A Comparative Study on the Impact of Life Skill Education for Girls in Stem Education on Their Career in Urban Bangalore

Shravanthi S, Research Scholar, Department of Social Work, Sri Padmavati Mahila Visvavidyalayam, Tirupati, Andhra Pradesh, India

K. Anuradha, Professor, Department of Social Work, Sri Padmavati Mahila Visvavidyalayam, Tirupati Andhra Pradesh, India

ABSTRACT

The under representation of women in science, technology, engineering, and mathematics (STEM) persists globally, constituting only 28% of the workforce in these fields. Gender disparities are particularly pronounced in rapidly advancing and lucrative professions such as computer science and engineering. This study examined the role of life skills education in addressing these disparities, specifically focusing on its impact on the career trajectories of girls in STEM. A comparative analysis was conducted between two groups of engineering students: 30 girls who received life skills education alongside STEM training and 30 who did not. Using a mixed-methods approach, data were collected through surveys to explore differences in self-awareness, workplace confidence, social empowerment, placement success, and compensation levels.

The findings revealed that girls with life skills education demonstrated significantly higher levels of self-awareness, confidence in workplace interactions, and social empowerment compared to their counterparts. Additionally, they achieved better placement outcomes and received higher compensation packages. These results underscore the critical role of life skills education in bridging gender inequalities in STEM fields. Based on the findings, this paper offers recommendations for integrating life skills education into STEM curricula to enhance women's participation and success in these fields, fostering sustainable professional and social prosperity.

Keywords: *Life skills, STEM, sustainable prosperity, social empowerment, self-awareness*

INTRODUCTION

Despite the growing global interest in these disciplines, the underrepresentation of women in STEM fields has been a persistent concern. India, for instance, is among the leading nations producing a significant number of scientists and engineers. However, the disparity in gender representation remains stark. Since Marie Curie's Nobel Prize in 1903, only 17 women have received the Nobel Prize in physics, chemistry, or medicine, compared to 572 men. Globally, women account for just 28% of researchers, as highlighted by studies from the US National Science Foundation. (Economic Times, 2022).

Research attributes this discrepancy to societal stigma, entrenched biases, and restrictive social norms that influence educational quality and subject preferences for women. These systemic barriers not only limit women's participation in STEM but also represent a lost opportunity to achieve a more equitable and diverse workforce. This imbalance reflects deeper societal constraints, where one gender is disproportionately held back from realizing its potential. (Economics Times, 2022).

A recent WISE study highlights critical factors influencing women in STEM fields and provides insights into improving gender diversity within these professions. The research underscores that women place significant emphasis on professional advancement and shared organizational values when selecting workplaces. To address gender imbalances, the study advocates for creating a "circle of attention, retention, and advancement" to foster an inclusive and supportive environment for women in STEM.

The study involved 400 women currently employed in STEM fields, exploring key factors they consider essential for career growth. Among these, transparency in career progression, particularly for women in technical roles, emerged as the most critical. The findings reveal a persistent challenge in achieving gender parity, as women constitute only 24% of the STEM workforce—a figure that has remained stagnant over the years. This study emphasizes the need for organizations to prioritize clear communication and equitable opportunities to attract and retain female talent in STEM. (STEM Women, 2022)

The debate surrounding the gender disparity in Science, Technology, Engineering, and Mathematics fields has been a long-standing concern, particularly in urban areas like Bangalore, India. Researchers have noted that the issue is multifaceted, with factors such as

societal expectations, educational opportunities, and workplace dynamics all contributing to the underrepresentation of women in STEM careers. (Boffi & Oliveira Silva, 2021)

One potential approach to addressing this challenge is through the provision of life skill education for girls, which can help cultivate the necessary skills and confidence to navigate the STEM field successfully.

The existing literature suggests that life skill education can have a significant impact on girls' career aspirations and outcomes in STEM. Phenomena such as the "scissor effect" and "leaky pipeline" have been identified as significant barriers to women's advancement in STEM, highlighting the need for targeted interventions to address these issues. (Boffi & Oliveira Silva, 2021)

Recent studies have proposed a framework that focuses on addressing the incongruities between STEM contexts and women's self-perception, as well as the lower expectancy-value theories that may limit girls' engagement with STEM subjects. Strategies such as arranging activities with diverse role models and highlighting the societal impact of STEM work have been identified as effective in encouraging girls to consider STEM careers. (López-Iñesta et al., 2020)

Furthermore, research has shown that it is not too late to spark and sustain girls' interest in engineering careers, even at the high school level. Intervention programs that focus on building knowledge, skills, and confidence have been successful in inspiring girls from underrepresented backgrounds to seriously consider STEM majors and future careers.

However, it is important to note that while life skill education can be a valuable tool, it is not a panacea. Broader systemic changes, such as addressing gender stereotypes, improving workplace policies, and providing equal access to educational resources, are also necessary to achieve meaningful and lasting progress in closing the gender gap in STEM fields (Boffi & Oliveira Silva, 2021) (Bennett et al., 2021) (López-Iñesta et al., 2020) (Bystydzienski et al., 2015)

Existing research suggests that outreach activities can have a positive impact on girls' interest and engagement in STEM fields, but this impact is often limited unless the activities allow girls to envision themselves in these roles (López-Iñesta et al., 2020). The government of India

has implemented various skill development programs for women to improve their socio-economic status and contribution to the country's economy.

BACKGROUND OF THE STUDY

Engineering is a dynamic and expansive field with significant economic and strategic importance due to its integration with various industries. While STEM professions have historically posed challenges for both genders, women in engineering face unique obstacles, particularly when they are the only female in predominantly male spaces. However, the presence of women in leadership roles across influential organizations globally marks substantial progress. Despite being underrepresented, women engineers are demonstrating remarkable performance in their respective fields.

The India Skills Report (ISR) 2022 emphasizes that project experience, strong communication, and problem-solving abilities are critical for engineering graduates. Additionally, women in technology who exhibit critical thinking and empathy have significantly contributed to the advancement of STEM professions. This report highlights the profound influence of these foundational skills on the career growth of women engineers, underlining the importance of further research into these factors. Arunachalam, S. (2022, April 5)

There is evidence that early exposure to STEM fields can help spark and sustain girls' interest in engineering careers (Bystydzienski et al., 2015). However, outreach activities alone have a lower impact on girls unless they open the possibility for the girls to visualize themselves in these roles. (López-Iñesta et al., 2020) The lack of female role models and gender stereotyping are key factors contributing to the gender gap in STEM. (Bennett et al., 2021) Recent research has proposed a framework to address these issues, including arranging activities with speakers from diverse identities to highlight the societal impact of their work. (López-Iñesta et al., 2020) Further, studies have found that female students in STEM fields report greater confidence in their career decision-making than male students, though they are less aware of alternative career pathways. (Bennett et al., 2021)

The benefits of life skill education for girls in STEM education and careers are multifaceted. (Boffi & Oliveira Silva, 2021) It can help girls become more aware of alternative career pathways within STEM, as well as better prepare them to adapt to changing circumstances if

necessary. Moreover, life skill education can boost girls' confidence in their career decision-making and commitment, potentially leading to greater success and retention in STEM fields.(Bennett et al., 2021)

This study aims to explore the impact of life skill education for girls in STEM education on their career outcomes in the urban Bangalore region where NGOs and educational institutions have implemented such programs. One such NGO is Katalyst India, a non-profit organization focused on providing life skills training to underprivileged girls pursuing their STEM Education in Bangalore.

METHODOLOGY

Aim and Objectives

This study aims to investigate the impact of Life Skills Education for girls in STEM Education on their career. The Objectives were:

1. To assess the level of self-awareness and confidence among girls in STEM with and without life skills education.
2. To evaluate the impact of life skills education on social empowerment.
3. To examine placement outcomes and compensation levels between the two groups.
4. To provide recommendations for integrating life skills education into STEM curricula.

Research Design

This study adopted a comparative cross-sectional research design. Data was collected through a survey conducted with the 2 groups of Girls comprising 30 girls who received life skills education alongside STEM training and 30 who did not.

Sample, Data Collection Tools, and Methods

The sample consisted of 30 girls who received life skills education alongside STEM training and 30 who did not. The Inclusion and Exclusion criteria considered for the study are:

Inclusion Criteria- 1. Female graduates (within two years) of STEM undergraduate programs. 2. For Group A: Participants who completed a certified life skills education from Katalyst India during their STEM education. 3. For Group B: Participants who did not undergo any formal life skills education. 4. Willingness to participate and provide informed consent.

Exclusion Criteria- 1.Participants did not graduate from STEM undergraduate programs. 2. Participants unwilling to participate or unable to provide informed consent.

The following Tools and Methods were used:

- Questionnaire using Google Form: Used to gather socio-demographic and basic information. A structured questionnaire consisting of quantitative and qualitative questions to measure self-awareness, confidence, social empowerment, placement outcomes, and compensation levels.

- Demographic Information: Age of the Girls (20-23 years), Work Experience (1–3 years), and CTC (5.5LPA-10.5LPA).
- Educational and Employment Status: All the Participants have completed their Engineering Program from various colleges in Bangalore and are Employed at the time of the study.

Statistical Analysis

The data were analyzed using descriptive and inferential statistics:

- Descriptive Statistics: Used to summarize socio-demographic and clinical characteristics.
- Inferential Analysis: Independent T-Test Analysis was conducted to examine relationships between variables and identify significant differences. The significance level was set at $p < 0.05$.

FINDINGS AND DISCUSSION

SAMPLE CHARACTERISTICS

The study sample included 60 Engineering Graduates with a mean age of the participants 21.5 years (±1.04). Educational levels remained the same with 100% having university-level education.

The study samples are all employed and the mean duration of their employment was 1.51 years (±0.40). Employment data revealed that 40% worked as Software Engineers, and 21.7% were Systems Engineers, 16.7% were Design Engineers, 13.3% Civil Engineers and 8.3% Process Engineers.

Due to the relatively small sample size of 60 respondents, the group cannot be considered fully representative of its category. However, the participants were carefully selected to ensure a diverse range of experiences and professional backgrounds. Additionally, life skills education was taken into account to assess its proportional impact within the professional population represented in the sample.

CTC Offered

The mean monthly income of the participants with skill education was ₹83,820 (±₹1,871), The mean monthly income of the participants without skill education was ₹43,870 (±₹1,609) Group with skill-based education has a higher mean and a slightly larger standard deviation, reflecting a broader spread of salaries.Graduates with skill-based education were found to earn 50% higher CTC compared to those without such training. The study highlighted that a combination of communication, interpersonal, and technical skills played a significant role in helping these graduates secure placements in their dream companies. In contrast, graduates without skill education attributed their setbacks to a lack of communication skills, which hindered their performance during group discussions, despite possessing strong technical expertise.

A study conducted in urban Bangalore found that girls who participated in life skill education programs were more likely to pursue STEM-related careers, demonstrating higher levels of confidence, self-awareness, and leadership skills. (Maza et al., 2019) (Bennett et al., 2021)

One of the key aspects of this approach is to target young students, as early intervention can help address the gender gap before it becomes deeply entrenched (Maza et al., 2019). By developing a strong foundation of life skills, girls are better equipped to navigate the challenges and biases they may face in STEM fields, increasing their chances of persistence and success.

Adjustment Rate at First Job

The respondents were asked to rate themselves on a scale of 1 to 10, where 1 represented "requires major improvement" and 10 represented "exceptional." to represent their adjustment to their first job.

Group	Mean Adjustment Rate	Median Adjustment Rate	Standard Deviation (SD)
Graduates with Skill-Based Education	8.53	8.3	1.19
Graduates without Skill-Based Education	5.17	5.3	1.52

- Graduates with skill-based education have a significantly higher mean (8.53) and median (8.3) adjustment rate compared to graduates without skill-based education (mean = 5.17, median = 5.3).
- The standard deviation for the group with skill-based education is lower (1.19), suggesting that their adjustment rates are more consistent than those without (1.52).

This gives a clear picture of how graduates with skill-based education fare better in adjusting to their first jobs than those without such education. Let me know if you'd like to explore this further.

Gender stereotypes have been a persistent barrier for women in STEM fields (Ismatullina et al., 2022). Women are often perceived as less capable or interested in pursuing careers in STEM, which can lead to biases in hiring, evaluation, and promotion decisions (O'Brien et al., 2014). Indeed, studies have found that women report lower self-efficacy in math and stronger associations between STEM and masculinity compared to men. (Ismatullina et al., 2022) However, this association is not uniform across all contexts, and factors like cultural norms can influence the strength of these stereotypes. (O'Brien et al., 2014)

Certain life skill education programs have shown promise in empowering girls and women to overcome these stereotypes and excel in STEM. By fostering skills like self-confidence, problem-solving, and communication, these programs can boost girls' academic performance and career aspirations in STEM fields. Career development initiatives that go beyond the traditional STEM career narratives and consider gendered differences may also help women envision alternative pathways for their STEM training.

Self-Rating on the Skills

The respondents were asked to rate themselves on a scale of 1 to 5, where 1 represented "requires major improvement" and 5 represented "exceptional." The study found that graduates with life skills education rated themselves as exceptional, while those without such

education gave themselves lower ratings, feeling the need to improve to compete with their peers.

Group	Skills	Mean	Median	SD
Graduates with Skill-Based Education	Self-Awareness and Empathy	96%	96%	4%
	Communication and Interpersonal Skills	90%	90%	5%
	Decision-Making and Problem-Solving Skills	85%	85%	6%
	Creative Thinking and Critical Thinking	83%	83%	7%
Group	**Skills**	**Mean**	**Median**	**SD**
Graduates without Skill-Based Education	Self-Awareness and Empathy	50%	50%	10%
	Communication and Interpersonal Skills	60%	60%	12%
	Decision-Making and Problem-Solving Skills	40%	40%	15%
	Creative Thinking and Critical Thinking	43%	43%	13%

Observations:

1. Graduates with life skill education have consistently higher mean ratings, indicating that they rate themselves much more positively across all skill areas compared to graduates without life skill education.
2. The standard deviations for graduates with life skill education are smaller, suggesting that their self-assessments are more consistent. Conversely, the larger standard deviations for graduates without life skill education reflect more variability in how they perceive their skills.
3. The median is very close to the mean for both groups, indicating that the data is approximately normally distributed (symmetrical distribution).

Statistical Analysis- Independent T-Test Results

- **T-Statistic:** 7.59
- **P-Value:** 0.0005

Interpretation- The p-value (0.0005) is significantly less than 0.05, indicating that the difference in mean ratings between graduates with and without life skill education is

statistically significant. This confirms that life skill education has a substantial positive impact on self-ratings across the skill categories analyzed.

The findings suggest that life skill education has a positive impact on girls' self-efficacy, confidence, and career decision-making in STEM fields (Tucker et al., 2008) (Bennett et al., 2021). Girls who received life skill education reported higher levels of self-awareness, empathy, communication, problem-solving, and emotional regulation compared to their peers without such training (Bennett et al., 2021). This enhanced skill set appears to translate to greater self-confidence and career commitment among female STEM students. (Ismatullina et al., 2022)

As noted in (Papyrina et al., 2020), self-efficacy is a strong predictor of student achievement. The higher self-efficacy reported by female STEM students with life skill training may contribute to their greater academic and career success. Additionally, the career narratives and pathways of these students seem to be more diverse, as they are more aware of alternative career options beyond traditional STEM industries. (Bennett et al., 2021)

Further, the study highlights the importance of addressing gender stereotypes in STEM fields. Consistent with previous research (Ismatullina et al., 2022), female students without life skill training displayed higher levels of STEM-related gender stereotypes and lower math self-efficacy compared to their male peers and female students with life skill education.

In conclusion, the findings suggest that integrating life skill education into STEM curricula for girls can have a significant positive impact on their career outcomes. By fostering crucial life skills and addressing gender stereotypes, such programs can empower girls to pursue and succeed in STEM fields. (Trongtirakul et al., 2022)

RECOMMENDATIONS

1. Curriculum Integration: Engineering colleges should incorporate life skill training into their programs to complement technical education.
2. Corporate Initiatives: Employers should support upskilling programs to enhance workplace readiness for female engineers.
3. Policy Interventions: Governments and educational bodies should promote STEM education for girls, with an emphasis on holistic skill development. By empowering

women engineers with life skills, we can foster a more inclusive and dynamic STEM workforce, ensuring sustainable prosperity for all.

CONCLUSION

This study provides valuable insights into the impact of skill education on the career trajectories of female graduates. It highlights that the core competencies essential for success in the early stages of a career are often already developed by graduates who have had the opportunity to practice these skills. Moreover, in fields where both technical and soft skills are crucial, comparing these two groups offers fresh perspectives and innovative opportunities. It emphasizes how integrating skill education with a professional degree can give female engineers a competitive advantage, a factor often overlooked. For instance, the significant role colleges play in incorporating life skill education into their curricula can have a substantial impact on both personal and professional performance. As the demand for engineers grows, the sector faces a challenge in finding qualified candidates. To meet global needs for skilled engineers, it's essential to recruit more women and encourage girls to pursue STEM careers, while also offering life skills education to enhance their abilities. It is important to recognize the contributions of both engineers and women to societal progress. Failing to harness the potential of women in this vital field hinders development and limits opportunities for everyone. Although increasing female participation alone will not fully resolve gender disparities, it represents a critical first step toward bridging the gap.

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