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## **ENROLLMENT TRENDS OF WOMEN IN STEM PROGRAMS AT TERTIARY LEVEL IN PUNJAB: A BARRIER TO ACHIEVE SDG (5)**

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### **ABSTRACT**

Women's involvement in higher education has exceeded than men in numerous South Asian nations as well as in Pakistan. STEM education, however, does not reflect this tendency, as a result, women are less likely to seek jobs in STEM fields. The present study seeks to demonstrate the importance of STEM education for women in achieving gender equality and promoting sustainability. The study aims to examine the enrolment trends of women in STEM programs at the tertiary level in Punjab and to identify the main factors that contribute to the gender gap in STEM programs. The current study employed a mixed method research approach. For this purpose two public and two private engineering and technology universities in Lahore were chosen by lottery method of random sampling by applying the ratio analysis method. In order to investigate the key factors sustaining the gender STEM gap at the tertiary level,

a total of 150 participants were selected using stratified sampling techniques. Four qualitative interviews were also conducted with these participants to gain a deeper understanding of the key factors and barriers to achieving gender equality in STEM sectors. To analyze quantitative data, SPSS software was used, descriptive statistics, T-Test and ANOVA were applied on demographic variables. On ENVIVO software, qualitative data were analyzed through coding and thematic analysis. The findings identify a range of causes, rank them according to importance, and make recommendations as how to increase women's participation in STEM Education in order to meet SDGs (5).

**Keywords:** Gender equality, STEM Education, Sustainability, Sustainable development

## **Introduction**

This particular research analyzed the current enrolment trends of the previous five years of both men and women in STEM programs at the tertiary level in the universities of the Punjab, investigating the key factors perpetuating the gender STEM gap, and also explained why STEM education is important for women in achieving sustainability and gender equality. In addition, this research also provides suggestions about what measures could be taken to raise the enrolment rate of women in STEM programmes.

## **Gender Equality**

Gender prejudice continues to hold back so many women in Pakistan as it does to the women to the rest of the world (Alkire & Sabine, 007). Empowering women and advancing gender parity are critical to accelerating sustainable development. SDG 5 targets to promote gender fairness and inspire women.

The UN explains that SDG 5 promotes women's empowerment in the numerous ways, which is access to high-quality education, support for female entrepreneurs through training, informational resources, workplace safety, and opportunities for career advancement, STEM education paves way for female participation in the real world (Li, et.al., 2020).

With too few women in decision-making positions and higher-paying STEM jobs, consequently, it is essential to promote gender inclusivity in order to develop excellence in science and technology.

## **STEM Education**

STEM Education combines four different areas; Science, technology, engineering and mathematics, collectively called STEM (Kaleci & Korkmaz, 2023). Women who participate in STEM education learn not only to be able to acquire useful skills but are also prepared for a future in which most careers will demand a foundational knowledge of math and science (KAZU , YALÇIN, 2021). Thereby, STEM Education for women is becoming more and more important as we live in a constantly changing society with technological breakthroughs.

It is crucial to eliminate gender discrepancies through STEM education because women perform exactly as well as men in STEM-related businesses and are in high demand in many fields with a male predominance. STEM-based gender equality opens up a whole new universe of educational and professional opportunities for women (Aslam et.al. 2022). Diversity promotes research in general, beyond just enabling a higher representation of women in STEM fields.

Keeping women out of the cutting-edge scientific sectors of the twenty-first century will seriously impede world development (UN Women, 2017). It is thought that a society's capacity for innovation may be compromised by the underutilized potential of women in disciplines like STEM (Aslam, et.al., 2022).

Research shows that women present only 28% of the personnel in science, technology, engineering and mathematics, STEM fields, and men be more numerous than women in STEM programs .

There are disproportionately large gender inequalities in the job market of the future such as computer science and engineering.

STEM is the profession of the future as it fosters modernization, civil advance, inclusive growth and sustainable development. Specifically, women in Pakistan make up 57% of all out-of school children and experience regular prejudice.

Although the reality that a greater number of women compared to ever previously are going to school, females have a disadvantage in STEM courses in many contexts, and they seem to lose enthusiasm for STEM-related topics as they enter puberty (UN Women, 2017).

### **Sustainable Development/ Sustainability**

Sustainable development broadly refers to a systematic approach to growth and development and management of natural, industrial and social capital for the benefit of current and future generations (KAZU & YALÇIN, 2021).

A set of 17 Sustainable development goals (SDGs) were agreed by UN member states at the sustainable development Summit in 2015, with the intention of eradicating poverty, combating inequality and injustice, and addressing climate change. The SDGs' goal is to create a set of global objectives that address the most pressing environmental, political, and economic issues facing the globe.

There is currently a shortage of technological expertise, which will only get worse if women are not encouraged to pursue careers in STEM fields and given equal opportunities. The 2030 Agenda gives significant attention to gender equality and women's empowerment (Sustainable Development Solutions Network, 2013).

Sustainable development goal 5 is about achieving gender equality and to empower all Women.

### **Statement of the Problem**

In Pakistan, for various factors, women are consistently excluded from science, technology, engineering and mathematics (Kaleci & Korkmaz, 2023). Especially in higher education, STEM subjects are usually dominated by male students. This issue stands in the way of achieving SDG5 to accomplish gender equality (UN Women, 2017).

As the gender gap continues to grow and women's status in socioeconomic development is hidden, it is imperative to take the initiative to support women in the scientific community and to increase the representation of women in science and technology, utilizing their talents to the fullest at all stages of scientific and technological education, training and employment are economically essential for accomplishing national growth. This study aims to find the measures on how to achieve gender equality in STEM programs to contribute to progress on SDG 5.

### **Objectives of the Study**

1. To analyze the women's enrolment trends of the previous five years in STEM programs at the tertiary level in both private and public universities in province of the Punjab.
2. To investigate the key factors perpetuating the Gender STEM gap in Pakistan.

**Research Questions**

1. What are the enrolment trends of women in STEM programs at tertiary level both in private and public universities of province of the Punjab?
2. What are the key factors perpetuating the gender STEM gap in Pakistan?

**Significance of the Study**

Gender equality in achieving sustainability is the theme of this study and emphasis is placed on boosting girls' participation in STEM education. The aim is to encourage all those women who are interested in STEM fields, future generations of women must be empowered to participate in and recognize themselves as major stakeholders in scientific advancement. Moreover, there hasn't been much study done on this topic in Pakistan.

It is expected that the outcomes of this study would increase women's participation in STEM education and will identify measures that could facilitate educational policy makers and job market stakeholders to understand what initiatives are needed to be taken to promote women's participation on a larger scale in STEM fields in Pakistan and elsewhere around the world.

**Methodology**

It is a mixed method quant/qual explanatory research (Creswell & Clark, 2011) with a population of public and private universities of Engineering, Sciences and Technologies in Lahore.

**Population**

Women studying at public and private universities in Punjab, those who passed intermediate level in fields of science (FSC/ICS) and choose humanities over sciences for higher education (4-year Bachelor's degree) at tertiary level.

**Sample**

This research involved data collection of women enrollment trends of previous five years (2018-2022) and analyses in form of tables to show women's enrolment trends in STEM programs at randomly selected 2 Public and 2 Private Universities of Sciences, technologies Engineering and Mathematics in Lahore.

With the help of cluster sampling technique 150 female students were selected as the sample of the study. Four out of 150 female students were approached by the researcher to gather qualitative textual data.

**Data Collection**

In order to gather enrollment data for both women and men in different STEM disciplines to demonstrate the lower percentage of female engagement in STEM sectors, the researcher approached two public and two private engineering and technology universities.

**Data Analysis and Findings**

The following table shows the enrollment patterns of both men and women in major STEM subjects at public institutions in Lahore, Punjab, from 2018 to 2022.

**Table 1**

| Program                             | 2018  |       | 2019  |       | 2020  |       | 2021  |       | 2022  |       |
|-------------------------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
|                                     | Boys  | Girls | Boys  | Girls | Boys  | Girls | Boys  | Girls | Boys  | Girls |
| BS-                                 |       |       |       |       |       |       |       |       |       |       |
| Electrical Engineering              | 97.64 | 2.36% | 96.97 | 3.03% | 96.04 | 3.96% | 95.15 | 4.85% | 93.75 | 6.25% |
|                                     |       |       | %     |       | %     |       | %     |       | %     |       |
| BS-                                 |       |       |       |       |       |       |       |       |       |       |
| Mechanical Engineering              | 99.48 | 0.52% | 99.64 | 0.36% | 99.33 | 0.67% | 98.93 | 1.07% | 98.82 | 1.18% |
|                                     |       |       | %     |       | %     |       | %     |       | %     |       |
| BS-Software Engineering             | 86.4% | 13.60 | 93.45 | 6.55% | 88.30 | 11.70 | 86.10 | 13.90 | 82.03 | 17.97 |
|                                     | %     | %     |       | %     | %     |       | %     | %     | %     | %     |
| BS-Civil Engineering                |       |       |       |       |       |       |       |       |       |       |
| Engineering Technology              | 100%  | 0%    | 99.52 | 0.48% | 99.58 | 0.42% | 99.61 | 0.39% | 99.62 | 0.38% |
|                                     |       |       | %     |       | %     |       | %     |       | %     |       |
| BS-Mathematics                      | 64.5% | 35.50 | 64.30 | 35.70 | 63.52 | 36.48 | 60.70 | 39.30 | 58.66 | 41.34 |
|                                     | %     | %     | %     | %     | %     | %     | %     | %     | %     | %     |
| BS-Physics                          |       |       |       |       |       |       |       |       |       |       |
|                                     | 71.63 | 28.37 | 73.68 | 26.32 | 71.60 | 28.40 | 64.58 | 35.42 | 70.65 | 29.35 |
|                                     | %     | %     | %     | %     | %     | %     | %     | %     | %     | %     |
| BS-Information Technology           |       |       |       |       |       |       |       |       |       |       |
|                                     | 89.91 | 10.09 | 76.67 | 23.33 | 70.85 | 29.15 | 77.78 | 22.22 | 69.56 | 30.44 |
|                                     | %     | %     | %     | %     | %     | %     | %     | %     | %     | %     |
| BS-Bio Chemistry and Bio Technology |       |       |       |       |       |       |       |       |       |       |
|                                     | 38.17 | 61.83 | 37.74 | 62.26 | 37.62 | 62.38 | 36.26 | 63.74 | 34.47 | 65.53 |
|                                     | %     | %     | %     | %     | %     | %     | %     | %     | %     | %     |

|                  |       |       |       |       |       |       |       |       |       |       |
|------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| BS-              |       |       |       |       |       |       |       |       |       |       |
| Chemistry        | 64.22 | 35.78 | 60.12 | 39.88 | 58.66 | 41.34 | 54.35 | 45.65 | 53.18 | 46.82 |
|                  | %     | %     | %     | %     | %     | %     | %     | %     | %     | %     |
| Total % per year |       |       |       |       |       |       |       |       |       |       |
|                  | 79.11 | 20.89 | 78.01 | 21.99 | 76.17 | 23.83 | 74.83 | 25.17 | 72.75 | 27.25 |
|                  | %     | %     | %     | %     | %     | %     | %     | %     | %     | %     |

Table 1 shows that at public universities of Engineering and Technology of Lahore, in year 2018, only 20.89% girls enrolled in various STEM disciplines, while the percentage of boys was 79.11%. In year 2019, only 21.99% girls enrolled in various STEM disciplines while the percentage of boys was 78.01%. In year 2020, only 23.83% girls enrolled in various STEM disciplines, while the percentage of boys was 76.17%. In year 2021, only 25.17% girls enrolled in various STEM disciplines, while the percentage of boys was 74.83%. In year 2022, only 27.25% girls enrolled in various STEM disciplines, while the percentage of boys was 72.75%.

**Table 2: shows the enrollment patterns of both men and women in major STEM subjects at private institutions in Lahore, Punjab, from 2018 to 2022.**

| Program                | 2018  |       | 2019  |       | 2020  |       | 2021  |       | 2022  |       |
|------------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
|                        | Boys  | Girls | Boys  | Girls | Boys  | Girls | Boys  | Girls | Boys  | Girls |
| BS-                    |       |       |       |       |       |       |       |       |       |       |
| Electrical Engineering | 91.34 | 8.66% | 95.90 | 4.01% | 88.30 | 11.70 | 79.60 | 20.4% | 80.20 | 19.8% |
|                        | %     | %     | %     | %     | %     | %     | %     | %     | %     | %     |
| BS-                    |       |       |       |       |       |       |       |       |       |       |
| Mechanical Engineering | 96.12 | 3.88% | 94.89 | 5.11% | 98.12 | 1.88% | 91.09 | 8.91% | 90.90 | 9.01% |
|                        | %     | %     | %     | %     | %     | %     | %     | %     | %     | %     |
| BS-                    |       |       |       |       |       |       |       |       |       |       |
| Software Engineering   | 85.12 | 14.88 | 91.85 | 8.15% | 79.12 | 20.88 | 88.67 | 11.33 | 86.89 | 13.11 |
|                        | %     | %     | %     | %     | %     | %     | %     | %     | %     | %     |
| BS-Civil               |       |       |       |       |       |       |       |       |       |       |
| Engineering            | 98.89 | 1.11% | 96.70 | 3.3%  | 96.99 | 3.01% | 99.23 | 0.77% | 98.99 | 1.01% |

|                              |       |       |       |       |       |       |       |       |       |       |
|------------------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| Technology                   | %     | %     | %     | %     | %     | %     | %     | %     | %     | %     |
| BS-                          |       |       |       |       |       |       |       |       |       |       |
| Mathematics                  | 84.50 | 15.05 | 76.12 | 23.88 | 63.52 | 36.48 | 63.80 | 36.02 | 60.12 | 39.88 |
|                              | %     | %     | %     | %     | %     | %     | %     | %     | %     | %     |
| BS-Physics                   | 89.12 | 10.88 | 88.34 | 11.66 | 76.34 | 23.66 | 69.45 | 30.55 | 71.90 | 28.01 |
|                              | %     | %     | %     | %     | %     | %     | %     | %     | %     | %     |
| BS-                          |       |       |       |       |       |       |       |       |       |       |
| Information Engineering      | 88.12 | 11.88 | 86.80 | 13.02 | 79.12 | 20.88 | 75.90 | 24.01 | 70.15 | 29.85 |
|                              | %     | %     | %     | %     | %     | %     | %     | %     | %     | %     |
| Technology                   |       |       |       |       |       |       |       |       |       |       |
| BS-Bio                       |       |       |       |       |       |       |       |       |       |       |
| Chemistry and Bio Technology | 97.00 | 3.00% | 93.15 | 6.85% | 89.90 | 10.01 | 98.99 | 1.01% | 94.35 | 5.65% |
|                              | %     | %     | %     | %     | %     | %     | %     | %     | %     | %     |
| BS-                          |       |       |       |       |       |       |       |       |       |       |
| Chemistry                    | 64.22 | 35.78 | 60.12 | 39.88 | 58.66 | 41.34 | 54.35 | 45.65 | 53.18 | 46.82 |
|                              | %     | %     | %     | %     | %     | %     | %     | %     | %     | %     |
| Total % per year             | 88.27 | 11.73 | 87.10 | 12.90 | 81.12 | 18.88 | 80.12 | 19.88 | 78.52 | 21.48 |
|                              | %     | %     | %     | %     | %     | %     | %     | %     | %     | %     |

Table 2 shows that at private universities of Engineering and Technology of Lahore, in year 2018, only 11.73% girls enrolled in various STEM disciplines, while the percentage of boys was 88.27%. In year 2019, only 12.90% girls enrolled in various STEM disciplines while the percentage of boys was 87.10%. In year 2020, only 18.88% girls enrolled in various STEM disciplines, while the percentage of boys was 81.12%. In year 2021, only 19.88% girls enrolled in various STEM disciplines, while the percentage of boys was 80.12%. In year 2022, only 21.48% girls enrolled in various STEM disciplines, while the percentage of boys was 78.52%.

The enrolment ratio of previous five years (2018–2022) of both men and women at one private and two public universities of Engineering and Technology in Lahore is presented in the table across various STEM disciplines. The facts clearly show that women are underrepresented in STEM disciplines, particularly mechanical, civil, and electrical engineering, information and communication technology, manufacturing, and construction. According to the statistics, women make up about 1/4 of the total population in these disciplines. However, there are several areas like mathematics, chemistry, and physics where women have a slightly better representation.

Currently, enrollment data for a small subset of STEM disciplines has been collected due to the study's limitations. The results clearly show that there is a significant gender gap in STEM disciplines at the Tertiary level, even though the data does not represent overall enrollment records in all STEM subjects at both public and private universities in Punjab.

**Quantitative Data Analysis**

**Table 3**  
**Information Regarding Program Wise Data**

| Program          | Frequency | Percent |
|------------------|-----------|---------|
| B.Ed. Hons       | 20        | 13.4    |
| Bs-Islamic study | 10        | 6.7     |
| Bs English       | 32        | 21.5    |
| Bs Fine Arts     | 67        | 45.0    |
| Bs Psychology    | 20        | 13.4    |

Table 3 shows that 67 respondents were from Bs Fine Arts students, 32 students were from Bs English, 20 students from B.Ed. hons and 20 from Bs Psychology, and 10 students from Bs Islamic study.

**Table 4**  
**Reasons to Choose Humanities Over Sciences**

| Responses   | Mean |           | SD        |
|---|------|-----------|-----------|
|   | Yes  | No Maybe  |           |
| 1. It is easy to get admission in humanities.       | 92.6 | 4.7 2.7   | 1.10 .381 |
| 2. It is easy to Score in humanities.               | 67.1 | 18.8 14.1 | 1.47 .731 |
| 3. Instructional material is sufficient.            | 90.0 | .7 .3     | 1.09 .402 |
| 4. There aren't enough science teaching facilities. | 100  |           | 1.00 .000 |



|   |      |      |      |      |      |
|---|------|------|------|------|------|
| 5. Nature of humanities is applied to real life.  | 53.7 | 34.9 | 11.4 | 1.58 | .690 |
| 6. To follow my teachers.   | 15.4 | 75.2 | 9.4  | 1.94 | .496 |
| 7. Due to fear of poor result of science subjects' women opt to humanities.                     | 69.1 | 23.5 | 7.4  | 1.38 | .622 |
| 8. Psychological factors led to choose humanities.  | 83.9 | 8.7  | 7.4  | 1.23 | .574 |
| 9. Humanities subjects have better Job prospects.   | 79.2 | 14.8 | 6.0  | 1.27 | .565 |
| 10. Men are underrepresented in the humanities compared to women.                               | 92.6 | 2.0  | 5.4  | 1.13 | .469 |
| 11. Women's Enrolment trends of humanities at secondary level are higher than sciences.         | 9.4  | 2.0  | 4.0  | 1.10 | .415 |
| 12. There are more trained teachers for humanities.   | 40.3 | 38.3 | 21.5 | 1.81 | .766 |
| 13. Less resources and funds are needed for humanities.   | 92.6 | 2.7  | 4.7  | 1.12 | .449 |
| 14. Because of their affinity for the home, women have been closely associated with humanities. | 100  |      |      | 1.00 | .000 |
| 15. It is better to study humanities than to stay uneducated.                                   | 100  |      |      | 1.00 | .000 |
| 17. Humanities are considered soft subjects that appeal to women's emotionality.                | 86.6 | 13.4 |      | 1.27 | .684 |

|   |      |      |      |      |      |
|---|------|------|------|------|------|
| 18. Women are less likely to choose sciences due to personal characteristics, such as a lack of arithmetic confidence and a distaste of competitive surroundings. | 73.2 | 10.7 | 16.1 | 1.43 | .756 |
| 19. Women are regarded to be stronger at verbal thinking and writing.   | 73.2 | 10.7 | 16.1 | 1.13 | .502 |
| 20. Because that women will certainly get married after college; humanities degrees are also considered to be "easy degrees" for them to obtain.                  | 93.3 | 6.7  |      | 1.04 | .282 |

Table 4 shows the reasons to choose humanities over sciences. The frequency it is easy to get admission in humanities (Yes= 92.6, No= 4.7 2, Maybe= .7 1) mean score (M= .10, SD= .381). It is easy to Score in humanities (Yes= 67.1, No= 18.8, Maybe=

14.1) mean score (M= 1.47, SD= .731). Instructional material is sufficient (Yes= 90.0, No= .7, Maybe= .3) mean score (M= 1.09, SD= .402). There aren't enough science teaching facilities (Yes= 100) mean score (M= 1.00, SD= .000). Nature of humanities is applied to real life (Yes= 53.7, No= 34.9, Maybe= 11.4) mean score (M= 1.58, SD=

.690). To follow my teachers (Yes= 15.4, No= 75.2, Maybe= 9.4) mean score (M= 1.94, SD= .496). Due to fear of poor result of science subjects' women opt to humanities (Yes= 69.1, No= 23.5, Maybe= 7.4) mean score (M= 1.38, SD= .622). Psychological factors led to choose humanities (Yes= 83.9, No= 8.7, Maybe= 7.4) mean score (M= 1.23, SD= .574). Humanities subjects have better Job prospects (Yes= 79.2, No= 14.8, Maybe= 6.0) mean score (M= 1.27, SD= .565). Men are underrepresented in the humanities compared to women (Yes= 92.6, No= 2.0, Maybe= 5.4) mean score (M= 1.13, SD= .469).

Women's Enrolment trends of humanities at secondary level are higher than sciences (Yes= 9.4, No= 2.0, Maybe= 4.0) mean score (M= 1.10, SD= .415). There are more trained teachers for humanities. (Yes= 40.3, No= 3 .3, Maybe= 21.5) mean score (M=

1.81, SD= .766). Less resources and funds are needed for humanities (Yes= 92.6, No= 2.7, Maybe= 4.7) mean score (M= 1.12, SD= .449). Because of their affinity for the home, women have been closely associated with humanities (Yes= 100) mean score (M= 1.00, SD=.000). It is better to study humanities than to stay uneducated (Yes= 100) mean score (M= 1.00, SD= .000). I skipped sciences because of its objectivity, what makes it so closely associated with masculinity (Yes= 91.9, No= 8.1) mean score (M= 1.08, SD= .273). Humanities are considered soft subjects that

appeal to women's emotionality. (Yes= 86.6, No= 13.4, Maybe= 1.27) mean score (M= .684, SD= 18). Women are less likely to choose sciences due to personal characteristics, such as a lack of arithmetic confidence and a distaste of competitive surroundings. (Yes= 73.2, No= 10.7, Maybe= 16.1) mean score (M= 1.43, SD= .756). Women are regarded to be stronger at verbal thinking and writing (Yes= 73.2, No= 10.7, Maybe= 16.1) mean score (M= 1.13, SD= .502). Because that women will certainly get married after college; humanities degrees are also considered to be "easy degrees" for them to obtain (Yes= 93.3, No= 6.7) mean score (M= 1.04, D= .282).

**Table 5**

Descriptive Statistics of Factors Regarding Barrier to Achieving Sustainable Development Goal

| <b>Factors</b>                               | <b>Minimum</b> | <b>Maximum</b> | <b>Mean</b> | <b>Std. Deviation</b> |
|--|----------------|----------------|-------------|-----------------------|
| <b>Gender Discrimination</b>                 | 6.00           | 31.00          | 8.8993      | 2.82303               |
| <b>Unfavorable Institutional Environment</b> | 4.00           | 10.00          | 6.1745      | 1.47379               |
| <b>Institution-Community Relationship</b>    | 4.00           | 8.00           | 4.7651      | .91820                |
| <b>Less Financial Allocation</b>             | 6.00           | 13.00          | 8.8658      | 1.71896               |
| <b>Family Factors</b>                        | 8.00           | 29.00          | 10.5436     | 2.52416               |
| <b>Societal Factors</b>                      | 5.00           | 49.00          | 9.3826      | 5.37964               |
| <b>Policies &amp; Management</b>             | 4.00           | 29.00          | 8.6174      | 3.71010               |

Table 5 showed the descriptive statistics of factors regarding barrier to achieving sustainable development goal. It was shown in table that the mean score of Gender Discrimination (M= 8.8993, SD= 2.82303), Unfavorable Institutional Environment (M= 6.1745, SD= 1.47379), Institution-Community Relationship (M= 4.7651, SD= .91820), Less Financial Allocation (M= 8.8658, SD= 1.71896), Family Factors (M= 10.5436, SD= 2.52416), Societal Factors (M= 9.3826, SD= 5.37964) and Policies & Management (M= 8.6174, SD= 3.71010).

**Table 6**  
**Information Regarding University Wise Data**

| University                   | Frequency | Percent |
|------------------------------|-----------|---------|
| Lahore College               | 36        | 24.2    |
| Queen Marry                  | 38        | 25.5    |
| University of Home Economics | 37        | 24.8    |
| University of Education      | 38        | 25.5    |

Table 6 shows the information regarding university wise data. It was shown from the table that 38 students were from queen marry and 38 from university of education, 37 students were from university of home economics, and 37 students were from Lahore college.

**Table 7**  
**Descriptive Statistics of Factors Gender Discrimination**

|   | Mean | Std. Deviation |
|---|------|----------------|
| <b>1. Gender discrimination is a major barrier of low enrolment of girls in STEM fields.</b>  | 1.19 | .392           |
| <b>2. Teachers and parents undervalue girls' arithmetic skills, since STEM fields are frequently seen as being masculine.</b>   | 1.38 | .488           |
| <b>3. Predetermine social value of gender; females are associated with inferior reproductive roles whilst males are associated with superior productive roles as financial earners.</b> | 1.48 | .501           |
| <b>4. Pakistan's female literacy and school enrolment rates demonstrate that investment in human development favors males</b>   | 1.89 | 2.403          |
| <b>5. The underrepresentation of women in STEM fields may be caused in part by the myth that females are intellectually inferior to males.</b>  | 1.44 | .682           |
| <b>6. STEM disciplines have a disposition to maintain rigid, exclusive, male-dominated cultures that are not friendly or attractive to women</b>  | 1.52 | .501           |

Table 7 descriptive statistics of factors gender discrimination. I was shown in the table that Gender discrimination is a major barrier of low enrolment of girls in STEM fields.

(M= 1.19, SD= .392 2). Teachers and parents undervalue girls' arithmetic skills, since STEM fields are frequently seen as being masculine. (M= 1.38, SD= .488 3).

Predetermine social value of gender; females are associated with inferior reproductive roles whilst males are associated with superior productive roles as financial earners. (M=

1.48, SD= .501). Pakistan's female literacy and school enrolment rates demonstrate that investment in human development favors males (M= 1.89, SD= 2.403). The underrepresentation of women in STEM fields may be caused in part by the myth that females are intellectually inferior to males. (M= 1.44, SD= .682). STEM disciplines have a disposition to maintain rigid, exclusive, male-dominated cultures that aren't friendly or attractive to women (M= 1.52, SD= .501).

**Table 8**

*Descriptive Statistics of Factors Unfavorable Institutional Environment*

|   | Mean | Std. Deviation |
|---|------|----------------|
| <b>7. Switching from science to humanities is due to authoritarian role of teaches and unfavorable environment of the institution.</b>                  | 1.60 | .922           |
| <b>8. Co-education is culturally unacceptable <u>incertain</u> families.</b>  | 1.42 | .495           |
| <b>9. Parents' lack of trust in educational institutions in the public sector may be responsible for the low enrolment rate of girls in STEM fields</b> | 1.75 | .915           |
| <b>10. Women have fewer role models to encourage their interest in these fields.</b>  | 1.41 | .637           |

Table 8 showed the unfavorable institutional environment. It was shown from the table that switching from science to humanities is due to authoritarian role of teaches and unfavorable environment of the institution. (M= 1.60, SD= .922). Co-education is culturally unacceptable in certain families. (M= 1.42, SD= .495). Parents' lack of trust in educational institutions in the public sector may be responsible for the low enrolment rate of girls in STEM fields (M= 1.75, SD= .915). Women have fewer role models to encourage their interest in these fields. (M= 1.41, SD= .637).

**Table 9**

*Program Wise Comparison of Students Perceptions*

| Factors                                      | Groups         | df  | Mean   | F     | Sig. | Square |
|--|----------------|-----|--------|-------|------|--------|
| <b>Gender discrimination</b>                 | Between Groups | 4   | 6.479  | .809  | .521 |        |
|  | Within Groups  | 144 | 8.011  |       |      |        |
|  | Total          | 148 |        |       |      |        |
| <b>Unfavorable institutional environment</b> | Between Groups | 4   | 7.344  | 3.621 | .008 |        |
|  | Within Groups  | 144 | 2.028  |       |      |        |
|  | Total          | 148 |        |       |      |        |
| <b>Institution-Community relationship</b>    | Between Groups | 4   | .762   | .901  | .465 |        |
|  | Within Groups  | 144 | .845   |       |      |        |
|  | Total          | 148 |        |       |      |        |
| <b>Less financial allocation</b>             | Between Groups | 4   | 1.190  | .396  | .811 |        |
|  | Within Groups  | 144 | 3.004  |       |      |        |
|  | Total          | 148 |        |       |      |        |
| <b>Family Factors</b>                        | Between Groups | 4   | 2.126  | .328  | .859 |        |
|  | Within Groups  | 144 | 6.489  |       |      |        |
|  | Total          | 148 |        |       |      |        |
| <b>Societal Factors</b>                      | Between Groups | 4   | 24.815 | .854  | .493 |        |
|  | Within Groups  | 144 | 29.055 |       |      |        |
|  | Total          | 148 |        |       |      |        |
| <b>Politics &amp; Management</b>             | Between Groups | 4   | 10.583 | .764  | .550 |        |
|  | Within Groups  | 144 | 13.853 |       |      |        |

Total 148

Table 9 showed the program wise comparison of student’s perceptions. It was discovered that the mean score of students perceptions regarding gender discrimination (F= .809, Sig= .521), Unfavorable institutional environment (F= 3.621, Sig= .008),

Institution-Community relationship (F= .901, Sig= .46), Less financial allocation (F= 1.190, Sig= .396), Family Factors (F= .328, Sig= .85), Societal Factors (F=.854, Sig= .49) and Politics & Management (F= .583, SD= .764). the significance difference remains insignificant for all factors at .005 level because the significance vale was above than .005.

**Table 10**

*Institution Wise Comparison of Students Perceptions*

| Factors                                      | Groups         | df  | Mean   | F    | Sig. |
|--|----------------|-----|--------|------|------|
| <b>Gender discrimination</b>                 | Between Groups | 3   | 10.673 | 1.34 | .261 |
|  | Within Groups  | 145 | 7.914  |      |      |
|  | Total          | 148 |        |      |      |
| <b>Unfavorable institutional environment</b> | Between Groups | 3   | 2.351  | 1.08 | .358 |
|  | Within Groups  | 145 | 2.168  |      |      |
|  | Total          | 148 |        |      |      |
| <b>Institution-Community relationship</b>    | Between Groups | 3   | .108   | .126 | .945 |
|  | Within Groups  | 145 | .858   |      |      |
|  | Total          | 148 |        |      |      |

|                                  |                |     |        |      |      |
|----------------------------------|----------------|-----|--------|------|------|
| <b>Less financial allocation</b> | Between Groups | 3   | .414   | .138 | .937 |
|                                  | Within Groups  | 145 | 3.007  |      |      |
|                                  | Total          | 148 |        |      |      |
| <b>Family Factors</b>            | Between Groups | 3   | 3.604  | .561 | .642 |
|                                  | Within Groups  | 145 | 6.429  |      |      |
|                                  | Total          | 148 |        |      |      |
| <b>Societal Factors</b>          | Between Groups | 3   | 12.949 | .442 | .723 |
|                                  | Within Groups  | 145 | 29.271 |      |      |
|                                  | Total          | 148 |        |      |      |
| <b>Politics &amp; Management</b> | Between Groups | 3   | 1.617  | .115 | .951 |
|                                  | Within Groups  | 145 | 14.016 |      |      |
|                                  | Total          | 148 |        |      |      |

Table 10 showed the institution wise comparison of student's perceptions. It was discovered that the mean score of students perceptions regarding gender discrimination ( $F= 1.34$ ,  $Sig= .261$ ), Unfavorable institutional environment ( $F= 1.08$ ,  $Sig= .358$ ),

Institution-Community relationship ( $F= .126$ ,  $Sig= .9445$ ), Less financial allocation ( $F= .138$ ,  $Sig= .937$ ), Family Factors ( $F= .561$ ,  $Sig= .642$ ), Societal Factors ( $F=.442$ ,  $Sig= .723$ ) and Politics & Management ( $F= .115$ ,  $SD= .951$ ). the significance difference remains insignificant for all factors at .005 level because the significance vale was above than .005.

### Qualitative Data Analysis

#### Theme 1: Decision to Leave Science and join Humanities

Actually, I wanted to continue sciences but when I observed keenly, I realized arts in scope is vast then sciences. Arts allow us to see events from a variety of perspectives, which aids our critical and analytical thinking. Science tends to describe facts in black-and-white terms that aren't always entirely accurate of the reality we live in.

When I came to know the vast variety and nature of arts i decided to opt for arts. Also, my brother forced me to not continue science because of its difficulty level, he convinced me by saying that



you can do much more in arts, you have variety of options and you can score better in arts so I moved from science into humanities.

### **Theme 2: Obstacles That Prevented to join STEM education.**

After looking into every perspective of both science and arts, with little pressure from my family, it was completely my decision as I came to know about my abilities which are Sharper when it comes to art subjects. One more thing I experienced that made my mind to continue with arts rather than sciences is that my family was not really willing to put extra ordinary money for my university fees.

Because they were already paying money for my brother education who was studying computer engineering at that time from a famous private university. So, I feel restricted in my choice for my future career and choose to study arts from a government institution with the thought of completing my studies and to not sit and waste my academic year.

### **Theme 3: Factor Keeping Most Women from Pursuing Careers In STEM**

In country like Pakistan' gender biases are mostly the reason that girls change their fields and career direction due to the male dominance not only in our houses but also at work places.

### **Theme 4: Financial Strain**

Financial strains does matter because these subjects have high criteria and not being able to take admission the girls opt to other private universities that offers the program on high fees and mostly parents don't want to pay that much to educate a girl.

### **Theme 5: Family Pressure**

Financial pressure is always there, parents are not so happy to pay my dues as they have a thought that it is of no use to educate a girl and it is more important for a girl to get married at small age so she can have a good marriage life after.

### **Theme 6: Suggestion for Pursuing Stem Education**

Our nation needs innovative generation full of diversity, if we really want to see changes in our future days then it is necessary for our government to make some better and effective plans for women empowerment in wider terms.

### **Recommendations**

The goal of the study is to inspire Pakistani researchers to investigate this crucial yet understudied topic in order to get crucial insights. Future study should cover a wide range of socioeconomic classes and geographic regions. Future study should also try to better understand the ideal level of parental involvement in female STEM education. In order to determine whether there are any counterparts between male and female predecessors of female engagement in STEM education, the predictors of male participation in STEM education should also be researched in the

Pakistani setting.

### **Discussion and Conclusion**

There is a scanty research available on the topic under the discussion, one study (Kaleci & Korkmaz, 2023) discovered that elementary school females had more favorable views towards science subjects. Although there were no gender differences regarding career seeking in science subjects.

Examining the current enrolment ratio of women in STEM fields was important to validate the current study to confirm that the problem of women's underrepresentation is indeed a current issue. Family pressure, financial concerns, and harassment have been some of the major areas identified as important barriers preventing the majority of women from establishing themselves as STEM professionals.

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