

1600 Pennsylvania Ave NW,
Washington D.C. 20500

March 8, 2017

Mrs. Amy Qu
Software Engineer & College Liaison
Google
76 9th Ave
New York, NY 10011

Dear Mrs. Qu:

I hope that you are doing well. My name is Naeem Hossain, and I am a junior software engineer attending your alma mater, Rutgers University. We have previously met at events such as the HackNY, NY Tech Meetup, and the HackRU. In fact, you were my person of contact when Google sponsored the HackRU in the fall of 2016. I am writing to you about a specific problem in our field – the lack of women in tech.

Problem

This is a very serious and pressing issue within the industry. The National Center for Women in Information Technology reports that only 18% of undergraduates in information technology (IT) and computer science-related fields (CSRF) were women; it further discusses that this number is decreasing steadily (National Center for Women in Information Technology, 2012, p.16). Dr. Mokter Hossain from the US-China Education Review validates this; the number of female students selecting computer science as a major declined by 43% between 2005-2007 (Hossain & Robinson, 2012, p. 444). Indeed, the U.S. Equal Employment Opportunity Commission explains that this bleeds into post-graduation employment, as “high-tech” (IT/CSRF) underrepresents women by 12% compared to the average across all industries (U.S. Equal Employment Opportunity Commission, 2016, p. 2). Ellen Spertus from the MIT Artificial Intelligence Laboratory Technical Report (AITR) writes that the cultural biases against women pursuing careers in IT/CSRF are deeply rooted in societal and educational institutions. She adds that women are conditioned at young ages to believe that computer science is for men (Spertus, 1991, p. 1). This ultimately has a drastic effect on the number of women who take math and computer science courses in high school, which not only enforces 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. 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. She details her experience of sexual advancements by a manager, and watching the percentage of women engineers decline rapidly over 2 years (Kuchler, 2017). Trae Vassallo et al. from the Women in Tech initiative explains that Fowler’s experiences are not outliers. Their findings gather insight from hundreds of women within the Silicon Valley tech community. According to

their survey, 66% of women felt excluded from networking events because of their gender, 88% experienced questions to male peers that should have been addressed to them, 60% reported unwanted sexual advances while half reported receiving multiple advances, 33% had at one point felt afraid of personal safety because of work-related issues, and 60% of women who reported harassment to management were not satisfied with the course of action (Vasallo et. al, 2017). The most notable component of this literature is that women reported feeling more secure among female coworkers, underlining the need for more women in the industry. Indeed, this malicious treatment contributes to the chilling effect that keeps fresh talent out of bountiful opportunities in the tech field. 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. It corroborates that women remain an untapped resource for filling these positions (National Center for Women in Information Technology, 2012). Ultimately, this means that educational institutions need to foster an environment that encourage women to enter IT/CSRF, something that will help to make the industry treat its female members better.

Paradigm

There are a number of experts that have performed research on either improving the retention of young female students in STEM, or the lack of women in tech – but not both. This is because tech is a relatively new industry, the demand for workers has only occurred in recent years, and researchers have yet to develop the tools to effectively and accurately provide unique solutions to combat the lack of women. Furthermore, much of the academic literature is focused on macro effects relating to society, culture, education, and industry. This makes it difficult to empirically gauge the tools needed to improve retention at earlier education levels (such as middle/high school), and downright impossible to estimate foolproof success plans. As a result, much of this paradigm will focus on drawing from experiences that improve retention at post-secondary institutions, and replicating them at lower-education levels. It will also draw research from a handful of the most qualified and rigorous researchers in the field.

One such expert is Sarah-Jane Leslie, professor of philosophy and education at Princeton University. Professor Leslie conducts a meta-study compiled from academics of 30 disciplines in STEM. She reports that “belief scores”, or the quantity of self-perceived qualifications that an individual possesses for a certain task, are the most important indicator for retention and success of women in any field. Her research corroborates that if an employment opportunity requires ten qualifications, and a male candidate possesses five, then he is likely to apply for the position. 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”. 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. She concludes that outreach, community-building, and mentorship programs are the most effective way to overcome this “confidence gap” in female students (Sarah-Jane Leslie, et al., 2015, p. 263-265).

Furthermore, Rosemary L. Edzie from the University of Nebraska-Lincoln describes that the lack

of women in computer science and STEM is a “national crisis. She surveys thousands of educators, students, and researchers and compiles their results into a cohesive analysis. Her report finds that a majority of STEM educators do not feel knowledgeable about career options in science, and that student interest a career path is the most important indicator that he/she will pursue it. Additionally, Edzie’s research echoes Dr. Leslie’s; there is a statistically strong relationship between self-efficacy and persistence in a given field. Her research goes one step further to report that women do not drop out of STEM classes because of poor performance, but rather because they lack confidence. Evidently female students do not believe that they are performing as well in class as their male peers, even when their grades demonstrate otherwise. 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 reverse the effect of gender inequality (Rosemary L. Edzie, 2014, p. 20-23).

Finally, William Gaudelli from the University of Central Florida gives a nuanced perspective on teaching young students about technology and CSRF. He writes that teachers and mentors must be flexible and adapt to new trends within the tech community. For example, ordering Raspberry Pi programming kits and giving students a tutorial on how to use them is one of the best ways to incorporate new technology into modern teaching methods. He concludes that industry professionals and older mentors might have an edge due to their daily use of resources such as coding languages, frameworks, and community networking (Gaudelli, 2006, p. 110-114).

Plan

The basic plan is to focus on a local middle/high school community in New Jersey and begin a comprehensive, multifaceted program that aims to pique interest in IT/CSRF among young women. This plan will focus on the Freehold Regional School District (FRSD) located in Central New Jersey, where administrators have already expressed notable interest in starting a local technological program and “hacker ” community. There are three main ways to accomplish these goals. First is to establish a mentorship program between prospective middle/high school female students and current female college students. Second is to invite prominent women to speak about their experiences at middle and high schools. Third is to establish district-wide hackathons (24-hour coding events where students can build, learn, and network), one for middle and one for high school. Many of these programs already co-opt the infrastructure of existing college organizations. Success in this district will be used to justify future expansion programs to provide even more opportunities to young women in middle and high school. Costs will be discussed in detail.

The first initiative, a mentorship program, aims to foster a connection between younger female students and older, experienced college role models. The mentorship program solves for some of the most egregious problems preventing women from joining IT/CSRF by providing a role model and person to communicate with. This can be done in conjunction with local universities, such as Rutgers University. In fact, Rutgers already has a successful mentorship program that was established two years ago (I was an architect of the program). The Rutgers University Computer Science Mentorship program is run by the Undergraduate Student Alliance of Computer Scientists (USACS) in conjunction with Women in Computer Science (WiCS), and

can offer approximately 45 female mentors. The mentors are volunteers and organizational duties are relegated to the USACS education director. There have been no costs to run the program, and there are no projected costs to run it for this initiative. Each mentor can typically serve 3-6 mentees, for a total of 270 mentees at the middle/high school level. Additionally, institutions such as Princeton University, NJIT, and The College of New Jersey run similar mentorship programs. Alumni from FRHS, (notably from Cornell, MIT, and UCLA), have come back to aid in the past as well. These individuals and organizations have expressed interest in organizing and serving the mentorship program. Furthermore, the role of the mentor is to foster an interest in computer science and answer young students' questions about their academic path. In addition, the mentors advise mentees about specific projects, enlighten mentees about upcoming networking opportunities and hackathons, and serve as a role model. School administrators have already shown interest in implementing this program at one middle and high school, then expanding it to the rest of the district. This way, advertising, marketing, and nuanced organization can be done by the administrators. Ultimately, the mentorship program comes with no cost, has dozens of volunteers along with institutional backing, and is one of the best ways to ensure that young women personally develop and maintain an interest in IT/CSRF.

The second initiative, inviting notable women from the industry to speak at FRHSD middle/high schools, has also seen success at local New Jersey postsecondary institutions. Rutgers University hosts a weekly speaker series every Friday that invites companies, industry professionals, and prominent researchers to speak in front of students (I am an organizer for these events). One notable speaker is Brian Kernighan, the co-creator of the C programming language (the most used programming language in the world), who spoke at Rutgers in February of 2017. USACS also runs these events, and thus has the network to reach out to past or interested speakers to deliver speeches for young women at FRHSD. Some of these notable speakers include Estefannie, a popular YouTube personality who builds and codes interesting "hacker" projects, Rent the Runway startup co-founder Jennifer Fleiss, and Skillshare founder Alexandra Qin. There are a few costs associated with inviting speakers to local middle schools. First, transportation and fees generally range from \$100 - \$300 per speaker. Second, food and drinks are usually served at such events, and range from \$80-\$150 per event. Third, advertising is usually \$20 to print paper and make announcements via loudspeaker and social media. Fourth, renting room space to host speakers costs USACS \$100 per event, although schools will likely use their own auditoriums for free. The total cost comes out to around \$470 per speaker event. There are a number of ways to finance these events. An annual report from FRHSD states that the OceanFirst Foundation has donated \$10,000 for the very purpose of expanding the district's tech community (Freehold Regional High School District, 2016, p. 17). Additionally, Facebook is providing USACS with a \$250,000 grant to expand tech within the New Jersey region, some of which can be allocated to the FRHSD speaker series. Both of these grants will be enough to cover the comparatively miniscule costs of hosting the events, and the administration is likely to invest some money to host speakers as well. The speaker series will ultimately help to improve female retention by showing young women that computer science is a viable career path, and that women industry leaders exist as role models for them to aspire to.

The third initiative involves two hackathons – one at the middle school level and one at the high school level. They are useful for introducing new students to coding and building, as they are

geared towards learning. A typical hackathon involves arriving Saturday morning, building a project, attending tech workshops, eating copious amounts of food, and presenting the project 24 hours later on Sunday morning. The best projects will win a prize. Additionally, hackathons serve as the best events for networking due to the high concentration of industry-related individuals present. In fact, sponsors pay to set up tables for the express purpose of recruiting fresh talent for internships. There are professional organizations, such as Major League Hacking, that are dedicated to providing resources and advice to hackathon organizers. They bring supplies to hackers, host events, invite speakers, and distribute prizes (Major League Hacking, 2012). It is preferable to set up a women-themed hackathon (such as HackHers, held at Rutgers University) and encourage female students to attend. This allows them to gain confidence as they build projects and experience coding, work with peers and network, and see that they are as qualified as men when it comes to computer science. Indeed, women-centric hackathons such as AthenaHacks in Georgia and HackHers have in the past experienced wild success. HackHers enjoyed 80% female attendance, and grew from 30 attendees at its inception in 2014 to over 600 in February of 2017 (Nikhilesh De, 2017). With the help of existing organizers and infrastructure, such as HackHers and HackRU (another Rutgers hackathon that hosts 1000+ individuals), creating a vibrant, female community-oriented hackathon is a possibility. However, there are certain costs associated with hackathons. Food, transportation, space, equipment, and other resources will cost about \$15,000 per hackathon, judging from previous high school hackathons held in other districts. There are a number of ways to finance this. First, sponsors such as Google, Facebook, Twilio, etc. pay hackathons to set up a table at the event in order to advertise and recruit potential interns. The HackRU raises approximately \$40,000 every event (I chair the finance team), and HackHers raises approximately \$30,000 every event through sponsorship payments. Each sponsor typically pays a range of \$1000 - \$10,000 depending on certain services. These services include sponsor demos, API talks, resume collection, and a spot on the judging panel. It is entirely possible and orthodox to fund the two FRHSD hackathons through sponsorships, given that the incentives to sponsor hackathons can and have already been replicated at the high school level. In fact, there are specific sponsors, such as the Anita Borg Institute, who exclusively fund programs for women in STEM (Anita Borg Institute, 2015). Additionally, Google and Facebook both have initiatives that specifically search for opportunities to invest in diversifying technology-related fields (Maxine Williams, 2016). Additionally, the district may provide some funds, although it is unclear how much they can allocate. Ultimately, the costs are high, but there exist numerous resources with which to finance them. In the 5 hackathons that I have organized from the high school to collegiate level, costs have never been a glaring issue as sponsors are always willing to invest in hackathons. Ultimately, a female-centered district hackathon at the middle and high school level will connect young women with a community of like-minded computer scientists and mentors. This will motivate them to pursue IT/CSRF, as it bolsters their confidence through project building, prizes, and networking.

In essence, a mentorship program, speaker series, and women-oriented hackathons will solve the core problems that hamper the progress of women in tech. They will instill a newfound confidence in young female students, promote diversity, and show that there are community members willing to rally and provide resources to those in need. The price for a semester's worth of mentorship, speaker events, and hackathons comes out to \$20,000. Sponsors, district funding,

investments from local businesses can finance all of this. Local communities and universities can also contribute funds, or have budgets specifically earmarked for such programs.

Conclusion

I have presented the problem, detailed the paradigm, and provided a plan (along with a price and financial methods) to combat it. Thank you for reading this letter, and I sincerely hope this moved you to focus attention on the pressing issue of the lack of women in tech. If you are further interested in solving this problem, then I invite you to attend my public presentation at Lucy Stone Hall 267, Monday May 1 at 2:30 pm. I hope to see you there.

Sincerely,

Naeem Hossain
Junior Software Engineer & Hackathon Organizer

Annotated Bibliography

Anita Borg Institute (2015). Awards and Grants. Retrieved from <<https://anitaborg.org/awards-grants/>>.

The Anita Borg Institute helps to fund initiatives to empower women in technology-related fields. This is a list of their grant and awards program

Ashcraft, Catherine, Elizabeth K. Eger, and Michelle Friend. (2012). Girls in IT: The Facts. *National Center for Women & Information Technology*. Retrieved from <https://www.ncwit.org/sites/default/files/resources/girlsinit_thefacts_fullreport2012.pdf>.

This report, compiled by the National Center for Women & Information Technology, is one of the most recent and accurate metrics to evaluate the progress of women in computer science. It provides numerous statistics ranging over a 20-year span on the status of women in the tech industry.

De, Nikhilesh. (2017, February). Annual 'HackHers' competition draws more than 600 students. *The Daily Targum*. Retrieved from <<http://www.dailytargum.com/article/2017/02/24-hour-hackhers-competition-draws-more-than-600-students>>.

The article covers HackHers, a hackathon that celebrates women in technology-related

fields. The event was hosted on 2/17/17

Ellen Spertus. (c, 1991). Why are There so Few Female Computer Scientists? *Massachusetts Institute of Technology*. Retrieved from
<<ftp://publications.ai.mit.edu/ai-publications/pdf/AITR-1315.pdf>>.

Ellen Spertus from MIT warrants why female participation in computer science and STEM fields is low. Understanding what deters and prevents women from entering the field provides valuable insight in how to improve both enrollment and retention.

Edzie, Rosemary L. (2014, May). Exploring the Factors that Influence and Motivate Female Students to Enroll and Persist in Collegiate STEM Degree Programs: A Mixed Methods Study. *University of Nebraska*. Retrieved from
<<http://digitalcommons.unl.edu/cgi/viewcontent.cgi?article=1175&context=cehsedaddis>>

Rosemary L. Edzie provides a comprehensive analysis as to why women do not enter STEM fields at the same rate as men, and details the solutions available to educators, students, and community leaders.

Freehold Regional High School District. (2016). FRHSD 2015 Annual Report to the Community. *FRHSD*. Retrieved from
<<http://www.frhhsd.com/cms/lib8/NJ01912687/Centricity/Domain/4/Annual%20Report%20FINAL.pdf>>.

The Freehold Regional High School District presents an annual report on diversity, demographics, college readiness, academic achievement, and fiscal policy for each of its individual high schools. This is important in gauging how much progress should be made in improving the gender gap at the high school level.

Gaudelli, William. (2006, Winter). Convergence of Technology and Diversity: Experiences of Two Beginning Teachers in Web-Based Distance Learning for Global/Multicultural Education. *Teacher Education Quarterly*. Retrieved from <<http://files.eric.ed.gov/fulltext/EJ795200.pdf>>.

William Gaudelli, associate professor of social studies education at the University of Central Florida, provides unique insight on different methods that most efficiently teach computer science and information technology to students in high school. This provides insight on the best methods for the mentorship program

Google. (2014, May 26). Women Who Choose Computer Science— What Really Matters: The Critical Role of Encouragement and Exposure. Retrieved from <<http://static.googleusercontent.com/media/g.wxbit.com/en/us/edu/pdf/women-who-choose-what-really.pdf>>.

Google, (one of the companies conducting groundbreaking research on diversity in tech), uses internal data alongside National Science Foundation reports to calculate the most effective way to involve young women in computer science and STEM from a young age.

The report concludes that community events (such as hackathons) shape girls' perceptions about the tech industry, and are associated with large advances in enrollment at the post-secondary education level.

Kuchler, Hannah. (2017) Susan Fowler, the Techie Taking on Uber. *Financial Times*. Retrieved from <https://www.ncwit.org/sites/default/files/resources/girlsinit_thefacts_fullreport2012.pdf>.

The article reports on the plight of Susan Fowler, a female ex-Uber software who alleged

rampant sexism, cronyism, and harassment during her employment at Uber. She is now embroiled in an investigation headed by the company.

Hossain, Md. Mokter, and Michael G. Robinson. (2012). How to Motivate US Students to Pursue STEM (Science, Technology, Engineering and Mathematics) Careers. *US-China Education Review A 4 (2012) 442-451*. Retrieved from

<<http://files.eric.ed.gov/fulltext/ED533548.pdf>>

Dr. Hossain and Michael Robinson explore the declining American participation in STEM-related majors such as computer science. They attempt to find causal links on chilling effects in the industry and seek ways to motivate increased participation.

Leslie, Sarah-Jane, et al. (2015). Expectations of Brilliance Underlie Gender Distributions Across Academic Disciplines. *American Association for the Advancement of Science: Women in Science 347.6219 (2015): 262-65*. Retrieved from

<https://internal.psychology.illinois.edu/~acimpian/reprints/LeslieCimpianMeyerFreeland_2015_GenderGaps.pdf>.

Leading Princeton University psychologist, Sarah-Jane Leslie et al. conduct research into the low percentage of women entering STEM fields. The report was published in ScienceMag, and concludes that one of the most prominent causes preventing women from reaching STEM comes from societally based stereotypes during psychological development years. The report concludes that motivating young women to join STEM from the 6th-10th grade has one of the largest impacts on improving female retention within STEM fields such as computer science.

Major League Hacking. (2012). The MLH Hackathon Organizer Guide. Retrieved from

<<https://guide.mlh.io/>>.

Major League Hacking (MLH) is an organization that provides resources for individuals to host and plan hackathons. Hackathons are 24-hour coding events that offer computer science students opportunities to build, learn, network, and explore the tech community around them. This website provides extensive documentation and planning advice on how to start a hackathon at a middle and high school level.

U.S. Equal Employment Opportunity Commission, (2016, May). Diversity In High Tech.

Retrieved from <<https://www.eeoc.gov/eeoc/statistics/reports/hightech/upload/diversity-in-high-tech-report.pdf>>.

This report from the Equal Employment Opportunity Commission (EEOC) provides an overview of the rapid service and labor growth within the tech industry, and highlights four key diversity problems that inhibit tech from realizing its full potential.

Vassallo, Trae, et al. (2017). Elephant in the Valley. *Women in Tech*. Retrieved from <<https://www.elephantinthevalley.com>>.

Trae et al. detail the results of their survey of hundreds of women in Silicon Valley tech companies. They compile these into a simple info graphic that presents statistics on abuse, harassment, and other problems plaguing the industry.

Williams, Maxine. Facebook, (2016, July 14). Facebook Diversity Update: Positive Hiring Trends Show Progress. *Facebook Newsroom*. Retrieved from <<http://newsroom.fb.com/news/2016/07/facebook-diversity-update-positive-hiring-trends-show-progress/>>.

Maxine Williams, the Global Director of Diversity at Facebook, uses data from

the company's EEO-1 Report to break down and display gender demographics at Facebook.