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Women and Girls in STEM Fields: How Gender Bias Impacts Individual'S Academic Decision

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Abstract: Female figures have experienced consistent stigmatization in a variety of domains; one of the most significant fields is STEM, which is perceived as a laborious and 'hardcore' discipline. Women, who are generally correlated with characteristics such as delicate and tender, maintain a lower participation rate in both STEM subjects and jobs. In order to obtain a more profound knowledge behind this trend, this essay aims to investigate potential reasons by generalizing current issues into three sections: academic, familial and occupational. The major research method used will be the semi-structured interview, where some questions are pre-designed, and some are improvised. One sample question of the predetermined question is 'Describe the gender bias you have experienced.' After an abundant collection of evidence, the essay comes along to the conclusion that schools, families and workplaces do hold crucial embodiment of gender bias in academic preferences. Deficits of the education system mainly include a shortage of models, inappropriate learning content and a discriminating academic atmosphere. The familial aspect displays its effects through parental disapproval and enforcement of changing majors. Meanwhile, STEM occupations also exist issues, including sexual harassment and maladjusted salary. Deterrence, as a result of these reasons, extensively blockades women from entering these domains. Thus viable blueprints of rectification, such as law establishment and additional support, are also brought up. Such measurements are firmly believed to be effective alleviations of the current status.

Keywords: STEM, gender bias, stigmatization, stereotype

1. Introduction

In the present timescale, people are more prone to societal views, particularly norms and expectations in certain aspects. According to simplepsychology.org, norms offer people an expected idea of how to behave and provide operations to achieve predictability in society. The conception of norm plays a key role in understanding conformity in particular. People conform to the expectations of the public, which is the reason why most people, most of the time, conform to social norms [1]. This can be operationalized as the social phenomenon when social members generally accepted the informal rules that accepted standards of behaviour of categorized social groups. In other words, it is when the general society holds a stereotype, which can be both benevolent and malevolent, towards groups of the population that they should act or behave in certain ways. The rapid development of social media and technologies made society even more susceptible to these norms, as the internet provides a platform for recipients to exchange thoughts and propagate arguments.

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This issue roots in one ordinary facet of lives, that is, gender groups. This phenomenon can be observed in various locations in people's daily life, including the workplace, school or within family. In general, women is seen as relatively weak figure and usually play an inferior role in most circumstances. Firstly, girls in school place are usually recognized as those who ought to be only excelled in specific subjects, such as language study and other subjects that require memorization skills, as girls are deemed to hold superiority in wielding such skills. In contrast, male students are more likely to be seen as good at skills like calculating and so are linked to better performance in science subjects such as Mathematics and engineering. This norm can also be seen in other aspects of school life, including haircuts, uniforms and behaving manner. Another example could be a workplace, where women, especially during pregnancy or ready to, would be seen as a vulnerable figures as they can not attend work and contribute to firms' achievements and developments. This further weakens the power of women in the workplace and reinforces the structural stigmatization of the female population, and one potential outcome can be a decline in the willingness of HRs to recruit female employers. This can be seen in some recruiting conditions, such as age and whether pregnancy. There are even regulations when firms forbid women with a certain amount of time of pregnancy to be recruited. There are only some aspects of how women are suppressed in the workplace, while other aspects should also be taken into account.

Under this unfair treatment and stereotypes, girls are discouraged from taking those occupations with apparent stereotypes within them, which means a witness of changing courses/subjects after consideration for the potential harm in future careers and workplaces due to unfair treatment. According to Pew Research Centre, E.OTWELL/SCIENCE NEWS, among STEM workers, the largest range between the two gender – Black women and Asian men – is that women earned only 55.3% of men's salary [2]. Thus, women tend to change their major in universities or even early in optional classes in junior high school. The impact is imposed on not only females but also the male population. Male students are seen as more experts in science fields as the societal stereotype towards males is that they are more logical, so they should be good at calculations and conferences. Research shows women occupy only 28% of the workforce in STEM fields, while men greatly outnumber women majoring in most STEM fields in university [3]. Thus they are seen as more likely should take science-related courses and occupations in the future, adding to the stereotype of people.

This research is going to examine previous studies and point out some primary causes of the phenomena of gender bias in STEM subjects, directly address to specific triggers that may come into effect. This research will apply a semi-structured interview as a research proposal, where half of the questions in the questionnaire will be designed, and half will be variable as they are changeable to interviewees' replies. These are all effective methods to obtain the result. After having these materials at hand, a principal quantum analysis is helpful in diagnosing the problem. After the completion of the interview, by categorizing the different issues and reasons from what each interviewee talked about, the distribution of the answers can be seen. Therefore, it can be observed the reasons they stated more directly, prompting the diagnosis of the issue and drawing out a holistic conclusion.

2. Flaws in the Academic System

In the first place, deficits in the education system and negative academic climate in the school inculcate the norm that STEM subjects hold specificity to sex. This impression even stemmed from kindergarten and primary school; the age ranks when children take the shape of their awareness towards society and the general world. Learning materials like picture books and storybooks tend to portray certain occupations to specific genders [4]. According to Dakar, Tinny and Anand, Sarita, NCERT released a report in 2014 which focused on gender analysis of 18 primary NCERT textbooks; males were seen function in a range of occupations, while women were stuck to jobs such as homemakers, teachers, nurses and doctors, particularly in English textbooks, where a large number

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of characters were depicted in men/boys figures. One Class III Environmental Studies textbook, portrayed women in the stereotypical role of fetching water [5]. It is clearly observed that students are exposed to biased information in the textbook, which prompts the formation of their correlated impression between gender and occupations. Furthermore, it is more susceptible for children to take in this knowledge and then consolidate them in their minds due to their undeveloped mindset and naïve ideas. Textbooks, or other learning materials, can be viewed as implicit hints to students about the distant border between genders and their future occupations, subtly affecting students' perceptions. Given the fact that the occupational aspirations of students are shaped in their early stage of the academy, such flaws in the education system 'foreshadow' the future stereotype of the specific sex. Therefore, under the consistent infection of such bias, it is safe to predict that students are more likely to follow the trend these textbooks are transmitting – women are in subsidiary jobs instead of those considered as 'hardcore'. Consequently, these 'false' materials indirectly but essentially cut the number of girls entering STEM fields.

Meanwhile, the scholastic environment also plays a key role in students' decisions. Globally, the majority of junior schools are exoteric on elective courses, which tend to be advanced that are required more complicated and advanced knowledge, including psychology, chemistry and economics. These disciplines are designed to widen students' knowledge base and arouse their interest in future majors and occupations. In fact, the pre-college or pre-career setting and experiences are quite determinant in students' choice of majors. However, when taking a glance at STEM-related subjects, the 'inimical' climate in many STEM disciplines is still actively remnant. This is operationalized as any form of unwelcoming to girl students in high school, college and other academic circumstances. Some examples can refer to scholastic attitude, lesson settings and classmates' interactions. According to findings in 2014, throughout high school and college, typical gender disparities in academic performance in the subjects of science or mathematics are insignificant or tend to benefit female students. Nonetheless, greater significant gender disparities in the beliefs of science and mathematics competence on average have been detected throughout high school and university [6]. This can be ascribed to several factors, one of them being the deficiency of role models due to biological commonalities; teenagers are more prone to imitate or pursue role models of identical gender as theirs. However, in STEM disciplines, it is seemly fewer women models compared with men. Firstly, by examining the history of scientific subjects, there are only a handful of women scientists or celebrities in the STEM field, compared with numerous male counterparts. Taking a glance at one ordinary college, the University of Valencia (UVEG) and the School of Engineering at the University of Valencia(ETSE-UV), there were only 28.13% female full professors in UVEG and 16.67% female professors in ETSE-UV [7]. STEM field in modernized college is still illustrating women as minority groups. At the same time, young women were more susceptible to the presence of role models as their behaviour seemed to be more reflective of the demands and requests of others [8]. This shortage of role models not only reduces girls' chances of peering onto their outstanding predecessors but induces female students to question women's capability in STEM, subsequently shrinking women's self-approval and beliefs. Eventually, some may not want to take risks to step into the STEM field. A higher percentage of women math and science teachers correlated with a significant amount in the chances of declaring physical sciences, engineering or mathematics as a major. It appears to motivate more girls to elect a STEM major at a 10% significance in both biology and PSEM [8]. The most pivotal influence is rooted in girls' minds, where they do not view themselves as scientists or engineers and, naturally, do not prefer a STEM profession. An explicit and positive relationship is displayed between women models and the likelihood of girls' preference in STEM fields.

Another potential thesis that can impair girls' participation in STEM courses can be the fact that there has already been a higher percentage of boys peers within the subject courses. The theory mentioned before in the role models can also be applied in class, where students tend to interact more

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frequently with those of the same sex as theirs. This means, in the male-dominated STEM subjects, a higher male attendance indicates enhanced difficulties for girls to socialize and meet their accompanier. The state of being 'surrounded' and interacting with male peers steadily undermine girls' determination and level of confidence. In a 2016 research, female students are greatly impacted by losing their sense of belonging and lowering academic self-concept, attributed to male-dominant peers in STEM [9]. Under the effect of such situational factors, it is reasonable to foresee fewer girls picking or retaining STEM-related courses.

3. Embodiment in Family Conception

In China, it is widely believed that boys are the one fit in science subjects and girls should pick art subjects. This can attribute to the nature of Chinese traditional societal norms towards the two genders; that is, women are the ones who should hold qualities such as sentimental, caring and maternal. In other words, their roles in society tend to be childbearing, enduring and caring. The suppression of matriarchal representation can already be seen in the early writing "The second gender" by Simone de Beauvoir, 'Women are shut up in a kitchen or in a boudoir, and astonishment is expressed that her horizon is limited. Her wings are clipped, and it is found deplorable that she cannot fly. She will not have to continue to dwell in the present if only the future is made accessible to her.' The nature of helpless and inferiority of women that the author wants to deplore demonstrates a persistent trend of gender bias.

When this conceptualization maps onto the job markets, the categorization of employment differentiates to a large scale between the two genders. Men are the one who is rational and sturdy that ought to overtake the responsibility in any circumstance, in particular with an emergency. Thus, there is no wonder why mechanical and engineering occupations that 'seemly' relate to body strength and logic match up with male figures. Adversely, women possess a tender and delicate trait, which is generally recognized as a flimsy and dependent figure. These made the gender more inclined to those of domestic and services jobs, a huge contrast with STEM careers. Society is 'expecting' boys and girls to behave in a certain mode and become certain roles, eliminating students' driving force or even liberty to pick courses regardless of their personal interests. Under the manipulation of such norms, the public completely ignores some population groups, including both men and women - boys passionate about nursery or girls interested in programming.

One of the most 'firsthand' embodiments is within the family, as parents in the older generation are more prone to feudal views, pursuing those traditional and out-of-date perceptions. This is especially true when parents find out their children are choosing courses/subjects they perceive as 'improper' or 'meaningless', the usage of imperative wording like 'there is no point for a girl to be an engineer! It would be best if you changed your major!' It definitely acts as an obstruction when students contemplate their final decision. Historically, precedent studies have claimed that parents relatively distrust their girls' mathematical capabilities more than their boys, directing daughters to stereotype mathematics as a 'for-man-to-do' discipline [9].

Taking an extremity, the family relationship, especially that between parents and their children, can be completely torn up, and the student's life can be ruined. Nonetheless, as teenagers still hold a relatively strong dependency on parents and family, the most probable outcome is that girls give up the idea of choosing a science subject, even though it is the discipline they prefer the most or receive the highest grade. According to one 2017 paper, if parents think their children are incapable of the STEM context, they may intervene and operate intrusive instruction with negative impacts on children's self-reflection [10]. Thus, it can be concluded that it is relatively easy for parents to achieve their aim of altering their children's choices. By wielding their empowerment and rights, parents' acknowledgement and expectations towards a child can even determine a child's perception towards

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themselves. Familial nonsupport can exert tremendous pressure and opposition on relatively immature students ——— one of the fontal reasons behind the trend.

4. Solid Prejudice Within the Job Market

The inferior treatment and measures in the workplace towards women is the third cardinal aspect this essay is going to discuss. The whole argument will be analyzed in three facets: elaborate, interrelationship and measurements in the workplace. Generally, people pick courses that are concordant with their potential future occupation, as well as personal passion towards the courses. However, the overall unfair 'vogue' in the workplace that disfavour female have discouraged girls from entering the field to a large extent. These are some pieces of evidence that reflect current inequality in STEM circumstances. According to Maria Temming, women typically earn less than men, in particular to those Black and Hispanic - both races had $57,000 as their earnings in 2017-2019. In contrast, Asian men held $103,300, and White men held $90,600 in the same time period [2]. Out of doubt, salaries and wages paid are the overarching indicators when people evaluate a job. A positive correlation can always be seen between the two variables - salaries and ardour towards the occupation. Given this case, it is more prone for male workers to look down on female workers. This further strengthens the prevailing impression of stereotypically masculine traits in STEM employment: Men are seemly advantageous compared to women. Nevertheless, such an apparent income gap in STEM fields between genders definitely lessens women's willingness to consider STEM for their potential careers. To a micro level, such degraded payment means demotivated working experiences, leading to a decline in job-related happiness and efficiency at work. On a macro-level, the STEM field will continue to hold an increasing trend of sex disproportionation, resulting in a relatively unhealthy environment where female workers are recognized as a 'scarce resource' in the workplace.

Moreover, Sexual harassment is another form of discrimination that women suffer from. These miserable experiences can establish severe mental stress on victims, and as such erotic comments or words can exert various negative emotions. According to Leaper and Starr, sexual harassment refers to unwanted sexual behaviours, which in an academic context may create a negative environment that broadly undermines women's motivation. In the study, 21.9% of women never reported having experienced sexual harassment [11]. As for further reinforcement, at least half of the female population in STEM academics report experiencing sexual harassment, and even more females in male-dominated STM workplaces report experiencing gender-based discrimination [12]. Consequently, women are more susceptible to negative emotions, even the inducement of psychological disorders. According to Alicen Ricard, 7.2% of women in life-physical-social sciences reported at least one bout of depression in the year the study was performed versus 2.3% of men. 11.1% of women reported depression in engineering-architecture-surveying versus 3.3% of men. In mathematics and computer science, 10.4% of women reported versus 4.6% of men [13]. Such abnormal distribution displays an obvious phenomenon that women suffer from reduced mental health. In some extreme scenarios, psychological disorders or other types of harm can be induced in women, and all these acts act as deterrence that prevents women from entering the industries. There is no wonder why STEM career aspirations witnessed a downgrade.

That is how women are ostracized by means of social interactions, while some discrimination can also come towards their biological characteristics. Certain conditions during recruitment in STEM faculties disadvantage the female population. In China, most Human Resources recruiters, when seeing women employees, will always check their pregnancy, especially in STEM fields that require a large amount of input energy and time. How humiliated or furious will a woman be by the time she has been asked such a violating question in the career that she pursued her whole academic life? Such acts severely insult female workers, particularly within the male-dominated STEM field. Although

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such behaviour is illegal in the majority of other parts worldwide, the executive suite and other officials may have some discussions on the sly about female employers' future planning schemes. In extreme cases, staff may sneak into women's social media or other apps to collect out-work information! Under the effects of such abominable cases, it is rational that women are driven away from these unfriendly circumstances towards them.

5. Some Potential Solutions

Until this point, there are traces to follow and prove that the pessimistic environment within STEM subjects might witness an enlarging gender gap. It is crucial to address some changes in the phenomena by means of policies. For some impactful measurements that can be established, the government should be considered as one of the paramount agencies. The authority and authenticity of the institution could ensure the sufficiency of resources required and the role of a permanent regulator. The first arena where the regulations should cover is education. A prior study in 2006 states that classroom signs of a non-inclusive climate can obstruct girls from exploring certain regions of interest. An increased proportion of women educators in science and mathematics subjects gives pupils the perception of a more 'feminine' approach to STEM areas. This helps to counteract the entrenched belief that STEM fields are dominated by men [8]. It could be seen as a vehicle to relieve women's concerns and improve their impression towards STEM. By adjusting the ratio of women and men teachers within this subject, more female paradigms can be constructed for students to admire and compare. As to the previous proof, girls are more susceptible to female models, and so increases their interaction. Typically, a more intimate relationship can be built between teachers and students, proliferating the likelihood that students can seek comfort and assistance from their coaches. Therefore, it is highly potential for female students to gain more belongingness within STEM subjects.

Out of doubt, educational institutions such as schools and Education Bureau are ultimately the ones who implement these policies. Some other strategies may come into effect in countering one issue being raised beforehand with self-efficacy can also be focused on socialization within the classes and on campus. Firstly, the bureau can accordingly hold extracurricular activities that surround the theme of STEM on girls, arousing their interest in participating STEM domain, especially for those of early education. Secondly, more prudent censorship of learning materials of both inner-school and outer school is crucial. Gender biased portrays, texts and contents should be immediately eliminated by means of withdrawal, rectification and republishing. Related government faculties should act as a regulator of the market to prevent any inappropriate information from flowing into the book market. Thirdly, schools should restructure their academic climate in STEM majors, forbidding any forms of discrimination towards the women population, and so concordant punishment should be devised. This can include a deduction in credits, referral comments or reference on the transcript. Through such strategies, it is probable to encourage more females into the subjects.

Within the dimension of working space, the government and firms should collaborate together to prevent unfair treatment towards women in STEM occupations. This is especially true for those most appealing and obvious factors - treatment and salary. Starting with treatment, in order to shorten the gender gap and reach a gender balance, it is essential to display women in an appealing environment, including adequate conditions and mild interaction. Identically, to fulfil the aim of gender bias, female employers should be recognized to the same standard as their male counterparts, that is, banning any sexual jokes and harassment. Heavy penalties should be imposed to ensure that such protection is solid, such as large fines and records in profile.

Another point that needs to be minimized is pregnancy. There are laws about the issue in many nations - such discussion is illegal. However, private chats should also inhibit, and firms should encourage their employers to report those violators. Meanwhile, shortening the range of salary between different genders should also be an aim set to achieve. Females in STEM, compared with

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males, should receive more subsidies from whatever government or companies as an incentive to take their careers. This can include extra maternity leave, higher rates of allowance and commission, and other welfare benefits. Beyond this, mental support also be subsidized for female students. STEM institutions should provide concordant services to female workers, such as regularly surveying women's job happiness and satisfaction and collecting feedback if any unfairness exists. To conclude, a reduction in biased experiences between genders should first be implemented to attract and absorb more women into STEM domains.

6. Conclusions

Overall, there are diversified contributors to the phenomena of gender bias in the STEM field: educational, familial and occupational. The education system displayed its significant flaw in textbooks and failing academic climate, including a lack of role models and academic protection from discrimination. Another non-negligible factor is embedded in the family, which has been solidified by societal norms and expectations towards a specific gender, as well as traditional perspectives from the parental generation. As for the broadest facet, gender bias in the workplace imposed its essentiality mainly on unfair treatment toward women. Initiated with in proportional salary compared with males, sexual harassment also plays a cardinal role in deterrence, particularly to girls in their academic careers when choosing majors or job orientation. Nonetheless, such rooted factors could be alleviated through several measurements, including the provision of extracurricular classes related to STEM, enrollment of more female tutors and hardened regulation towards learning materials. This applied the same impacts on a workplace where support is in multiple forms, such as financial and physical. Mental subsidies such as maternity and harassment prevention could also be settled. Several populations may find this essay useful: girls students, educators and policymakers, women workers in the STEM field and any other female that perceived themselves as under suppression. Starting with students, those who attempted to have STEM as their future major or career may want to develop a more holistic overview of their decision. The analysis of copious levels of reasons could help them gain a deeper insight into the current status of the disciplines, easing the decision-making process. Moving onto education, it is also worthy for officials in Education Bureau to obtain a fair view of potential issues that exist in the system, which means effective measures could be administrated, while some had already mentioned in the previous section.

However, there are still inevitable flaws presented. The essay barely mentioned effective resolutions to societal norms, as the author perceived this should be considered as a stemming reason that cannot be achieved in the short-term; the most probable outcome might be another feminist revolution addressing the issue. What is more, the analysis of the educational system and workplace can not be recognized as perfectly holistic; that is, there might be other hidden factors that indirectly prompt gender bias towards women. While the paper does provide an in-depth overview of different dimensions and brings up several constructive improvements that hold feasibility, it also guides future research onto specific orientations; the first one should be the social aspect that is a deficit in this research, how to alter the public's thoughts on specific thoughts, especially in developing countries who are seemly more opposing such changes. Furthermore, a more detailed dissection of familial impact can also be carried out, as some implicit reasons can not be directly seen. The ultimate restriction of this essay is the negligence of minor reasons, as it aims to present some most representative reasons. One niche reason includes personality deficits of individuals, as some employers may be particularly hostile to females, which this essay has not discussed, which could be one of the future approaches.

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