | 91% | 6% |
| “I’m smart enough to have a career in STEM” | 68% | 63% | 5% |
| “If I enter a STEM field, then I will have to work harder than a man to be taken seriously” | 57% | N/A | N/A |
| “I would feel uncomfortable being the only girl in a group or class” | 47% | N/A | N/A |

As seen in Table 2, the common link between higher confidence, ability, and ambition of the STEM-interested students is that they have access to resources in STEM fields. In essence, the literature posits that girls who are not interested in STEM experience a lack of peer support, opportunities/resources to do things related to computer science (such as coding), or school clubs/activities where they could gain a better conception of what the field is about.

In short, the lack of women in tech is a problem to be addressed at the middle/high-school level, and the report suggests that providing resources and programs to improve female STEM retention at schools is the key to improving postsecondary retention. For example in its annual report, the Freehold Regional Schooling District (FRSD) details how a record few female students (350 out of a total female population of 6,000) surveyed had any interest in pursuing IT/CSRF (Freehold Regional High School District, 2016, p. 4). Unsurprisingly, the district does not have a strong tech community for students to benefit from, few opportunities or events related to computer science, and there are no clubs/activities that can help foster an interest in the field. Ultimately, this means that educational institutions need to work harder in order to foster environments that encourage women to enter IT/CSRF. This is something that, according to the research of Spertus, will help to balance out the gender gap in tech and encourage more women to enter the industry (Spertus, 1991, p. 5). In cases such as the FRSD, it will help to embolden a generation of young female computer scientists to actualize their potential as engineers, thinkers, students.

Paradigm

The lack of women in tech, specifically at institutions such as FRSD, needs to be solved for two key reasons. First is detailed in the aforementioned experiences of Susan Fowler and backed by the research of both Ellen Spertus (methodology discussed at length previously) and Sarah-Jane Leslie (discussed later). A lack of female workers leads to a vicious cycle where women are discriminated against and deterred from engaging in the industry (Spertus, 1991, p. 10). Thus, fostering a culture and community of women in tech helps to combat oppressive behaviors by providing role models, support networks, and displaying that women are capable of performing the same jobs that men are. Second, as detailed previously in the NCWIT study, there is a crisis in the industry where only 30% of IT/CSRF careers can be filled at current graduate rates (National Center for Women in Information Technology, 2012). However, the same report from the National Center for Women in Information Technology concludes that women remain a potential source for filling these jobs. Thus, ensuring that more women enter the tech industry has the dual purpose of ensuring that companies can hire adequate numbers of IT/CSRF laborers, as well as providing high-paying jobs (U.S. Equal Employment Opportunity Commission, 2016, p. 3). Despite these daunting statistics, there are model programs to emulate. The most successful of these (discussed later), is the national program “Girls Who Code”, which seeks to improve the gender gap of women in computer science through mentorship programs, summer workshops, and hackathons at local high schools across the country.

Sarah-Jane Leslie, professor of philosophy and education at Princeton University conducted a study to determine why women did not enter STEM fields as often as their male counterparts. It is a national meta-study compiled from academics of 30 disciplines in STEM, and data from over 5000 women at various educational institutions/fields (Leslie, 2015, p. 263). This report finds that the most common factor inhibiting women from entering STEM are “belief scores”, or the quantity of self-perceived qualifications that an individual possesses for a certain task (Leslie, 2015, p. 264). These “belief scores” are the most important indicator for retention and success of women in any field. Leslie’s study found that if an employment opportunity requires ten qualifications, and a male candidate possesses five, then he is likely to apply for the position (Leslie, 2015, p. 264). However, if a female candidate possesses the same number of qualifications as her male counterpart, then she is less likely to apply out of a perception that she is “not qualified enough” (Leslie, 2015, p. 264). Professor Leslie isolates other factors, such as socioeconomic status and race, to discover that this lack of confidence is the strongest explanation why women do not pursue educational paths or careers in STEM (Leslie, 2015, p. 265). Leslie’s research ultimately provides a thorough conception of why females do not enter IT/CSRF, which can be used to tailor a list of solutions.

Furthermore, Rosemary L. Edzie from the University of Nebraska-Lincoln attempted to provide solutions to the lack of women in STEM. Edzie’s study employed mixed-methods sequential exploratory research study that surveyed hundreds of female STEM enrollees across the nation, and then compiled the results into a cohesive analysis. Her report echoes Dr. Leslie’s; there is a statistically strong relationship between self-efficacy and persistence in a given field (Edzie, 2014, p. 12). Her research goes one step further to explain why the confidence gap exists – a lack of female peers and role models to depend on, limited access to pre-STEM exposure due to societal norms discouraging girls to explore STEM, and limited support from teachers/mentors (Edzie, 2014, p. v). The report concludes that mentorship opportunities, higher numbers of female educators and role models, community events that improve morale to pursue career paths, and networking tends to build confidence in young women to pursue IT/CSRF, and thereby reverse the effect of gender inequality (Edzie, 2014, p. 23). In essence, Edzie’s report gives a thorough analysis on the root causes of women in technology. Her suggestion to foster community mentorship programs, encourage female role models, and host community events such as hackathons are the correct path towards fighting the gender gap in tech.

Finally, Girls Who Code runs a highly successful model program that can be replicated locally at the middle/high school level. Girls Who Code is a national non-profit organization dedicated to closing the gender gap in IT/CSRF. It correctly identifies that women “drop out” of pursuing computer science programs between the ages of 13-17, and tailors its approach to fostering a number of programs for young women in local school communities (Girls Who Code, 2015, p. 2). According to the 2015 expense report, the organization maintained expenses of around $6.7 million, and assets (through the form of grants/donations from individuals, schools, companies, and local governments) at about $16.5 million – doubling its assets from the 2014 fiscal year (Girls Who Code, 2015, p. 8). This means that the entire national organization maintains about a $10 million net profit, and is still growing as a very lucrative model for empowering young women in IT/CSRF. Indeed, this is seen through the 57 top tech companies such as Google, Facebook, and Amazon that have pledged to hire Girls Who Code alumnae (Girls Who Code, 2015, p. 3). Women who leave the Girls Who Code program are 67% more likely to pursue a major in IT/CSRF, and the number of program students has grown from less than 1000 in 2013, to over 11,000 in 2015 (Girls Who Code, 2015, p. 2). Girls Who Code has established itself in school communities across the United States, from Seattle to Newark (Girls Who Code, 2015, p. 2). Indeed, this seems to be a very successful model to emulate. The main program, called the “club program”, offers free weekend/after-school mentorship for 6-12th grade girls, along with “all the resources necessary to run them” such as computers, internet access, etc. (Girls Who Code, 2015, p. 3). Club programs encourage and teach young women of all technical skill levels to use computer science to positively impact their community, and are held in two-hour sessions in schools, libraries, and community centers. Such activities include teaching beginner coding projects and hands-on tutoring from one of the 10,000 Girls Who Code alumni mentors (Girls Who Code, 2015, p. 4). The report finds that each club program costs approximately $1,600 to run over the course (September - May) of an academic year, and all 350 hundred local club programs have had 100% success of being fully funded by contributions from local colleges, businesses, and individuals alongside government grants (Girls Who Code, 2015, p. 8). The results of the clubs is apparent, as 65% of participants say they are considering a major or minor in IT/CSRF because of Girls Who Code – an increase of 32% from the average (Girls Who Code, 2015, p. 4). Ultimately, Girls Who Code provides a successful model for use in improving the participation of women in tech at FRSD.

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