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Bridging the Gender Gap: Women in STEM Management

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Bridging the Gender Gap: Women in STEM Management

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Acknowledgments

This paper is dedicated to my mother, my husband, and my mentor.

To my mother, Sue Skeeters, who always taught me to keep pushing through, be my kindest self, and never let anyone tell me I could not accomplish my dreams. I am a strong woman because of you.

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Abstract

The purpose of this thesis is to study the current effects of training and accommodations on women in the Science, Technology, Engineering, and Math fields. Currently, there is a lack of women at the senior levels in the STEM field. This study evaluates the current literature as well as the personal experiences of 14 subjects. This information was collected through interviews. No personal data besides gender and age is communicated in the paper, with company names and signifiers removed. With the information gleaned from this research, the study evaluates the current programs and assesses a path forward. The assumption from the research in this paper is that the current programs are not effective and there is a better way to support women in becoming senior leaders in the STEM fields.

Chapter I

Introduction

This thesis is a critical analysis of the current situation and support in place for women in the Science, Technology, Engineering, and Math (from here on out referred to as STEM) fields. Many of the findings have proven to isolate rather than empower the underrepresented female population. After analysis of the literature and interviews, this study works to suggest changes to programs and curriculum to help support women in their STEM careers. This study can potentially lead to possible new training and theories.

Background and Need for the Study

There is a lack of female representation in the STEM fields in management positions. This lack of female representation causes an embedded stigmatism that the STEM fields are a "male" field. It also limits the creativity in the field as a result of the narrow ray of male only knowledge. The purpose of this study was to learn more about the challenges women in STEM management face. Once the data was collected, the study has suggestions for learning and development programs to help women bridge the gap between the increased number of women in STEM degree programs and the lack of women in management. In the finalization of this project, the study comes to a comprehensive evaluation from the field and proposes how to adjust current support.

This project was chosen due to the extreme lack of women at high levels of the STEM field. According to Wise, in 2019 only 14% of STEM management were women (2019) and "only 11% of executive positions in Silicon Valley companies are held by women. (Bailey, 2020) Historically, girls have been steered toward the "softer" sciences, such as psychology and

anthropology. In recent years, there has been a push for schools to focus on young girls and their

interactions with Science, Technology, Engineering, and Math, but there has not been a direct

uptick in the correlation with women entering the STEM fields post college. There is also a

problem with the lack of females in the STEM fields for young women to look to as mentors.

This is an issue we need to address as STEM becomes one of the main job areas in our nation, if

not globally. As of now, 49.6% of the population's possible ideas and innovations are not being

embraced in an area that is ever growing. (Ritchie, H., & Roser, M., 2019)

In this study, individuals were interviewed on their experience in their STEM careers.

The study looked into what support they have experienced, what support they have been offered,

and what greatly hindered them in their careers or studies. This project was chosen due to the

researcher being a woman who works in STEM, although I do not have a background in the

majors and curriculum behind STEM. There is a lack of diversity and many women at the table

are being ignored. As a former teacher, it is evident that young girls often shy away from the

STEM projects at age 4 or 5, saying it is a "boys thing."

Purpose of the Study

The purpose of this project was to evaluate the pursuit of a career in management STEM

for women as opposed to men. As STEM roles expand globally, I wanted to discover how this

has affected the glass ceiling. This study shows the disconnect between women entering the field

and the amount of women in high ranks. This study evaluates the steps taken to average the

amount of senior executives based on gender and qualification. Through this project, the study

evaluated the guidance, struggle, and expectations women experience as they grow in their

career and evaluated if training, mentorship and guidance has helped or hindered women in

pursuing achievements similar to their male counterparts. This was discussed through the lens of social stratification and feminist theory.

Research Questions/Hypothesis

This project's goal was to understand the why and see if there was a way we can address a how. Why are young girls already primed to ignore STEM experiences and why, when society says they back women in STEM, are so many women overlooked for promotions or for their opinions in this male dominated field? The hypothesis was that although there are a lot of base level supports for women in STEM, such as groups, mentor programs, and books, there is not much follow through from them. This study believes that the current support women have is a bandaid at best and that the current support is not utilizing supportive men mentors to their full ability to exact change. Through our understanding of the literature and analysis of the data collected, the study evaluated the current programs in place and proposes changes to the programs based on the needs of women interested in careers in STEM.

Theoretical Rationale

The theoretical framework behind this study will be social stratification and feminism. The study evaluated the need for strong female presence in the STEM field in order to create a more diverse profile. It also investigated the current gender biases placed on women and men in the same field of study. It looked at the biological differences as well as the perceptual difference. Lastly, this study looked into how much of the current lack of women in positions of authority is based on unconscious bias.

Limitations of the study

This study was limited by the sample size and location of the participants. This study interviewed 13 women at different levels in their careers in STEM and 2 males at different levels in their careers. The women and men have similar education. The participants are all located in the Silicon Valley currently, but only 2 were raised there. This area is highly geared towards careers in STEM. The area may increase the likelihood of women to gain more success in their career based on a saturated market.

Significance of the Study

In this study, I evaluated if women are being supported in their careers or supported to pursue careers in the STEM fields. This study helped evaluate the lack and/or need for a more comprehensive support system for women in the STEM fields. Through this study and the evaluation, I am able to facilitate the development of 47% (Daley, 2020) of the working population to an ever growing career option.

Definition of Terms

STEM: This is referring to the majors and fields of Science, Technology, Engineering, and Math.

Mentor/sponsor: A person or persons who are in your field or know detail about your work. These persons are able to support and guide you as you grow your career. They do not have to be the same gender or in the same field.

Soft Science: Sciences based on a more social level, often not able to be proved by hard evidence, ie- Psychology, Sociology, Philosophy.

Learning and Development: A term used for the trainings, committees, groups, and conferences established often by Human Resources in able to grow the community's understanding.

ERG: Employee Resource Group. These are normally based on an underrepresented commonality, such as gender or race, as a way to support peers who are struggling with the same adversities.

Unconscious bias: "Social stereotypes about certain groups of people that individuals form outside their own conscious awareness. Everyone holds unconscious beliefs about various social and identity groups, and these biases stem from one's tendency to organize social worlds by categorizing." (Navarro, 2020)

Chapter II

Introduction

Women in the Science, Technology, Engineering, and Math (STEM) fields face diversity and equity issues in their career. Currently, women in the US account for 47% of the working populations, but "the five largest tech companies on the planet (Amazon, Apple, Facebook, Google and Microsoft) only have a workforce of about 34.4% women." (Daley, 2020) This becomes more apparent the further a woman tries to get up the ladder of success. "According to IDC, the percentage of women in senior leadership positions grew from 21 percent to 24 percent between 2018 and 2019." (White, 2020) This is a small increase in female senior leadership, however "although these statistics are trending upward, women still feel less enthusiastic about their senior leadership prospects than men. The report found that 54 percent of men said they felt it was likely that they'd be promoted to executive management in their company." Meanwhile, only 25 percent of women said the same, noting a "lack of support, self-confidence and mentorship as well as feeling the need to prove themselves more than men to get promoted." (White, 2020)

This study has analysed the research around the effects and the necessary actions to help more women enter and excel in the STEM fields. Through the review of the literature, the study posed that this is a topic that needs to be addressed and focused on ways to assist further in this paper.

Review of Related Literature

College Years and Mentorship

Currently, women tend to change their majors away from STEM because of the "triple threat." Women in STEM majors face poor grades, low female enrollment in classrooms, and gender based stereotypes. Put together, all three of these issues lead to the lack of women pursuing their degree in STEM. In a study at Georgetown University from 2009-2016, researchers not only saw the drop of majors due to the triple threat, but also learned that increased mentorship and advocacy had a negative effect on retention. The increase in advocacy created even more pressure on the women already struggling with grades (Complex reasons, 2017). The researchers believed that all three areas of critique need to be present for women to decline pursuing their major in STEM. This only takes into account the climate of one, private university. The climate and "threats," as they are called, may be completely different for a public college or another private college in a different state. In general, the trends do see a higher number of women leaving their degrees in STEM without completion.

Although in this particular study it seems that they provided a gross over inflation of their findings, there is something to be said about the lack of women pursuing or completing their STEM degrees due to more than one factor. There is no single reason to explain the lack of diversity in STEM. In truth, there are many threats and reasons that may not be mutually exclusive.

A Pew research study by Hefferon and Funk (2018) looked into the factors for why Americans, regardless of gender, chose not to continue their pursuit of a degree in a STEM field. The study followed college students who declared that they would be pursuing a degree in a STEM field. Many of the students in the study did not finish their degree in their previously declared field. The lack of retention in this field was declared to be the amount of time and cost

that did not seem worth the investment. The degrees took a lot more time and money to

complete. Once in the field, students would still be giving much of their time to their job, with

little pay back. It was shown that other degrees, which took less of a time commitment, could be

far more lucrative. Interestingly, those students highly interested in STEM also did not see the

benefit of finishing their degree in the STEM field when it came to their future finances. Many of

the participants of this study however were in the midwest versus the west coast, where STEM is

more prevalent. This may lead to students' impressions that it would be difficult to join

competitive companies in the STEM field.

According to another study conducted at Georgetown University, there are multiple

reasons why women chose to stop pursuing their degrees in STEM fields (Roll, 2017). Among

these reasons are judgement from bad grades, wage gaps upon graduating, and undue pressure

from recruiting and mentoring. According to Roll,

> "form of bad grades equally affected male and female undergraduate's decision to exit
>
> from the STEM field, and the trend wasn't noticed in other male dominated fields --
>
> only in STEM, leading the researchers to determine that attitudes and perceptions about
>
> the field are an additional factor." Roll continues "'Women persist," Kugler said. "They
>
> have to get triple signals, triple cues, that they don't belong, that they don't belong to
>
> actually be turned away more than men." (2017)

This compound of three, bad grades, wage gaps upon graduating, and undue pressure

from recruiting and mentoring, leads to the lack of retention for female students. The "triple cue"

leads to failure to graduate. It is not one standalone aspect.

The wage gap upon graduating is an issue in every field. It is something society is constantly accessing and discussing in public forums. However, the Georgetown study pointed out that over saturation of the STEM field will lend to a wage decrease for both genders, pushing more women away from the fields. If they are aware that there is already a funding deficit, trying to break the wage barrier will appear even more difficult. The negative feedback of mentors and recruiting is also an issue in retention. In some aspects, mentorship and recruiting are pushing women into STEM fields strictly because they are female, not because they truly excel or like the field. This added attention causes added, unneeded pressure.

*Reconfiguring the firewall: Recruiting women to information technology across cultures and continents (*Burger, Creamer, and Meszaros, 2007) is a book of research studies focusing on girls and women in the computer science fields. For this literature review, the study will focus on three chapters, "Changing the High School Culture to Promote Interest in Information Technology Careers among High-achieving Girls," "Women's Entry to Graduate Study in Computer Science and Computer Engineering in the United States," and " Barriers to Women in Science: A Cautionary Tale for the Information Technology Community."

In "Changing the High School Culture to Promote Interest in Information Technology Careers among High-achieving Girls," researchers focused on 15 high achieving girls over a four year period. They were enrolled in an accelerated two week program in seventh and eighth grade. Their responses to computer science interest were evaluated then compared to their answers in high school four years later. The findings showed that out of the 15 girls, only one was still interested in Computer Science. Although that was the case, many still took Advanced STEM classes and wanted to go into science related fields, such as nursing. The researchers

anticipated the cause would be that computers were deemed to be "male" and the parents did not

support those fields for their daughters. On the contrary, the women did not see gender as the

issue. Rather they were bored by computer classes. They all had supportive parents who neither

pushed or pulled them away from computer classes, but did have a lack of curriculum support

for computer classes and did not have any mandatory computer classes and the optional ones

were deemed "boring" and not taught well. This led researchers to believe that a clear computer

class that was mandatory and taught by good teachers could lead more women into the computer

science field. A change in curriculum could help this disconnect.

  "Women's Entry to Graduate Study in Computer Science and Computer Engineering in

the United States," focused on what women need in computer programs to be successful. Much

of the focus was on transparency, mentorship, and flexibility. Interestingly, these were the same

needs that men stated they needed for a successful program. Mentorship seems to be key in the

literature. The industry is still fairly new, there is no clearly mapped out path and, if there is, it is

subject to change quickly and often. With mentorship, students can guide their careers while

having someone to talk it through with. Transparency of programs, careers, and expectation as

well as flexibility becomes key to retention on STEM students.

  "Barriers to Women in Science: A Cautionary Tale for the Information Technology

Community" was just that, a cautionary tale. It focused on the Affirmative Action Acts as well as

the current interventions that are being discussed worldwide. However, it is finding there is more

talk around these topics than action. The prejudice is deeply rooted in the cultures of the

industries. This short chapter spoke to starting at the root and working up. There is a need for

more open minded communication of core issues, such as work/life balance. With that, a

reduction in stigma around wanting to be a parent and a career person should be acknowledged and rejected. Women to be seen as a leader without needing to prove it more than their male counterparts. There is a catch twenty-two where women are either seen as too soft or too assertive when it comes to push back in their careers. This is not an issue men in the same positions of power have to deal with. Instead, it is an expected trait for men to be powerful and assertive. Foundational expectations and values need to change for society to change in the industry.

In a study by Mack, Rankins, and Woodson (2013), it was stated that there are currently no successful intervention programs. Many intervention programs focus on role models that are women, but until the field is more saturated, that is not an option. This means that we need to turn to open minded males to help become mentors and role models for younger generations. If women are not readily available as professors to higher education STEM fields, male professors who openly speak about how we can address that lack in the future should be instated. Women are faced with "not passively accept[ing] the dominant ideology of sexism but rather negotiate ideology and needs." (Weiler, 2009) Intervention programs could help advocate for the push against sexism and correct the ideologies of support.

Career Identity

Equity in the workplace is at the top of mind with the current media outcry. In her research, Cary Funk (2019) looks into the "hostile environment" that the STEM fields prove to be for women and people of color. For the purposes of this literature review, this study will only be addressing the article as it pertains to women in STEM.

According to multiple research studies, women are entering degree programs and careers in STEM at a higher rate than in the past. However, they are either choosing to enter the softer sciences, such as health and life science jobs, or struggling to be heard in the other technology related fields. In her study, Funk (2019) found that nearly 50% of the women in STEM fields feel they have experienced some sort of discrimination in their job. This could be anywhere from sexual harassment to small and repeated slights. The study also showed that with more education and a higher degree the perceived fairness of work tends to remain low, which in turn leads to less women pursuing post secondary degrees in STEM fields. However, this could be attributed to the choice in a particular field. If looking strictly at health and life sciences, women make up more than 50% of the jobs held. These are the softer sciences where relational ability is highly preferred, such as nurse or psychiatrist. However, women make up very little of the headcount for careers in computer science or engineering. When looking at the overall number, many would think that women are adapting to STEM fields and attaining more jobs, but critical eyes should look at the breakdown of career, ie: computer science or nursing, instead of the overall umbrella. The overall umbrella may look successful, but individual breakdown of careers are still dismaying.

This study also questioned the success or lack thereof in the education system. Programs such as Goldieblox or Coding for Girls are coming to the forefront of our society. However, these are extra external intervention programs. To get to the root of the disconnect, society needs to reevaluate the school system and what is being taught at a young level. Adding programs early into the curriculum could stop biases about gender as well as open new passions for many students. Intervention early can help young women learn more about STEM, but it can also

assist young men in learning how to assess a woman's ability. If everyone is interested in the

same curriculum at a young age, gender norms may dissipate.

Family Life

The total number of females attaining degrees in STEM fields has been steadily rising,

however women are still highly underrepresented in the STEM fields post graduation. The

analysis by McNeely and Vlaicu (2010) is that this discrepancy is highly related to the lack of

women teaching in STEM in higher education.

The initial issue around the lack of women in STEM higher education fields is the lack of

positions. Many of the current positions are held by men who do not plan to retire soon. Public

universities feel more of a push to circulate these positions to women who are qualified, but also

come into the same problem, there is no position to give even when there are qualified up and

comers. "Women now earn nearly 50% of all bachelor degrees and nearly 40% of all advanced

degrees in STEM" (McNeely and Vlaicu, 2010) so the applicant pool is there. In their study,

McNeely and Vlaicu point to the gap in child bearing years. Years when women have the

physical constraint of carrying the child are years where men in the same profession can

complete many research projects and get ahead of the game. So the question comes forth, how

can women have a family and a successful career? Even with companies who have competitive

and supportive maternity leave programs, the time a woman needs to take off is biologically

much longer then a male in the same couple. Until the biological constraint can be felt by both

genders, how are we ever going to account for the gap in work that comes from procreating?

Another interesting finding from this study is that the push for more female applicants

causes less women to apply. In fact, the attempt to diversify the pool creates a feeling of

otherness where women feel they are only being looked at because of their gender, not their

abilities. According to McNeely and Vlaicu, "efforts to recruit more women into the academic

applicant pool seem to diminish in fields with a higher percentage of female doctorates and

existing faculty." (2010) It is a fine line between how much you can push in this aspect. More

programs need to focus on showing how women are being picked for their quality of work and

not gender. Otherwise, you put women on a glass cliff where they are bound to fail.

Along with other occupations in the world, STEM is highly gendered. Society actively

tries to dispel this belief, but it is hard to get around this common bias. Unlike many of the

current research studies that focus on undergraduate or early career women, a study by Hart

(2016) focused on the issues mid-career women face and how gendering affects them. Women in

mid-career face one large obstacle that is unique to them, pregnancy. Hart (2016) proffered that

one of the largest issues in a gendered career is the stigma that wanting to be a mother means you

are not career focused.

To have a baby, you have to take time off. This is not an opinion, but rather a physical

reality. A woman will be giving birth, something that takes time and recovery. The problem is

this time off leads to time out of work. Many women in the STEM field have faced problems

with promotion after coming back from a "job gap" due to time off to have a child. A way to

edge this gap, is to start consulting. This way, it looks like you are still honing your skills and not

taking time away and losing the connection with current trends. In the research by Hart (2016),

Hart speaks to the idea that the "ideal worker" does not acknowledge parenthood. That is not a

sufficient answer for many people. Society needs to start analyzing this expectation and work our

way out of the stigma. If women can openly discuss the struggle of trying to balance parenthood

and career, society can be more adept at helping the more skilled and deserviting worker get the promotion, even if the worker had to take time off to heal.

Mack, Rankins, and Woodson (2013) focused on the issue that women face between graduate school and the workforce. Unlike the other studies, this is the time when family obligations hit the forefront of a woman's life. It is estimated that the United States needs "1 billion" (Mack, Rankins, and Woodson, 2013) degrees in STEM in the next decade to keep up with the exponentially growing job market. That means that regardless of stigmas, women will be entering STEM fields at a much higher rate. However, with the increased number of women in the field, we are not seeing many progressing as high or as quickly as men. The researchers looked into the conundrum that mid-career women face in the STEM fields.

One topic this study focused on was family obligations. Again, at mid-career level, most women are also thinking about the ticking biological clock. This means that if a woman wants to have a career and a family, one will have to suffer. The researchers discuss how this is the perfect opportunity for customized intervention. A woman's biological clock should not be the reason she cannot get a promotion or maintain a career. This could lead to the discovery of a program where you could do both. It also means more focus on affordable childcare.

Work and family are at the heart of everything we do. They are often a means to an end for each other and also directly competing. In the article "Work–Family Balance Self-Efficacy Relationship With STEM Commitment: Unexpected Gender Moderation"(P. Myers, and Major, 2017), the researchers focused on how family obligations and self-efficacy in one's work lead to attrition of women in STEM careers. Through their research, Myers and Major found that confidence in one's ability leads to a successful career for women in stem. They also found that

obligations of family are on both male and female minds, however, women are expected to be

more physically involved and men more driven by financial involvement. In conclusion, they

found that women are more committed to STEM roles, even when they have low confidence in

their ability to juggle family and career.

The findings of this research show that women are attaining more confidence in their

ability to be career driven and family oriented. This could show greater success with early

interventions. The study also showed that resilience of women and confidence in their abilities

are key to believing they could balance work and family. However, although women are tasked

by the physical caregiving more than men, men worried about the financial aspects of their

career so that they could support the family. As a note, this study was conducted with a majority

of the participants being around 22 years of age. Many were still single.

MENtorship: How do men play into this?

Women in tech: Take your career to the next level with practical advice and inspiring

stories (Wheeler, 2017) is a book that is meant to guide women in the industry through honesty,

life advice, and funny anecdotes. It is focused on a topic that saturates media and the market, the

lack of women in the technology sector. However, this book tends to put a negative light on the

realities of the technology industry for women. It also leans towards blaming women for having

too high of expectations. For this study, three chapters in this book called, "The Family",

"Mentorship", and "Bonus Chapter for the Men" will be analyzed.

Please note that the chapter "The Family" was written by a woman who chose not to have

children. She did become a stepmom later in her career, but she did not take any time off to have

a family on her own. This may impact the negative light she puts on choosing to have a career

and family. In this chapter, the author tells the reader that women cannot have it all. She states

that women will need to take time off work and that their job may not be there upon their return

for maternity leave. She suggests starting a consulting firm while on maternity leave for those

who do not want a resume gap, but she also says to not expect to be at the same level as anyone

else when you return, when in fact you may be well behind.

The chapters "Mentorship" and "Bonus Chapter for the Men" went hand in hand.

Mentorship is key to a successful career. In the technology industry, many of your mentors will

be men, and this study states that this can be beneficial. Where we currently stand, men still

make up more members of the industry than women. Having a mentor who is a woman is great,

but not necessary. Male mentors can help you overcome some of the same hurdles and shed

different opinions on certain matters. The author spoke of how she went to a male mentor with

frustration about the "good 'ol boys club"(Wheeler, 2017). She was not invited to golf outings

or whiskey tastings like her male counterparts. To his credit, the male mentor had not noticed,

but once made aware, he helped to make everyone else aware. It was an unconscious bias he

helped dissuade in his peers. The "Bonus Chapter for the Men" speaks at length about being

aware of these unconscious biases and empathy toward women and other cultures. The example

given was a weekly happy hour. The author stated a male boss was angry that a female on his

team and one male never attended his 10 person happy hour. He was later told it was because the

woman had no childcare during that time and the male was not able to drink. Unconscious bias

can be one of the greatest inhibitors in the ability for women to achieve managerial roles. The

unconscious bias extends to women themselves, as well. "Women are no less effective at

leadership, committed to their work, or motivated to attain leadership roles than men. However,

women are less likely to self-promote than men are." (Holt and Simon, 2016) The inhibitor

needs to be attacked through training and education for both genders.

Summary

In summary, mentorship and flexibility are key to both helping and hindering women in

the STEM fields. Mentorship can add too much pressure to already struggling members.

However, having a mentor who has either gone through the struggle (ex- a woman in the STEM

field) or an advocate willing to place their esteem behind you (ex- a male ally) seems to help

more than hinder. Many of the issues women face with career progression have to do with family

obligations. Flexibility and training to address this ever present biological need should be created

for the success of females in the higher ranks of STEM.

Chapter III

Case Study and Methodology

My case study followed 25-65 year olds working in the STEM field. Each person was given the same set of questions. Out of the original twenty participants who were selected, fourteen agreed to the study. The subjects were twelve women and two men. The participants were based in Silicon Valley. All have worked in some form of Science, Technology, Engineering, or Math. The number of years in the industry range from three to 50. Six participants are in management positions, four are on managerial tracks, two have chosen not to pursue managerial tracks and two are new to the field. This study assessed the subjects' interpretation of the challenges for men versus women, as well as, the challenges faced by women senior in their career to women just starting. The field site was multiple large and small science, technological, and engineering companies that were accessed based on the research's current occupation.

Interview Questions

1. What drove you to pursue a career in STEM and what was your major?

2. What have you come to find is a key failure in achieving gender diversity in the field and how, if at all, do you think that can be removed?

3. What, if anything, has the diversity and inclusion push from Human Resources done to help women professionals?

4. Have you ever received training or accommodations on the job for being a woman in this field and, if so, can you describe how that went?

5. How have those trainings or accommodations made you feel in terms of your confidence or sense of belonging on the job?

6. Do you think overqualified men are overlooked in the current search for gender diversity?

7. How do you see your career progressing? Do you plan on being a Director, VP, or higher?

8. What steps can you suggest for women coming into the STEM field?

9. In a perfect world, what would the learning and development for women in STEM look like?

10. What, if anything, would you do differently in your career progression now that you can look back on it?

Potential Contributions to the Field

Suggest different approaches and focuses for current training models by

1. Three women in high level management positions in engineering at a large technology or science firms, six women who are "up and coming" in the engineering field, and three women who have just started their careers in the engineering field were interviewed. To get an unbiased opinion, two men who are experienced engineers at a large tech firm and actively involved in women's equality and rights groups were interviewed.

2. Community based research:The researcher was currently working for the VP of Engineering at a large technology firm. With permission, the daily work environment and interactions seen were used to facilitate more questions around the broader issue.

3. Analysis of current literature was used with the study findings to critique current

    trainings and programs targeted towards women in the STEM fields.

Possible findings

Through a staged mock interview, the research found that the current idea of women

feeling ostracized by the support in place is a topic of concern for both men and women. The

study looked to unbiased information to confirm or deny the possible finding. Other concerns

that arose were the impact on child births and the decline of successful STEM companies.

Japan is currently seeing a decline in child births due to more women choosing their

career over parenthood. This dilema may cause an increase in fertility, surrogacy, and egg

freezing programs that could be covered by companies who want to ensure they have successful

workers. With that, Finland has a very lengthy paternity and maternity program which allows

parents more bonding time with their new family members. This has led to happier workers and

more productivity.

Chapter IV

Results

Reasons for Coming into the STEM Field

Out of the fourteen participants, everyone had a different reason for initially entering into the STEM fields. For the women, five had the underlying cause as "wanting to help people." The way of helping was anywhere from developing equipment or science technologies to customer service. The second most common reason for coming into the STEM fields was a split between two women who were enticed by the idea of a career or company change and one woman and one man who were both encouraged by their fathers to pursue the field. Outliers for two female and one male participants include, to gain more experience before further education in a completely different field, an interesting class in college that sparked a passion, and a strong drive to innovate and problem solve.

Leading Causes of Discrepancies of Diversity in STEM

An overwhelming seven women stated that key discrepancy in diversity occurs due to the lack of representation. This was seen by a lack of senior representation, such as few to no CEOs, board members, and other female high stakes leaders to look up to for your people. Additionally, there was a lack of outreach programs made available to young people in their communities and schools. It is worth noting that all seven of these subjects grew up in middle class to upper middle class, affluent communities.

Out of the remaining subjects, three women found that both conscious and unconscious bias of women were to blame for the discrepancies. This was led by stereotypes and gender biased expectations of performance and home life pressures.

Both male subjects attributed the discrepancies to gender diversity only. Both found their experience to have much racial diversity. This led both subjects to state that diversity was not a large problem in the STEM field.

The last result was an outlier. One female subject is in technical writing, which is a highly gendered occupation, with more of its members being female. Thus, this subject did not see the discrepancy in gender in the STEM field, either.

Human Resources Input into Learning and Development

The highest commonality among the subjects was the push for specialized focus groups through human resources and diversity teams. These groups included, but were not limited to recruiting pilots focused on diversity hires, employee resource groups focused on women in STEM fields, and sponsorship and coaching programs both external and internal to the subject's current company. An additional female subject coupled these programs with strong, female mentorship through her direct manager.

Two female subjects stated that human resources action was to ignore the issue. They both stated that occasional meetings have happened, but no actionable steps were taken after the meetings. Instead any issues raised were "swept under the rug" and human resources moved on.

Additionally, both male participants stated that nothing human resources had done helped them understand any of the issues that women in the field may be facing. They both stated that there was no insight to the effect, positive or negative, that training had on women in their field. However, if the trainings are there, women choose not to participate. "Personally I have not found they have done much for me, they do at least try to be available and provide resources. I have just never felt the need to use them." (26 year old, female subject)

Both male participants stated that without a training designed for men to experience what their female peers are feeling, conscious and unconscious bias will continue to perpetuate and permeate the STEM fields. A female participant, 60, stated "there is prejudice against women, they are always too young or too old. There is a very strong "old boys" club that is alive and well and precludes women from opportunities," while a male participant, 31, stated "HR pushes acting based on facts/data/qualifications and not being influenced by a person's background/race/gender. I don't think I ever am influenced by those, and think a majority of the younger adult generation behaves the same." Without an open line of communication through training, one side may never fully understand the issues impacting the other or how they can both persist against the same discriminations.

Trainings, Accommodations, and Overall Feelings

The purpose of many of the interventions stated above was assumed to be support for gender minorities in the STEM fields. When asked if given any specific training or accommodations five women and one man said no. Four women and one man said they had been offered training and accommodations based on gender differences and interactions in the STEM fields. Two outliers were women who were able to attend training and conferences, but they had to seek these opportunities out on their own and nothing actionable came from the training.

 When asked to analyse their personal feelings on the effects of the trainings and conferences they had attended, five female subjects and one male all felt the trainings neither helped nor hindered them in their careers. Seven female subjects suggested their personal feelings of the trainings were overall positive. Four female subjects stated that the trainings had

them feeling listened to and supported and three women felt the trainings were helpful and empowering.

Stereotypes in Hiring and Career Progression

Stereotypes are often brought up in the literature that create the biased opinion that due to diversity hiring efforts, overqualified men are overlooked for roles that are given to less qualified women. The subjects were asked their experience with this bias in order to compare literary opinion over practical opinion. Seven women and one male assessed that overqualified men were not overlooked in order to gain diversity hires. However, of those eight subjects three women and one man stated that this was a known opinion bias and has been brought up in front of them, even though deemed untrue. Additionally, two women and one man stated that they believe this was sometimes the case. One female subject believed yes, overqualified men were overlooked, and the last female subject believed no, but that overqualified women were overlooked often.

What could this mean for their career progression? The subjects were asked about their goals in career progression and if they saw this as a feasible accomplishment. Interestingly, all the female subjects, with the exclusion of one who was two years away from retirement, stated they would like to progress into a role as Senior Manager, Director, Vice President, or Chief Executive Officer. Both male participants said they do not wish to go into any managerial role. They all anticipated this was aquireable with differing levels of support and education.

Suggestions and Things to Change

Suggestions for women entering the STEM field differed greatly, but fell into six pillars. More education was suggested by one female subject. She caveated this with more education earlier on in your career. Four women said they would suggest having more confidence, both in

yourself and your work. Two women and one man suggested that you find sponsorship. All three suggested an established support community and a mentor. Additionally, two females and one male subject suggested to ignore the stereotypes and biases established in the field. They suggested to guide your opinion on the evidence and silence the stereotypes. Lastly, two female subjects each suggested to follow what makes you passionate and not let anyone push you where they think you should be and to not change for the role you think you need to be in.

Perfect Solutions

There are many options and opinions in the field when it comes to the amount and type of training, resources, and accommodations for women entering the STEM field. The fourteen subjects were asked their opinion on what the perfect solution to the training, resources, and accommodations would be in their experience. Two women and two men stated that these trainings, resources, and accommodations should be the same for all genders and races. The concern was that without training for men, the same issues would remain in the field. Four of the female subjects suggested that hiring and recruitment should have more of a focus on female hires and that this effort should start at a younger age. Two women stated that STEM should be normalized for females at an early age, essentially ridding us of the "pink aisle." Lastly, three female subjects suggested more gender based trainings that focus on developing skills for work and for leadership.

The last question asked of the subjects was what would they do differently. This was to gain a sense of how the field and its approach to women could change to be more accessible and equitable. Four of the female subjects suggested more skills training and schooling. Three female and one male subjects suggested ditching imposter syndrome earlier in their careers. One male

and four female subjects stated they had felt comfortable with everything they had done to reach

this point in their careers and would not change anything. Lastly, one female subject suggested

that it may be easier with a more open minded generation in the positions of power.

Chapter V

Discussion

As a result of the study and analysis of the literature, we examined the results as they pretain to

two key theoretical fondations: Social Stratification and Feminist Theory.

Social Stratification

Education

Many discrepancies in education begin in early elementary programs due to social

stratification. A key discrepancy pulled from the literature and this studies research was the lack

of STEM programs in schools. STEM programs are often not offered to low income schools and

when they are offered, are either at an extra cost or deemed "not girly." The industry has started

to attempt to fix this occurrence with products such as Goldieblox which package engineering

toys in a pink colorful box tied to a fairytale story.

In regard to getting women into STEM - I would say the most important thing is to

provide educational opportunities early on for women in historically male-dominated

fields. Women are often turned off from male dominated fields due to sexism, discomfort,

or isolation when surrounded by all men. If we can get more women in these fields early

on, there are more opportunities for women to advance in the STEM workplace,

especially when surrounded by other women and where there are women in high-level

positions to look up to. (30 year old, female subject)

The overall opinion seems to be that to help create more female senior managers in the

STEM field, we need to start earlier. However, this creates the new issue as to how. Many

communities are not privileged enough to support an additional educational program. It is also

important to mention that many STEM supplies can be expensive. Additionally, every school filters their students differently, whether it is by grades or by how loud a child or parent can be about the child's needs. Those students with good grades as well as those who verbally state their interest are more likely to be put into programs. This can easily create outliers in students who are either not assisted with outside help for grades, more concerned about helping their families then focused on grades, or are too quiet or shy to state their interest, especially if those interests feel outside their gender norms or expectations. Regardless of the social class of the school, at certain ages high test scores are deemed not "cool". Outside of funding struggles, schools need to find a way to combat this social identity problem early on.

For the students privileged enough to go to college, the world of STEM can be introduced anew. Most colleges have programs designed to support a future career in STEM, however, as seen in the literature portion of this paper, application, acceptance, and retention of women in these fields is still low. One of the subjects in this study stated that she was placed in an engineering class by default.

Always interested in Math but nothing else, actually fell into computer engineering by accident when I went to sign up for classes and they put me into the computer discipline by default. Major: Computer Science and Engineering (27 year old, female subject)

Without an accidental default, this student may never have found a passion for Engineering. How do we create this for every student? Many colleges have required courses in different fields, such as English, Math, and Science. While this hits a few STEM fields, creating a required course in Engineering could open the field to many more female students.

I had no idea half the careers and opportunities that exist in [my company] were out there

when I was in school. I don't think schools do a great job showing the breath of work

available, even less so for women. For the longest time I assumed my best options were

Doctor or Lawyer. (35 year old, female subject)

Forcing students to look at a subject outside of their expectations and comforts can create

opportunities in less sought after fields.This change could create a new group of women students

with degrees in STEM fields. If more women are given the opportunity to experience STEM

fields in general, the job market diversity for new graduates would drastically change. This could

tumbleweed into the creation of more gender diversity as well as the opportunity for growth into

management fields by strictly creating a more even and sustainable pipeline.

Company Choices

Many of the subjects mentioned taking the role in order to get into the company they had

idolized. This went anywhere from trying to gain more experience at a big name company to

further their career in another industry to knowing that the company benefits would be helpful.

I was a business and law major originally planning to go to law school. When I graduated

I got a job with [large technology company] and took the [larger technology company]

role 6 months later to increase experience and resume before law school. I loved it so

much I stayed." (35 year old, female subject)

There was a trend in this studies data that the company was a main driver to the subject to

stay in the STEM fields. Overall, half the subjects, all female, were not originally looking into

the STEM field. Many had received their degrees in soft sciences, English, and Law. Once they

were in the field, their interests peaked. This showed that there needed to be more open

opportunities for women early on in schooling and careers. However, what this means to communities where large tech firms are not based is still to be seen. This could come into more reflection as we look toward people who seek companies based on their benefits. "I have a degree in English and chose a career in tech because it aligned with my interests of writing for a large audience and because it has great benefits"(30 year old, female subject). This subject clarified that she wanted to "be able to support herself" and the company's benefits made this an easy option. For underprivileged communities, these companies' benefits could open many doors and possibly impact more females entering the STEM communities.

This brings more focus on the social stratification of our underrepresented communities. There are many efforts in STEM that are focused on the "betterment" of underprivileged communities. This is seen through outreach programs and study grants. However, many of these communities see no representation of themselves in the companies, especially women. "The urban planning field doesn't always represent the community it serves. For example, in [large Bay Area] County there is a large Latinx population but we don't have a Latinx planner on our team." (30 year old, female subject). Society expects the marginalized and laborers to accept the help when they don't get as much exposure to the gains of the help. This leads to a conundrum, how do we help at the root when we do not have the representation and how do we get the representation if we do not start at the root?

Feminism and Biases

Females are vastly underrepresented in the STEM industry. Given the reserach in this study, this is due to the following feminist theories.

Gender and Social Interactions

Science, Technology, Engineering, and Math for whatever reason have been highly gendered subjects. As seen in the literature, at a college level, the number of women in STEM classes is lower than men and the retention rate through four years of college is minimal.

There is a lot of racial diversity, and very few women. I think this is mostly attributed to the background of qualified candidates for my somewhat niche field of electrical engineering. Classes in school were racially diverse, but there were usually between zero to two women in these specific upper division classes. (31 year old, male subject)

If women were to get through the societal interactions in college and proceed into the STEM fields, why aren't we seeing more women at higher levels of the fields? One subject in the study stated:

I plan on one more promotion, but it will be a tough slog because women are discussed much longer in promo committees and are often sent back for reasons such as: not enough scope. How can women get scope if the "old boys" give scope to each other? (60 year old, female subject)

Higher education and promotion of women in the STEM field tends to be a double edged sword. They are critiqued at a higher level and not given the same exceptions and expectations as men. A key reason that was brought up often in the literature and this study are unconscious and conscious biases.

There are many unconscious and conscious biases a person can have, but for this study we will focus on the emotional stereotype. Over 75% of the subjects, both male and female suggested there was a bias towards women in the STEM industries as too emotional to be leaders. Half of the subjects stated this may be unconscious and with no intent to harm. However,

this appearance has nothing to do with factuality or a woman's ability to work. This bias leads to an impression that will follow a woman throughout her career. "Generally it is people's first impressions and sometime's lasting impressions of women and how skilled they think they are based on their gender." (26 year old, female subject)

Companies and schools are trying to actively combat this with their rigorous promotion cycles or with training to call out this bias.

Women in leadership is something that is talked about often, but in principle most companies are still struggling with basic "cliche" diversity issues - ie: women being labeled as emotional when a male counterpart is equally "emotional," women being labeled as stand-offish when they are in power, etc. (27 year old, female subject)

The standards that women are held to are vastly different then those of their male counterparts. "There is prejudice against women, they are always too young or too old. There is a very strong "old boys" club that is alive and well and precludes women from opportunities." (60 year old, female subject). Trainings that are designed for women focus on this aspect and how not to be deemed too emotional or apologetic. However, male counterparts do not receive the same training although they may be seeing women as too emotional and apologetic. A suggestion from a male subject was

Create opinions based on evidence, not the other way around. This is in no way meant for women specifically, but is advice I would give anyone coming into a STEM field. It is especially applicable to women given social bias and outdated stereotypes that women have to overcome. (30 year old, male subject).

However, how are men supposed to have this viewpoint when they are not taught to have this view point? They pose a risk of falling into the "old boys" club without conscious acknowledgement. Another potential roadblock to look at was that more than 50% of the females in this study responded that the reason they joined the STEM field was to "help people." This emotionally based pull on helping people was a key driver for entering the field, but could it create more bias in the eyes of their counterparts. Emotionality is there for men and women, but needs to be reassessed into a positive.

Familial Expectation

An aspect of female life that was only brought to light by one subject was familial expectations. Biologically, women carry most of the burden if choosing to procreate naturally. This is not a bias or an unfairness in a partnership, but a fact that a woman will need to take multiple months off in the middle of her career if she chooses to have a child naturally. Many women are faced with gaps of work or missed promotions that put them behind their male counterparts due to having a child. "I also worry about the challenges that adding motherhood into the mix will bring." (32 year old, female subject) After you have taken that gap, you have an expectation to help raise said child. This adds a problem for women who are mothers trying to make it to a level of senior leadership if they wish. They will have missed out on months of work while their male counterparts were able to get ahead. There is not currently a way to explain a gap in work and still be able to promote at the same rate as a male counterpart.

Conclusion

Conclusively, the lack of women in the STEM field and at senior levels has not gotten much better with the current learning and development initiatives. The amount of young women

applying into these majors in college has dwindled and of those women, there was a significantly

low retention rate through graduation. Once in the field, women are faced with unconscious and

conscious biases when trying to promote. They are hindered by their lack of scope and

emotionality, when their male counterparts are not judged on the same data. Current initiatives

have support for women in these situations, but the training was not given to the male

counterparts who are evaluating these promotions. Lastly, there was no work or effort in helping

women who choose to be mothers. These women had a forced gap in their work that their male

counterparts do not have to explain.

Recommendations

Overwhelmingly, the current initiatives are one sided and sparse. All the subjects in this

study stated that the trainings and programs were meant for women to help women and often

very hard to find. Through the literature and this study, I have identified that training and

mentorship are required in order for women to have a chance at success in the STEM fields.

The recommendation of this study is to create trainings in two separate ways. The

trainings should be offered to women only more often as a safe place to discuss ongoing issues.

The trainings should also have sessions designed for men to attend. If the male counterparts are

given the opportunity to see behind the curtain of inequity, they may have more of a chance to

detect the unconscious biases of themselves and others in order to support the growth of women

in STEM.

Likewise, mentorship is key for the success of any person in their career. A good support

system or someone who has been in these positions before can be very enlightening. However,

the recommendation of this study would be to find both a female and male mentor for young

women entering the STEM fields. A female mentor can help you to navigate the biases and

gender traps in the field. However, a male mentor may have had more success in promoting and

thus can help a young female around many roadblocks. If you have the backing of someone who

is higher in the workforce and willing to speak to your successes and not your emotionality, you

have a stronger chance of being successful in entering the senior levels if you so choose. The

research and recommendation can be summed up well by this male subject

> Find a mentor who you can ask questions. Work hard, proactively ask for more
>
> responsibilities as soon as you are ready for them. Understand why each task is required
>
> and what the goals are, see the larger picture to understand what the next steps will be.
>
> This is the same advice I would give any young engineer entering a company. (30 year
>
> old, male subject)

> Changing the way we train and mentor both women and men entering the STEM fields

will proactively alter the amount of women we see in senior management in the STEM fields in

coming years.

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