ATHENA RESEARCH CONFERENCE
NEVER STOP QUESTIONING

Exploring Indian Views on the underrepresentation of female teenagers in STEM

Abhishek Mukherjee
Singapore International School, Mumbai

ABSTRACT

Women are underrepresented in STEM fields in a significant manner
Focus of the study was Indian female teenagers and drivers of their under representation
Lots of research available in general, b nothing focused on this specific segme
Conducted both primary and secondar research
Overall, respondents believed that ther was significant underepresentation of female teenagers in STEM.
- Statistically significant: Overall under-representation : 4.48 (scale of 1-7, where 7 is strongly agree), std error of 0.17
- Poverty (mean= 5.70)and Parent's Traditional Values (mean=4.28) were the most important perceived factors for underrepresentation of women in STEM
- Other factors given some importance out of the seven included : Stereotypes, teachers' discouragement, lower confidence in female students
- Factors that were not considered important were: avoiding male dominated field, feminine attributes

Secondary research support the findings:
Poverty is the most important factor.78% of children who do not go to school do so are girls.
- Families who did not receive good education do not quite understand its value and less likely to encourage kids. Also, in limited budgets, male children get preference
While there are actions by Government and other organizations, very important to take personal action
- Teaching female children and mentoring them could have significant impact.

INTRODUCTION

Under-representation of women in STEM in India is a serious issue
- Women are only 15%-20% of tenured faculty at Indian universities (Bhattacharya, 2020).
- In 2009, only 3.2% of 744 Indian National Science Academy Fellowships were women.
- The United Nations stated that only 14% of employed researchers in STEM fields in India were women (Sindhwani, 2020).
- ~20% participation at elite Indian Institutions such as the Indian Institute of Technology (Sharma, 2016).

Women constitute half of India's population, very important problem to solve
it is integral that they help contribute to science such that India can develop itself further both in terms of academic research and in terms of science and engineering.

While there are some reports that have focused on Indian women, they haven't focused specifically on Indian female teenagers.
Many have also cited different reasons for the underrepresentation but haven't explored if some reasons are more significant than others within the context of India.

Methodology

Main method : Online survey, mixed method approach using both qualitative and quantitative data
Respondents were asked to rate the importance of contributing factors on a scale of 1-7.
Biological, Motivational, family-level, school-level, and societal-level factors, which have been identified from a report (Choi et al., 2017).
Furthermore, respondents' perceptions of young Indian women's participation in STEM were also rated.
The respondents' age group, location and gender were recorded to explore differences between ratings of factors that could potentially affect their perceptions.

Null Hypothesis: There would be no significant differences between the mean ratings of the factors that determine the lack of representation of Indian female teenagers in STEM fields.
Differences between demographics were tested as well
Overall, 60 respondents: 34/60 under 22; 43/60 in Tier 1; 39/60 women

RESULTS

A statistically significant difference between all the means was found
Poverty was rated the most important factor, followed by Parent's Traditional Values
Feminine Attributes and female Teenagers avoiding a male-dominated field were rejected as factors to explain the underrepresentation of female teenagers in STEM.
Differences between groups:
No difference by age or geography
Difference amongst men and women on a few variables

Factor	Mean	Standard Error	Median	Standard Deviation
Overall Underrepresentation	4.48	0.17	5	1.32
Avoid Male Field	2.48	0.19	2	1.50
Feminine Attributes	2.12	0.19	2	1.45
Absorb Stereotypes	3.62	0.25	3	1.92
Parent's Traditional Values	4.28	0.23	5	1.81
Teachers Discourage	3.08	0.21	3	1.65
Poverty	5.70	0.19	6	1.50
Less Confidence	3.37	0.23	3.5	1.78

DISCUSSION

Secondary research support the findings:
- While 10.5% of India's expenditure is devoted to education, there are vast inequalities between rich states and poor states. Rich Kerala spends $685 on education per student per year, while poor Bihar only spends about $100 on the same (Hunter, 2017).
- Poorer states such as Uttar Pradesh, Madhya Pradesh and Bihar also have wider gender gaps than richer states (Nair, 2010).
- While India has made improvements, many students still do not go to school, and Oxfam, a charity, estimates that 78% of students not going to school are female (Hunter, 2017).
- Many poor families have themselves not received a good education, and are therefore less interested in sending their children as they may not quite understand the value of it (Roy, 2018)
- With low-income families, money for education is low so typically the males are the ones having good education and jobs while females are told to stay home and do domestic work such as cooking, cleaning, and taking care of children.

CONCLUSIONS

My reflections on what we can do: It is important to supplement Government action through personal and community actions to bridge the gap in STEM participation by women.
- Teaching and mentoring students can have a significant impact

REFERENCES

Bhagat, A., & Vijayaraghavan, R. (2019, August 29). Gender disparity in STEM: Evidence from India. Gender disparity in STEM: Evidence from India - ACER Discover. https://www.acer.org/in/discover/article/gender-disparity-in-stem-evidence-from-india.
Bhattacharya, T. (2020, February 19). With Science's Gender Ratio Less Askew, More Indian Women Are Getting Recognition. https://thewire.in/the-sciences/indian-science-women-recognition.
Bhattacharya, S., & Tiwari, K. K. (2018). Educational Statistics at a Glance. ESAG-2018. Retrieved from https://www.education.gov.in/sites/upload_files/mhrd/files/statistics-new/ESAG-2018.pdf
Choi, S.-H., & Saas, J. (2017). (rep.). Cracking the code: Girls' and women's education in science, technology, engineering and mathematics (STEM). Retrieved from https://unesdoc.unesco.org/ark:/48223/pf0000253479/PDF/253479eng.pdf.multi
"Extrapolating Results to Other Populations." The Use of Epidemiological Tools in Conflict-Affected Populations: Open-Access Educational Resources for Policy-Makers, 2009, http://conflict.lshtm.ac.uk/page_174.htm.
(2017). (rep.). Final Report Status of Women in Science among Select Institutions in India: Policy Implications. Retrieved from https://niti.gov.in/writereaddata/files/document_publication/Final_Report_Women_In_Science_SSESS.pdf
Harikrishnan, K. (2009, November 18). Gender: Women in Science Face Discrimination in India – Part 1. Inter Press Service. http://www.ipsnews.net/2009/11/gender-women-in-science-face-discrimination-in-india-part-1/.
Hunter, E. (2017, September 8). Poverty leaves India with huge literacy problem still to solve. Poverty leaves India with huge literacy problem still to solve. https://theirworld.org/news/poverty-leaves-india-with-huge-literacy-problem-to-solve.
Jain, S. (2020, September 11). STEM and the digital economy for women. STEM and the digital economy for women | ORF. https://www.orfonline.org/expert-speak/stem-and-the-digital-economy-for-women/.
Khazan, O. (2018, February 18). The More Gender Equality, the Fewer Women in Stem. The Atlantic. https://www.theatlantic.com/science/archive/2018/02/the-more-gender-equality-the-fewer-women-in-stem/553592/.
Nair, N. (2010). Women's Education in India: A situational analysis. IMJ, 1(4), 100–114.
Narang, S., & Kotamraju, P. (2016, September 30). STEM in the Slums: Giving India's Girls the Skills to Rise Up. https://deeply.thenewhumanitarian.org/womenandgirls/articles/2016/09/30/stem-in-the-slums-giving-indias-girls-the-skills-to-rise-up.
Rath, N. Mishra, S. (2017). Gender Divide in Science: Breaking the Glass Ceiling. International Journal of Research in Sociology and Anthropology, 3(1), pp 1-8. http://dx.doi.org/10.20431/2454-8677.0301001
Ring, K. (2018). Women in Tech: India Leads the Way. 451 Research - Women in Tech: India Leads the Way. https://go.451research.com/women-in-tech-india-employment-trends.html.
Rossiter, M. W. (1993). The Matthew Matilda Effect in Science. Social Studies of Science, 23(2), pp 325-341.
Roy, P. (2018). Effects of Poverty on Education in India. Journal of Emerging Technologies and Innovative Research, 5(8). https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3640322.
Sharma, K. (2020, March 12). IITs take women's quota to 20% as govt pushes gender balance in tech education. ThePrint. Retrieved from https://theprint.in/india/education/iits-take-womens-quota-to-20-as-govt-pushes-gender-balance-in-tech-education/379395/
Sharma, M. (2016). (rep.). Women in Science and Technology: a vision document (p. 14). Allahabad, Uttar Pradesh: NASI.
Sindwani, P. (2020, February 28). India tops the world in producing female graduates in STEM but ranks 19th in employing them. https://www.businessinsider.in/careers/news/india-tops-the-world-in-producing-female-graduates-in-stem-but-ranks-19th-in-employing-them/articleshow/74117413.cms.
(2013). (rep.). Status of Secondary Education in India: A Note based on DISE 2012-13 Data . Retrieved from http://dise.in/Downloads/StatusofSecondaryEducationinIndia_2012-13.pdf
Verma, P. (2018, February 3). 31 National Institutes of Technology set to admit more women. The Economic Times. Retrieved from https://economictimes.indiatimes.com/industry/services/education/31-national-institutes-of-technology-set-to-admit-more-women/articleshow/62761531.cms?from=mdr
White, S. (2021, March 8). Women in tech statistics: The hard truths of an uphill battle. Women in tech statistics: The hard truth of an uphill battle | CIO. https://www.cio.com/article/3516012/women-in-tech-statistics-the-hard-truths-of-an-uphill-battle.html.
World Population Prospects - Population Division - United Nations. (n.d.). https://population.un.org/wpp/Download/Standard/Population/.