Subtle and Not-So-Subtle Messages of Non-Inclusion

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Abstract

Numbers involved in the gender gap in computer science are substantial and growing. The gender gap has been slowly decreasing in most STEM fields, with several showing significant gains, leading some to believe that time will solve the problem. However, the percentage of degrees awarded to women in computer science peaked in 1986, and has been significantly decreasing ever since.[1] Many studies have been performed, and many hypotheses formed to try to explain why this is so. One hypothesized reason is that subtle, and not-so-subtle, messages convey to women in computer professions that these are "men's fields;" another, that cyberbullying affects women disproportionately. Both may cause women to leave computer professions. This paper gives examples of messages of non-inclusion, discusses preliminary results of an on-going study on cyberbullying, and invites discussion of what those both in, and outside, the computer professions can do to address the climate for women.

Keywords

Gender Gap, Diversity, Under-represented groups.

Introduction

While many studies have been performed, and many hypotheses have been formed to try to explain why fewer women pursue careers in computer fields, the magnitude of gender disparity has continued to increase. Not only are proportionately fewer women going into computer fields than into other STEM fields in the United States, according to the New York Times, 56% of the women who go into technology, 47% of the women who go into science, and 39% of the women who go into engineering wind up leaving these professions.[2] The two possible reasons discussed in this paper, messages of non-inclusion and cyberbullying, have the potential to affect women both before selecting a profession and afterwards.

Messages of non-inclusion

Messages of non-inclusion in the computer field can come in many forms. One need only listen to the news to become aware of a multiplicity of relevant incidents. Some of these incidents are public and flagrant, such as the presentation of the blatantly sexist "Titstare" "joke" app at the Techcrunch Disrupt Hackathon San Francisco in 2013.[3] At the conference, dedicated to showcasing new applications and developments, two young Australians offered a one-minute presentation of an app designed to let men take pictures of themselves "staring at tits." The presentation was filled with tit related puns and pictures of women's breasts, and the largely male audience laughed appreciatively. Another presentation at the same conference simulated male masturbation. One can only imagine the chilling effect that this had on 9-year old Alexandra, in attendance to present her own app for scheduling children's playdates. While the

conference did apologize, claiming that it had no knowledge of what was to be in the presentations, since details were not uploaded in advance to the conference's wiki, this claim seems suspect, or indicates a severe breakdown in process. Others, such as Pax Dickinson, then chief technology officer of the news site Business Insider, defended the presentation of Titstare on Twitter, saying, "It is not misogyny to tell a sexist joke, or to fail to take a woman seriously, or to enjoy boobies,"[2] On Reddit, White_N_Nerdy commented, "I'm honestly trying to understand why anyone says that females are 'needed' in the tech industry....The tech community works fine without females, just like any other mostly male industry. Feminists probably just want women making more money."[2]

Messages of non-inclusion can also come from classmates and coworkers. Since 2011, the University of Tennessee at Chattanooga class CPSC 3610, "Ethical and Social Issues in Computing" has included at least one assignment on the Gender Gap. When students were asked to give their views on the Gender Gap, responses were troubling. Student comments, cited anonymously to protect student privacy included, "Men tend to think more logically than women," "Women aren't interested in technical things," "Girls just aren't interested in stuff like computers," "Women's brains can't handle the advanced math—it's a right brain, left brain thing," and "Women are better at nurturing than at technical things." Reasons given for this association were similarly disturbing: "Engineering has been, and always be, a male-dominated field," and "It's nothing to do with societal bias—it's how girls are raised." Student views on prospects of women's success in the professional world seemed murky as well. One student wrote that, "[One] reason that a woman would have a hard time getting [into] and progressing through an engineering or computer science career is that sometimes men have too much pride. There are men who would not tolerate knowing that a woman could do a better job." Another gave as his reason for few women in engineering as related fields as, "...women usually draws [sic] maximum benefits from their employers. If employers do not want to give a lot of benefits to an employee, they would most likely hire a male. I do not really believe there is any bias involved with this because the company just does not want to spend extra money on benefits." One student stated that, "it all boils down to the distractions that females may cause in the workplace." These opinions from male students regarding women seem to apply not just to theoretical women in the future workplace, but to their female classmates as well. One female student recounted an incident where students after a test were complaining no one could possibly have done well. She said, "I knew I should have kept my mouth shut, but I couldn't help myself. I said, 'I made an A.'" The male students immediately replied, "It's just because you're a girl." She said, "I can't believe the insufferable arrogance of the male students in the computer science department." This is far from being an isolated incident. In subsequent conversations with multiple groups of students in the department, the authors have observed a firm, fixed belief among male students that students are "graded easier so they won't drop out," and that students feel no compunction about expressing this belief whenever a female student does well.

Perceptions such as these, especially when prevalent, can impact future performance. For example, in one study by Spencer, Steele, and Quinn,[4] first year male and female psychology students from the University of Michigan who all "identified with math" and had similar math scores and backgrounds were given a math test based on the mathematics portion of the GRE exam. When the students were told that there were no gender differences in performance on this task, performance of males and females was similar, and differences were not statistically significant. However, when the students were told that "men tend to do better on this," male

participants performed slightly better and females scores decreased to less than a third of the previous score (see Figure 1). This study is consistent with the broader literature on stereotype threat and suggests that if female students are told that they will not perform well, that this may appreciably affect their performance, and therefore become a factor in women leaving fields where this is an issue.

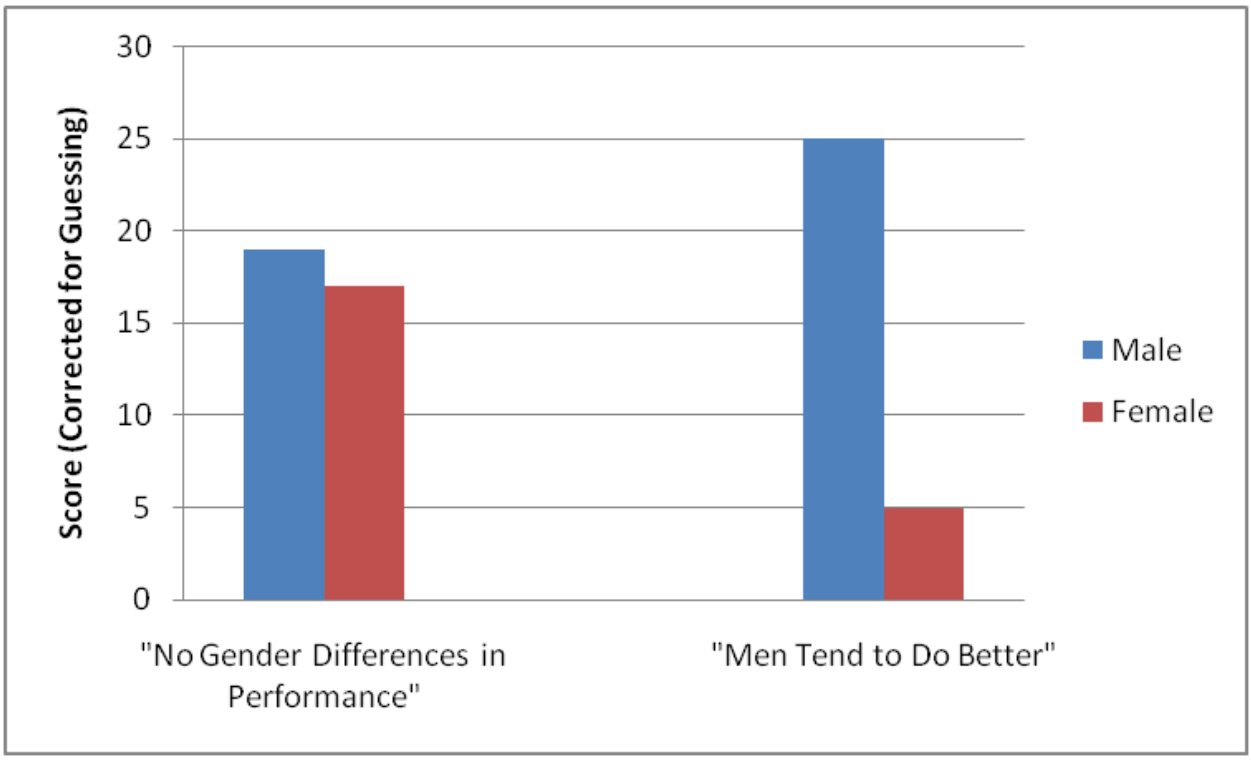

Figure 1.Messages about expected performance by females can signficantly affect performance[5]

Some of the messages can come even from those who intend to encourage women to enter computer fields. This is illustrated by the 2013 controversy over the stereotypes presented in the I Can Be A Computer Engineer book designed to accompany the much hyped Computer Engineer Barbie.[5] Computer engineering Barbie was announced in 2010 with a great deal of fanfare. The selection of computer engineer as Barbie's 125th career choice was strongly supported by the Society of Women Engineers, which worked with Mattel in developing Barbie's "geek chic" clothing and accessories. Nora Lin, the president of the Society of Women Engineers, said,

> All the girls who imagine their futures through Barbie will learn that engineers – like girls – are free to explore infinite possibilities, limited only by their imagination....As a computer engineer, Barbie will show girls that women can turn their ideas into realities that have a direct and positive impact on people's everyday lives in this exciting and rewarding career.[6]

The book to accompany the doll in 2010, Barbie shows her sister a game design she is working on, but says that she needs the help of two men to turn it into a "real game." During the course of the narrative, Barbie gets a virus on her computer, and spreads it to her sister's computer,

causing all of the sister's work to be lost. Barbie asks the computer instructor (who is a woman) how to repair the damage, but instead of doing it herself, recruits the same two men. After the damage is repaired, Barbie takes credit for their work, and then triumphantly exclaims, " I guess I can be a computer engineer!"[5] While the book had been available for several years, it did not become a *cause celebre* until fall 2014, when author Pamela Ribon read the book at a friend's house and wrote about the experience on her blog, which was picked up by Gizmodo and went viral. The wrath of the tech community was so fierce that the offending book was pulled from sale, and Mattel issued a public apology. Remixes and websites such as Feminist Hacker Barbie sprang up to offer alternative narratives for the images in the book. The original author of the book has said that she "regrets that she may have let stereotypes slip into the book," and is now afraid to open her email because of the backlash.[7] While it is apparent that Mattel had intended computer engineer Barbie to be a positive influence on young girls, as the discussion above illustrates, it may have perpetuated myths instead of providing an encouraging message.

Cyberbullying as a possible cause for the "leaky pipeline"

Another hypothesized reason for the leaky pipeline is whether cyberbullying affects women disproportionately and whether it causes women to leave computer professions in college or in the workplace.

There is a growing body of evidence that hidden biases within workplaces might contribute to the leakage of women and minorities from the STEM pipeline industries. The report published in 2011 by the Level Playing Field Institute (LPFI) revealed that both race and gender were significant predictors of negative workplace experiences among STEM workers. Women and minorities were much more likely than their counterparts to report exclusionary cliques, unwanted sexual teasing, bullying, and offensive jokes. These negative interactions often occur virtually or online through what had become known as cyberbullying.

To investigate whether the growing trend of cyberbullying could contribute to the "leaky pipeline", a study was conducted to investigate links and interactions among gender, race, and college major in experience of cyberbullying (Chesser, McCullough & Weathington, 2016). Fifty-seven percent (N=231) of participants reported that they were cyberbullied. Cross-tabulation analysis revealed that in the entire sample non-STEM students and professionals experienced cyberbullying at the higher rate than STEM students and professionals: 57.8% of non-STEM majors as compared to 43.7% of STEM majors, and this difference was significant with $\chi 2\ (1) = 6.332$, $p =. 012$.

Cyberbullying experience, however, varied by gender. Female participants from both STEM and non-STEM majors experienced more cyberbullying than males: 14.8% of STEM females and 43% of females from other majors were cyberbullied, compared to 11.2% of STEM males and 28.6% males from other majors, and this difference was significant for female participants with $\chi 2\ (1) = 9.904$, $p =. 002$.

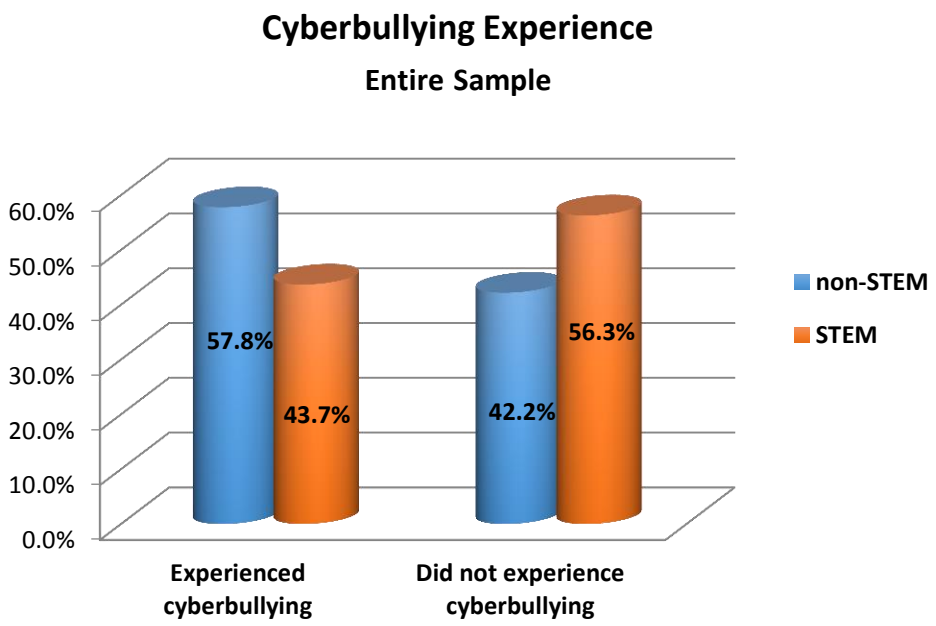

Figure 2. Cyberbullying experience of the entire sample while comparing STEM and non-STEM majors.

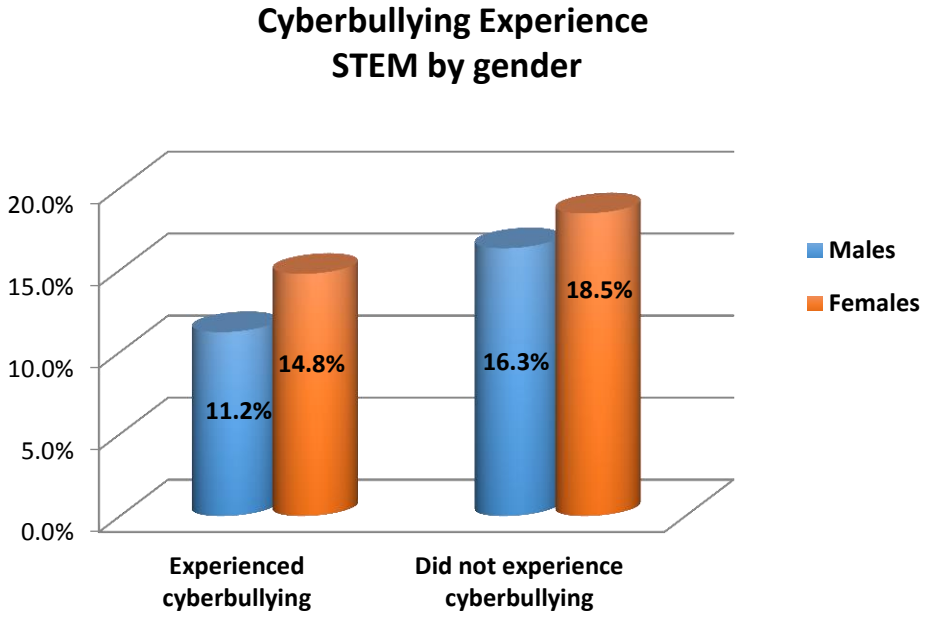

Figure 3. Cyberbullying experience of STEM majors while comparing males and females.

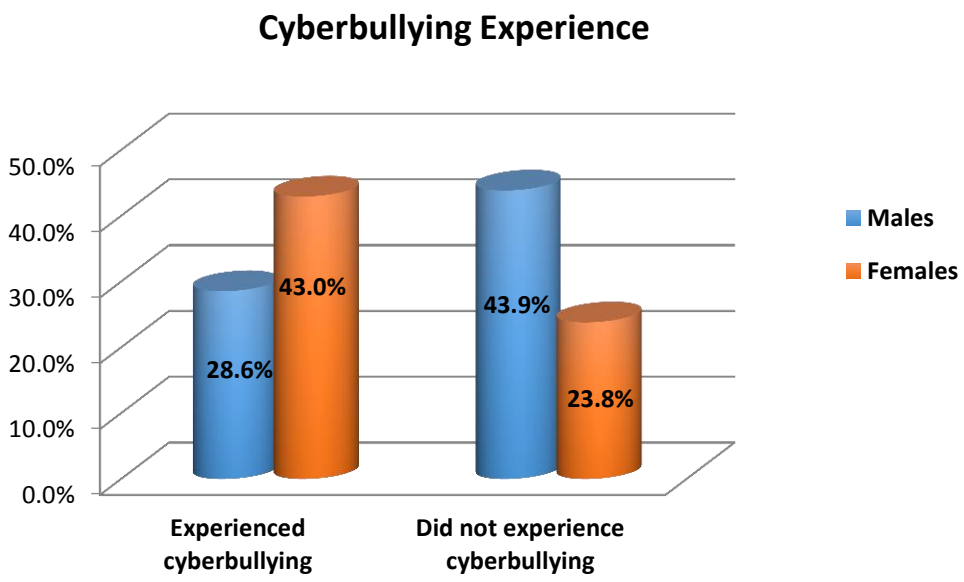

Figure 4. Cyberbullying experience of non-STEM majors while comparing males and females.

While the number of respondents who specified what was said during the cyberbullying incidents was too small for the results to be statistically significant, the differences between what was reported as being said to men and women was interesting. While men reported comments related to job, appearance, age, race, and religion, in addition to these, women also reported threats of violence, encouragement to suicide, lifestyle issues, gender, sexual slurs (such as bitch or slut), and other sexual remarks. The gender of the person performing the bullying, if known, was not included in the variables in this study, but will be explored in future work.

It was also interesting there is some indication that the number of means of cyberbullying employed may be somewhat age dependent. The different means identified in the study were mobile phone camera (image taken), instant messaging (e.g. MSN and Yahoo), chat rooms, email, webcam, and social networking sites (e.g. Facebook). Those of age 50 or greater were cyberbullied by an average of 2 methods; ages 40 to less than 50, by 2.4 methods; ages 30 to less than 40, 3.8 methods; 20 to less than 30, 2.4 methods; and ages less than 20, by 2.3 methods. Both the apparent sex differences in cyberbullying content and age differences in number of methods of cyberbullying will be explored in the authors' continuing work.

Discussion

Is this an issue that we are ethically compelled to address? All sources agree that this nation will become increasingly more dependent on technology in the current century. In December 2012, President Obama formally designated increasing the number of STEM graduates in the US by one million over the next decade as a Cross-Agency Priority goal to strengthen the American economy and make the nation more competitive.[8] The past strategy of importing workers in STEM fields cannot deal with a problem of this magnitude. If we weigh the costs and benefits of

the continuing--and in the case of computer science, increasing--gender gap, it appears to be in the best interest of our society to address it.

Who is responsible for addressing this? While we may hope for major government programs to address the gender gap in areas such as equal pay, in terms of what is acceptable behavior in the workplace, at technical conferences, or in on-line forums, it may fall to the individual to do whatever he or she can.

What can one person do?

- Refuse to accept stereotypes
- Raise awareness of implicit and explicit bias—including your own
- Be aware of how expectations affect performance
- Refuse to accept others' valuation of your abilities and potential
- Insist on objective standards for, and transparency in, performance evaluation

Conclusion

While educators and industries are currently trying to expand the number of women in STEM professions, this alone is not enough. Regardless of how many women can be encouraged or persuaded to go into STEM fields, this means little when such a large proportion of them later leave the profession. Something must be done to stop the messages of non-inclusion which women face daily in STEM fields in general, and computer professions in particular. Although there is no one "right answer" to ending under-representation, the most critical step to resolving a problem is recognizing that it exists. Each of us must do what we can to combat this problem if the Gender Gap is ever to be successfully addressed.

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