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Examining the Impact of Gender Bias and Stereotypes on Women's Participation and Advancement in Technological Fields

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ABSTRACT

This study tries to uncover the primary causes of gender discrepancies in the expanding tech industry through a thorough assessment of the literature, qualitative analysis of prior research, and survey data. These factors can range from structural injustices and lack of mentorship to social biases and cultural ethos. It also adds to the continuing conversation about women in technology by highlighting challenges as well as opportunities. It also offers guidance to industry executives and legislators who are working to build a more diverse and inclusive digital sector.

Keywords: *Women in tech, gender disparities, IT sector, glass ceiling, women participation, social stereotype.*

I. INTRODUCTION

Even since the nineties India has started emerging as an IT core. That witnessed a huge growth due to the liberalization of government policies concerning the software industry. The technology sector has proven to be a particularly challenging environment for women holding jobs requiring computing and engineering skills, and it has been highlighted that women are passed over for promotions and paid less for equal work. Due to the limited number of women in the tech industry, women are being deprived of well-paid careers. It is unfortunate that despite all the appreciable efforts of the government to achieve equalization of educational opportunities there still exist noticeable disparities in educational attainment in terms of gender in technical education. There are many reasons why women tend to avoid technological fields, including societal beliefs and the learning environment that tends to limit female interest in science and bias limiting women's progress in the scientific and engineering fields. Gender disparity in tech fields in India is a significant issue, as it is in many parts of the world. It continues to be a challenge even after repetitively highlighting the issue.

Research Questions

1. Why women are underrepresented in tech-related fields such as computer science, engineering, and information technology?
2. Can Gender stereotypes and bias deter women from pursuing careers in tech?
3. Is underrepresentation starting at the educational level, with fewer women pursuing STEM degrees?
4. Why is there often a gender pay gap where women are paid less than their male peers for similar work?
5. Why are issues such as workplace harassment, and discrimination frequent in some tech companies and hinder women's career advancement?
6. In what ways can these factors, including discouragement from family and unconscious bias hinder activities like hiring and promotion?
7. How does the demanding nature of tech jobs, make it challenging for women to balance their work and family responsibilities?

II. LITERATURE SURVEY

Zhang, Y., Gros, T., & Mao, E. (2021) examined the gender disparity in students' choices of IT majors. After conducting a few tests, results support their theory that female students are statistically less likely to choose CIS than their male peers, female students did change their majors more often. They decided that Female students tend to avoid IT majors; they think they will not be able to do them. But, such an assumption is not true. Their findings provide strategies for university and high school administration to be more active in developing drafting strategies to attract and retain female CIS students. At an early age, girls in general have less confidence in technology and perceive the field as male-dominant. Young (2000) used 462 middle and high school students as subjects to investigate gender differences in computer attitudes. Five aspects have been examined: confidence, perception of computers as a male domain, positive teacher attitudes, negative teacher attitudes, and perceived usefulness of computers. Survey results show that the main gender differences are greater confidence among boys, and the perception of computers as a male domain is prevalent among boys.
Whittington, K. B., & Smith-Doerr, L. (2008), examine how variation in gender differences in scientists' commercial productivity. Data from a sample of academic and industrial life scientists working in the US. The data show that by monitoring career and education, women are less likely to clear than men. However, in many firms—industrial settings characterized by sweet-talk, more flexible, women scientists are more likely to become patent-holding inventors than in more hierarchically arranged situations in industry or academics.

Drawing on the insights from previous research allows us to unpack the main reasons why there is a dramatic gender imbalance as females are underrepresented in the subject of computer science. The research was undertaken at a British University and focused on the Faculty of Technology and Environment. The content highlights the discouraging figures regarding the underrepresentation of females in computer science and reveals the significance of promoting successful female role models in the field. It also highlights the importance of expelling the negative stereotypical images related to the discipline and discusses the barriers females face entering the field as well as the benefits they will come across. To conclude the thesis proposes a set of recommendations that universities could adopt to help them with the recruitment and retention of female students.

Concept of glass ceiling

Studies have interpreted the glass ceiling as reflecting internal promotion biases, with rare exceptions. Hussain, et al contend that external hiring and recruitment procedures may also contribute to glass ceiling trends. Utilizing information on individuals who apply online for employment at 441 small- and medium-sized high-tech companies, they discover proof that the hiring practices used by both internal and external parties contribute to the glass ceiling. Women are classified into lower-level employment queues than men on the supply side. Although there are clear demand-side screening biases against women, a number of "what if" simulations indicate that these processes are not as important in creating the glass ceiling pattern as they may seem. These findings imply that bias correction measures
It investigated how women's decisions to leave computing and technology occupations were influenced by their perceptions of gender inequality(Hussain et al 2015).

Six American women who had left or were thinking about leaving computing-related employment because of perceived gender imbalance provided information via SurveyMonkey. Three main ideas emerged from this qualitative, transcendental phenomenological study: a) my skill is in doubt, b) men are more valuable, and c) I'm an outsider. The data also revealed two other, smaller themes: (d) pledges are broken, and (e) I have to stand up for myself. These results imply that women working in technology may still believe there is a gender gap, which could influence their decision to quit and look for opportunities outside of the field of computers and technology.

Women's participation in numbers

Women make up only 25% of employees in tech industries (e.g. computer science jobs, information technology, etc.). One possible explanation for this difference is that hiring decisions are made based on perceptions of cultural fit or similarity between the employer and the applicant. In previous research, we found no difference in hiring intentions between male and female candidates but did suggest that male candidates are better suited to corporate environments than female candidates. The current study explores whether perceptions of cultural fit depend in part on candidate stereotypes and whether men are a better fit for computer science environments even when women share the same interests and appearance. In our study, students were asked to imagine they were recruiting an applicant for a technology company Participants then answered questions that assessed the candidate's suitability for the company environment and hiring intentions. We hypothesize that typical candidates are better suited to the corporate environment and are more likely to be hired than atypical candidates. We also hypothesized that, while stereotypical female candidates would be more suitable than non-stereotypical female candidates, they would be less suitable and less likely to be hired than stereotypical male candidates. This suggests that common stereotypes about candidates hinder the hiring of atypical candidates, potentially discouraging women from entering the industry.

Decisions to leave IT

Fernandez, et al examined the impact of gender inequality on women's decisions to leave the IT and technology industries. SurveyMonkey was used to collect data from six women in the United States who had left or were considering leaving computing-related jobs due to gender inequality. This qualitative, a priori phenomenological study revealed three themes: a) my abilities are questioned, b) men are more valuable, and c) I am an outsider. Other but smaller themes that emerged from the data were d) commitments were broken and (e) I had to defend myself. These findings suggest that women in the tech industry may continue to

recognize gender inequalities that influence their decision to exit and seek opportunities outside the computing and technology industries, putting pressure on the industry's already depleted labor pool. However, analyzing data from only six participants limits the potential for generalization to the larger group of women working in technology.

Personal Experiences

Over the past three decades, the number of women participating in technology-related educational and career opportunities has steadily declined, leaving women only a small portion of the technology industry. Although this downward trend has been thoroughly researched and published, why there is a gender gap in technology is less clear. To better understand why women are underrepresented in technology, an anonymous survey collected raw data from nearly 150 Eastern Kentucky University Jensen, C. K. (2018). The Essence of Experiencing Gender Disparity by Women in Tech (Doctoral dissertation, The University of the Rockies), students, and the results are analyzed and discussed for this project. The project also discusses the facts about gender inequality in technology, possible causes of the gender gap, the consequences of a lack of gender equality in the technology industry, and possible solutions that educators and society can apply to help increase gender equality. Women in technology. This study relies heavily on empirical evidence rather than conjecture and aims to present the research conducted understandably and convincingly. While the raw data used in this project provides insight into students' perceptions of gender inequality in technology, it is not conclusive and could be enriched by further research. This problem of internal gender inequality the field of technology is of great importance, and as technology becomes increasingly prevalent in today's world, a lack of gender parity within the tech industry affects all people whose lives are influenced by technology.

Concerning gender diversity, the IT industry faces both a challenge and an opportunity

As in many other disciplines, women are underrepresented in the leadership of the technology sector. However, this situation also presents an opportunity: tech companies that can expand their ranks of female executives stand to gain significantly. It is critical to promote and support more women and girls to enter STEM sectors for the sake of global economies and the global transition to sustainability. There were many ways in which technological advancements aided women's capability and resource development. Women's adoption, usage, and pervasiveness of ICTs span the broad areas of outreach, education, lifestyle, prevention, health challenges, and perceptions of barriers.

SN	Author/s	Year	Topic	Objective	Method	Study Area	Reference
1	Bloodhart B, Balgopal MM, Casper AMA, Sample McMeeking LB, Fischer EV	2020	Outperforming yet undervalued: Undergraduate women in STEM	1) the recognition of women's achievements among their peers in undergraduate education and 2) the retention of women in STEM disciplines and careers.	Survey Based: Students from a large, western U.S. university who were enrolled in nine STEM undergraduate courses were invited by their instructors to participate in a study about perceptions of classroom experiences. Perceptions of other students. Gender of participants and classmates. Academic performance.	US	PLoS ONE 15(6): e0234685. https://doi.org/10.1371/journal.pone.0234685

2	Heidi Black burn	2017	The Status of Women in STEM in Higher Education	It focuses on areas of recruitment, retention, barriers, and faculty issues. Stereotypes, biases, campus culture, classroom experiences, identity, and sense of belonging are also explored.	In recent years, the spotlight on STEM education (pre-school through higher education) has given rise to hundreds of studies ranging from the recruitment and retention of women students to the workplace climate of women faculty and staff Government support for STEM Implications for librarians	US	Heidi Blackburn (2017) The Status of Women in STEM in Higher Education: A Review of the Literature 2007–2017, Science & Technology Libraries, 36: 3, 235-273, DOI: 10.1080/0194262X.2017.1371658
3	Mia Steinberg, Amanda B. Diekman	2015	New Routes to Recruiting and Retaining Women in STEM.	examine particular recommendations for policy actions that might broaden the participation of women and girls, and communally oriented people generally, in STEM.		US	https://doi.org/10.1111/sipr.12010
4	Catherine Mavriplis [1], Rachelle Heller [2], Cheryl Beil [3], Kim Dam [4], Natalya Yassinskaya [5], Megan Shaw [6], Charlene Sorensen [7]	2010	Mind the Gap: Women in STEM Career Breaks	qualitative exploratory study based on structured interviews with 15 women who have taken career breaks after receiving their science, technology, engineering or mathematics (STEM) PhD, but wish to re-enter the academic career track.	Procedures & Subjects	US	http://dx.doi.org/10.4067/S0718-27242010000100011

5	Yonghong Xu	2016	Focusing on Women in STEM: A Longitudinal Examination of Gender-Based Earning Gap of College Graduates	To increase the representation of women in STEM fields, interventions are called for to encourage a family-friendly workplace that is open to and supportive of women managing a home and career			
6	Laura McCullough	2020	Proportions of Women in STEM Leadership in the Academy in the USA	women held fewer leadership positions than the proportion of female PhDs in those fields. The proportion of women in non-STEM specific top academic leadership roles was also examined to see what proportion of those individuals leading academic institutions might have background in a STEM discipline and how that compares to men in the same positions.			
7	Bettina J. Casad, Jillian E. Franks, Christina E. Garasky, Melinda M. Kittleman, Alanna C. Roesler, Deidre Y. Hall, Zachary W. Petzel	2020	Gender inequality in academia: Problems and solutions for women faculty in STEM	the following three factors that likely contribute to gender inequalities and women's departure from academic STEM fields: (a) numeric underrepresentation and stereotypes, (b) lack of supportive social networks, and (c) chilly academic climates. We discuss potential solutions for these problems, focusing on National Science Foundation-funded ADVANCE organizational change interventions that target (a) recruiting diverse applicants (e.g., training search committees), (b) mentoring,		US	

				networking, and professional development (e.g., promoting women faculty networks); and (c) improving academic climate (e.g., educating male faculty on gender bias).			
8.	David N. Beede Tiffany A. Julian David Langdon George McKittrick Beethika Khan Mark E. Doms	2011	There are many possible factors contributing to the discrepancy of women and men in STEM jobs, including: a lack of female role models, gender stereotyping, and less family-friendly flexibility in the STEM fields. Regardless of the causes, the findings of this report provide evidence of a need to encourage and support women in STEM.				
10.	Alexandra Garr-Schultz	2018	Strategic Self-Presentation of Women in STEM	we investigate women's potential response strategies to the well-documented tension between female and STEM attributes in terms of individual self-presentation.	Study Impression Goals		
11.	Xuan Jiang	2020	Women in STEM: Ability, Preference, and Value	Women are underrepresented in both STEM college majors and STEM jobs. Even with a STEM college degree, women are significantly less likely to work in STEM occupations than their male counterparts. the gen−der gap in stem occupations cannot be explained by the gender differencesin ability or ability sorting. instead, a part of the gender gap in stem oc−cupations can be explained			

				by the fact that women are more representedin less math−intensive stem majors and graduates from those majors aremore			
12.	Elena Makarova1* Belinda Aeschlimann 2 Walter Herzog3	2019	The Gender Gap in STEM Fields: The Impact of the Gender Stereotype of Math and Science on Secondary Students' Career Aspirations	gender-science stereotypes of math and science can potentially influence young women's and men's aspirations to enroll in a STEM major at university by showing that a less pronounced masculine image of science has the potential to increase the likelihood of STEM career aspirations.	Accordingly, the low proportion of women in STEM leads to the spread of a gender stereotypical image of math and science as a male domain and beliefs about male supremacy in technical and math-intensive fields. In turn, such beliefs affect young people's career choices, leading to a mutual reinforcement of gender stereotypes, and gender gaps in career related interests and choices	US	https://doi.org/10.3389/feduc.2019.00060
13.	Abrar Ahmad1 and Dr. M. A. Sikanda	2022	Advancing Participation of Women in STEM Courses in the Higher Educational Institutions in India	The higher enrolment ratio of women enhances their living standards as well as decision-making powers in the society. While there is an increasing trend of enrolment of female students in STEM (Science, Technology, Engineering and Mathematics) courses are seen in India for the last few years, their participation in the workforce remains low.	Female deprived from education means discrimination against them and subsequently their alienation from the participation in the processes of development. Education has been considered as a strong agent of social change also at individual as well as at societal level. Significance of STEM courses Encouraging Participation of Women in STEM Courses in India	India	https://www.ciir.in

					All India Survey on Higher Education Reports		

III. METHODOLOGY

This research is based on qualitative study as it is suitable for exploring the experiences of women in the tech industry. There is a need for us to understand the gap that is there in stem and tech fields.
Thus, this research is being conducted to find the different reasons women are underrepresented in tech fields and their solutions.

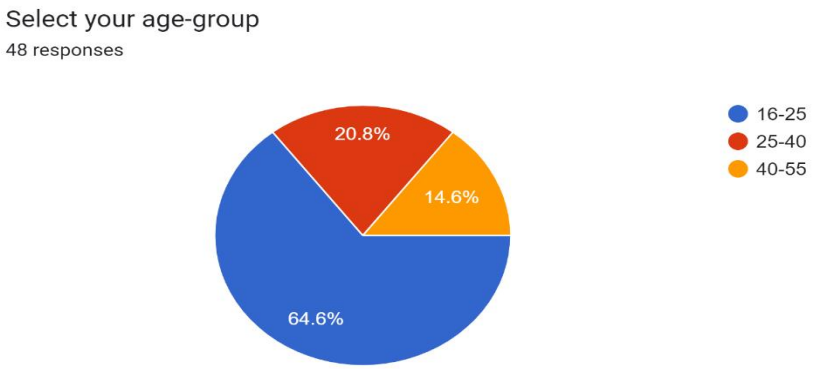
To begin with, around 50 responses were collected by a survey on the Impact of Gender Bias and Stereotypes on Women's Participation and Advancement in Technological Fields. We got responses from women of varied age groups from 16-25, 25-40, and 40-55. In this survey, we asked questions that would make it easier for us to understand the current situation of the gender ratio gap in tech fields, the problems faced by women in these sectors, and how those issues can be solved according to them. It was a transformative initiative aimed at understanding the struggles of Women in STEM. This survey was designed to capture the thoughts on the awareness, effectiveness, and potential challenges and opportunities associated with this initiative.

Social media is a big savior nowadays, and that's how we were able to get our responses and understand other perspectives that too from different age groups. We could also do better data analysis as we used member checking by taking in the email IDs of the ones who filled out the survey.

The questions asked were -:

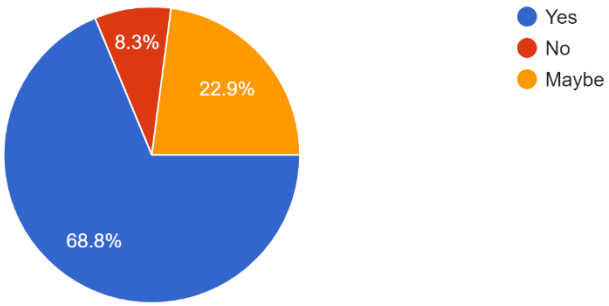
1. Do you think women are underrepresented in tech fields?
2. Do you think the lack of representation of women in leadership roles has an impact on younger generations of female professionals?
3. Do you think gender stereotypical opinions exist in society?
4. What initiatives do you feel should be implemented to break down gender stereotypical opinions?
5. Which of the following challenges do you think most women face in companies?
6. Do you perceive issues such as workplace discrimination are frequent in corporate sectors?
7. Which of the following impacts do you think the lack of representation of women in leadership roles in technology companies has on younger generations of female professionals?
8. Do you think some biases deter women from pursuing careers in tech?
9. What do you suggest to encourage more women to pursue STEM careers?
10. Do you feel mentorship and support networks help overcome the challenges imposed by gender biases in technological fields?
11. Do you think skill development can provide valuable guidance on navigating the complexities of a technological career?

IV. RESULTS AND DISCUSSION



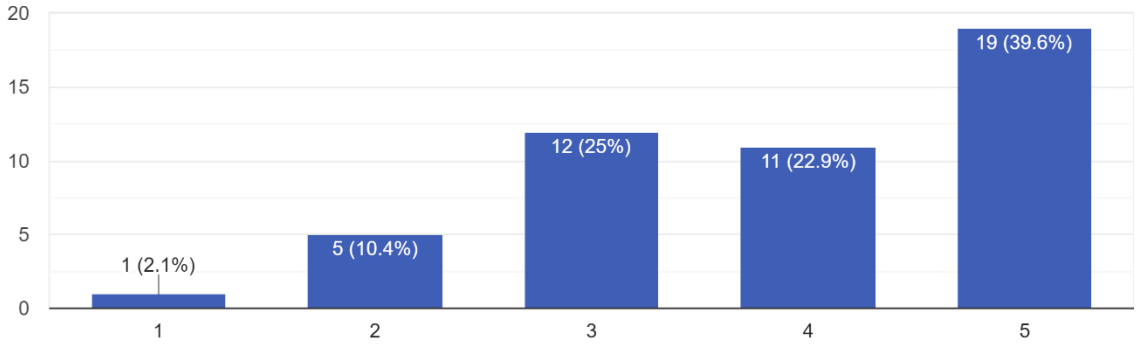
Do you think women are underrepresented in tech fields?

48 responses



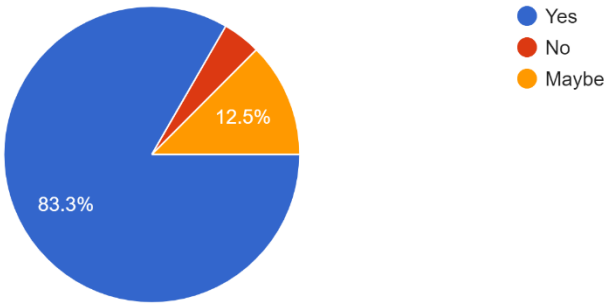
Do you think the lack of representation of women in leadership roles has an impact on younger generations of female professionals? (1-lowest) (5-highest)

48 responses



Do you think gender stereotypical opinions exist in society?

48 responses

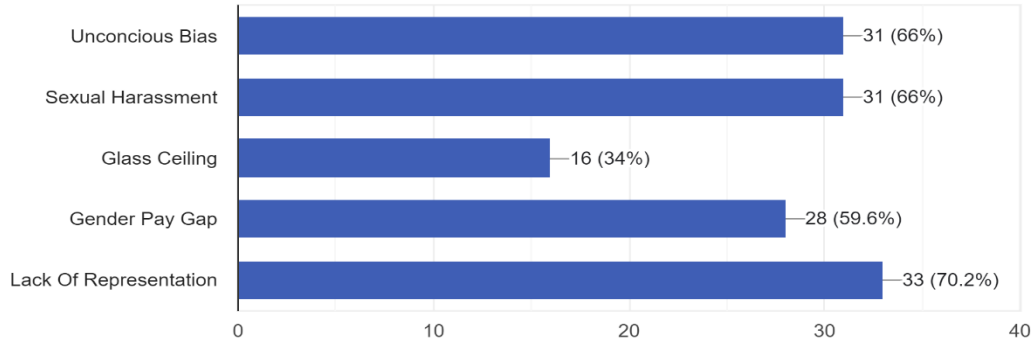


What initiatives do you feel should be implemented to break down gender stereotypical opinions

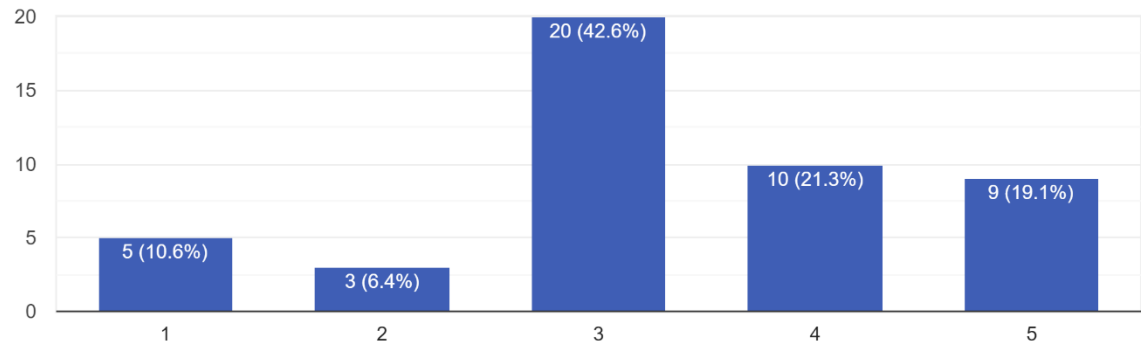
1.Allow women to lead more
2.Equal opportunities in education and employment
3.Career should be compulsory for both gender

4.Women need to be there at higher levels as a policy.
5.Ensure equal opportunities for both the genders on all fronts be it social or workplace related. Such opinions can't be tackled completely by organisations or related institutions, it really has to start from the most ground root level, family.
6.Empowerment and trust in their thought process and elevations professionally & personally as they are as bright & intelligent as men. In fact comparing should not exist at all.
7.Giving equal opportunities, equal pay
8.Raise awareness
9. Awareness programmes
•Financial assistance to weaker sections
•Career counselling
•Reducing gender gap at workplaces
10. Raising awareness about it! Having those conversations starting with your family and starting small :)
11. Large scale gradual but structural changes in educational system, and promotion of truly feminist pop culture
12. I think there should me more strict workplace policies
13. More representation in media. more people speaking about the issues.
14. Enabling social media campaigns about treating men and women as equals by producing content that shows this in a humorous way
15.Make girls educated who knows about her constitutional rights
16.Start at home by respecting women
17.Equal treatment in all aspects of life - choice of education, life partners, jobs, children
18.Reservation in all schools, jobs, parliament, government of 50% for the next 25 years.
19.Equality, treating them as our own
20.Gender Sensitivity Workshops
21.Well I do think that start from one family's viewpoint as we could focus on more on values we give during schooling it would be more impactful
22.Educating the society through various programs.
23.People are usually exposed to feminist literature and theories at a college level only. There should be an introduction to it from High School onwards, with clear examples of the impact that gender stereotypical opinions have on the real-world.
24.There is a certain line that simply divides people in two binary groups and then builds an entire social structure around the domination of one over the other. one step that should be taken is to remove this binary view of gender so that we view people as people and not as a specific gender which reduces the ableist attitude towards the other.
25.Children should be taught equality
26.One should be aware of sexism and one should think laterally
27.Gender stereotypical opinions should not be encouraged
28.More representation, diverse hiring , gender sensitization in schools
29.Probably could start with educating parents or would-be parents of kids to make sure they don't force or indoctrinate their daughters, or any child in general, to just do a particular thing that they (the parents) want. Teach them that their daughters aren't there just to help around with the household or raise their brothers when the parents aren't around. They are their own human beings with dreams and ambitions and aspirations, which should be encouraged. The parents should be taught and know that their children will be emotional at certain points and teaching one of them to hold it back in because that's not a "manly" thing to do, or mock the other because they are a girl, is an extremely dangerous act to do. Telling them that colors, toys, clothes, etc aren't supposed to be gendered and shouldn't be treated as such.
30.Also try to educate the already existing population on how their misinformed "knowledge" on how a certain trait or a certain job is "for men" or "for women" can be harmful and is prejudiced in it's notion, which very commonly holds back women, men and non-binary folks alike while trying to enter a certain field, or while just trying to exist in a way that is different from the established cisheteronormative world around them.
31.More diversity hiring, more encouragement workshops
32.More awareness to male counterparts and steps to increase female workforce participation at workplaces
33.I believe that education and awareness are key in breaking down gender stereotypical opinions. It is important to start by educating both men and women about the negative impact of gender stereotypes and how they limit our potential as individuals and as a society. This can be done through school curriculums, workplace training, and public awareness campaigns.
34.It is also important to challenge gender stereotypes in media and popular culture. This means promoting diverse representations of gender roles in movies, TV shows, and advertisements. We need to encourage more women in leadership positions and promote gender equality in the workplace.
35.In addition, we need to provide support and resources for individuals who are affected by gender stereotypes. This means creating safe spaces for people to talk about their experiences and providing access to counselling and other support services.
36.Finally, we need to encourage and celebrate individuals who challenge gender stereotypes and promote gender equality. This means recognizing and rewarding individuals who promote diversity and inclusion and encouraging others to follow their lead.

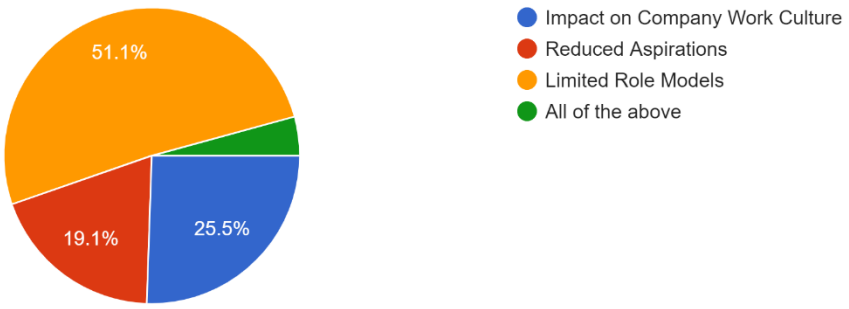
Which of the following challenges do you think most women face in companies ?
47 responses

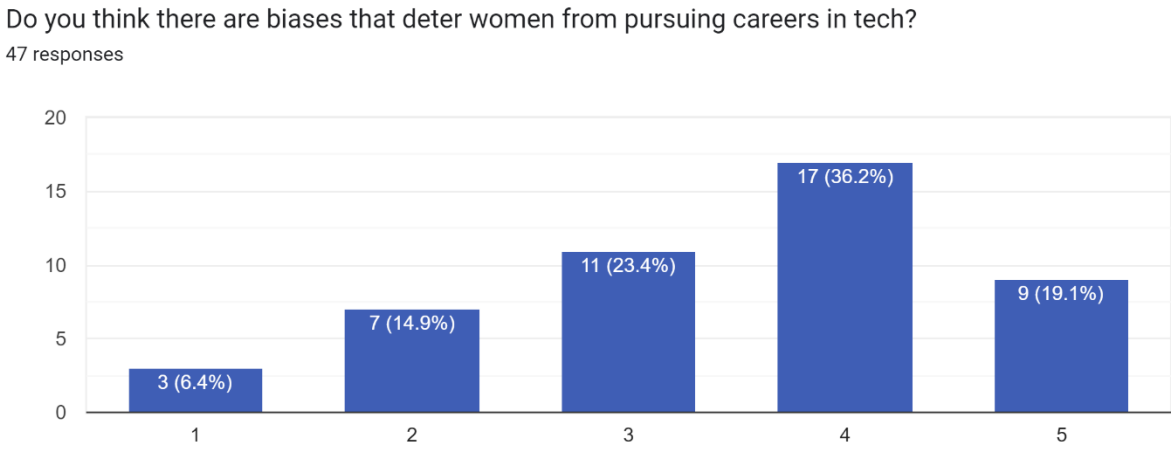


Do you perceive issues such as workplace discrimination are frequent in corporate sectors?
47 responses



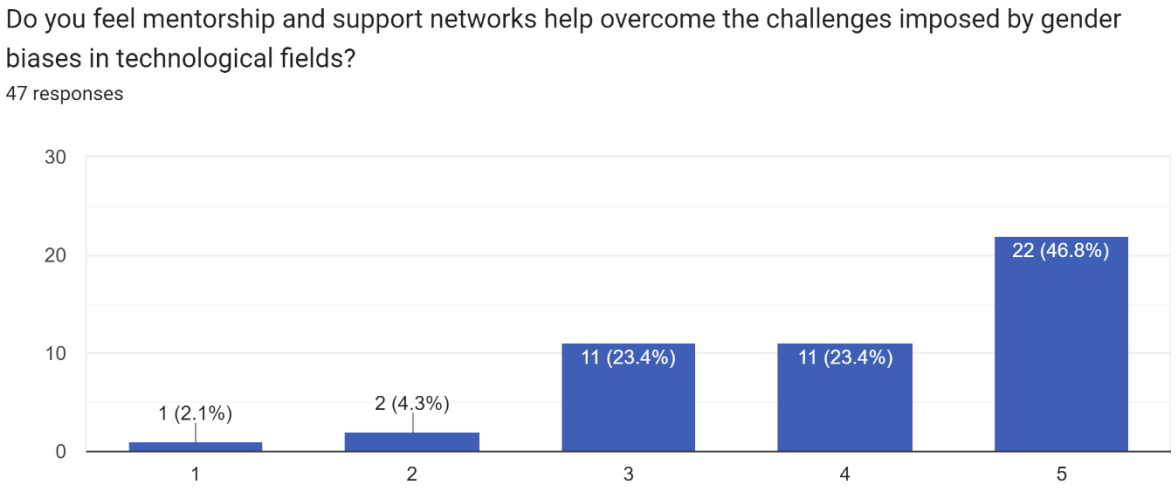
Which of the following impacts do you think the lack of representation of women in leadership roles in technology companies has on younger generations of female professionals?
47 responses

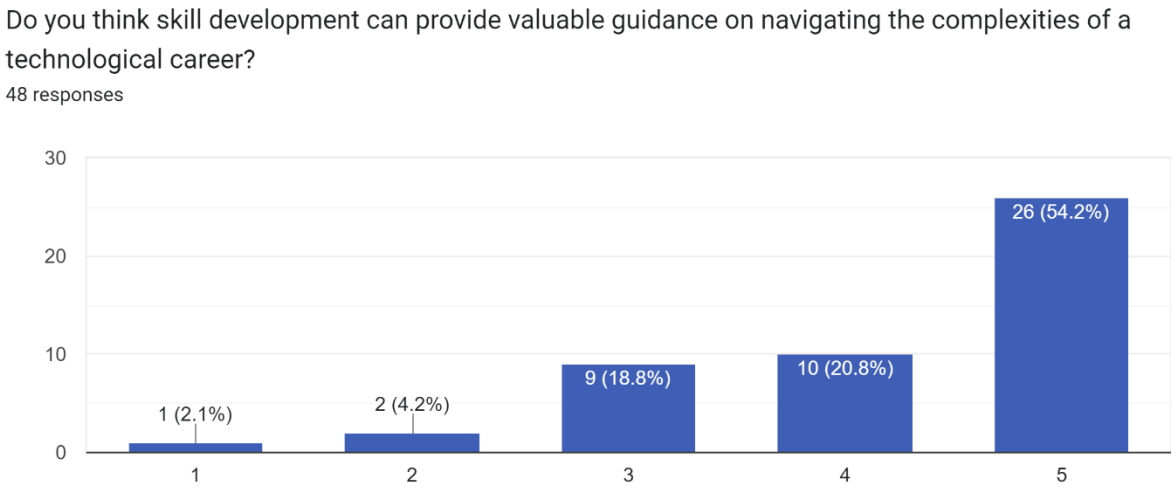




What do you suggest to encourage more women to pursue STEM careers?

1.STEM are usually the highest paying, so encouraging them to be financially independent.
2.Safe environment for women in colleges and workplaces
3.Focus on practical and logical world more than physical beauti and home's work
4.To create more success stories of women
5.Establish visible role models and ensure that these perspectives and experiences are very well brought forward, at the same time providing them with opportunities from a young age to try a hands on experience.
6.They should be free to choose what they want to do
7.Computer science
8.Be confident and independent and you'll pave your way through the hurdles.
9.Dont think what society is thinking
10.Equal opportunities, Mentorship , drop gender stereotypes, Educate parents , supportive school culture and education.
11.Skill Development from grassroot level
12.Encouragement, less mansplaining
13.Encouragement at educational institutions
14.maybe them being aware of stem careers would be helpful and maybe having workshops about these career paths
15.STEM informative camps, Marketing and collaboration with school
16.Biases at home that men and women are equally good in science and math Equal opportunities in schools and colleges, including through reservations in admissions
17.Mentorship programs in educational institution specially in schools.
18.Educating their parents or those around them in an influential position would be the first step, because they are the ones who women turn to for advice.
19.women have learnt to view themselves according to the lens of patriarchal society, viewing ourselves as people with infinite possibilities and potential is the most important step
20.a more welcoming environment
21.In general, let them figure out what they enjoy and encourage them. Never let them feel like they aren't inherently good enough to go into a certain field. The ideas of them being capable should be emboldened in their homes. They should be taught that they are people who should be respected just as other people are. They are no less intellectually than any other man in any field. To be more specific, maybe reservations can help with the underrepresention of women in these fields. Also as I said before for breaking down gender stereotypes, people, especially men, have to be taught that their preconceived notions on how the world operates can be wrong and harmful and they should realise it when it is and change accordingly.
22.More role models, diversity hiring
23.Design school curriculum in such a way that young females are drawn towards these careers
24.One way to encourage more women to pursue STEM careers is to provide mentorship programs and networking opportunities for them. This can help them connect with other women who are successful in STEM fields and learn from their experiences. Additionally, promoting positive role models and highlighting the achievements of women in STEM can also inspire young girls and women to pursue these careers. It's also important to address any biases or discrimination that may exist in the workplace and ensure that women have equal opportunities to succeed in STEM fields. Finally, providing scholarships and financial support for women pursuing STEM degrees can also help remove some of the barriers to entry.





V. CONCLUSION

This research has shown why women don't take up majors in STEM, why women leave jobs in tech fields, discusses the barriers females face entering the field as well as the benefits they will come across, why there still are barriers, and a lot more. We discussed the concept glass ceiling and women's participation numbers. The survey conducted made us understand better the many problems and their solutions from different perspectives. In short, women still have a long way to go in STEM and tech careers. There still is a need to remove tech barriers and fix the gender ratio gap as it has been rightfully said "When women achieve power, barriers fall on their own". We also need more role models from STEM to empower young women as "Behind every great woman, is another great woman."

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