PERCEPTIONS OF TEACHERS ABOUT CAUSES OF FEMALE UNDER-REPRESENTATION IN STEM SUBJECTS AT UNIVERSITY LEVEL

Abdul Majeed[1], Dr. Asif Jamil*[2]

Original Article

1. PhD Scholar, Qurtuba University of science and information technology, D.I.Khan
Email: abdulmajeedset@gmail.com

2. Professor, Qurtuba University of Science and information technology D.I. Khan
Director (Rtd) Institute of Education and Research, Gomal University D.I.Khan
Email: asifjamil72@hotmail.com

Abstract

The shortage of females in Science, Technology, Engineering, and Mathematics (STEM) skills is an ongoing challenge for governments and policymakers worldwide.Last decade has seen an increase in most of the countries in female educational attainment as more females than males are enrolled in tertiary education and obtaining degrees in different discipline. However, females still remain underrepresented in STEM, with a low enrollment in these programs and even lower numbers of graduates. This low participation of women in STEM fields has been considered a critical issue in our society. It affects the rights of females to receive high quality education, to develop their skills and to improve their career prospects. Additionally, it has a negative impact on the outcomes of STEM projects. In this perspective, the basic purpose of this study was to examine perception of teachers about the causes of female under-representation in STEM subjects at University level. All teachers in public sector Universities situated in the southern districts of Khyber Pakhtunkhwa comprised population of the study. A total of 161 teachers were selected randomlyas sample for the study. The major causes perceived by the teachers were: male domination of STEM careers, lack of awareness of educational and career opportunities, decision-making in course selection, lack of female mentors/role models, lack of encouragement from parents, and influence of current science curriculum, teachers, labor market, parents, and peers. It was recommended thatrespective policies be reconsidered and gender disparities be addressed and awareness among female about STEM education and career be provided. Researching effective methods for recruiting and retaining females in STEM degree programs was also suggested.

Keywords: *STEM, Female, Underrepresentation, University Level, Career Prospects*

INTRODUCTION

STEM education plays an essential role in human resource development. This increases the competences and capacity of individuals and thus creates a skillful workforce that can be capable of leading the most important financial system towards sustainable financial development (Sinnes, 2006). Women now comprise 34.1% of Pakistan's total student enrollment at the university level, but it is economically necessary to make full use of women's potential at all level of STEM education, training and employment, to achieve national development (Latif, 2017). Pakistan strives to bring equal participation of women in STEM subjects like the rest of the world. In the National Education Policy 1998-2010, a target was set to reduce gender inequality in STEM education by 10%.

On 25 September 2015, the United Nations General Assembly approved the 2030 Agenda for Sustainable Development which has 17 Sustainable Development goals (SDGs) and goal 5 basis gender equality, aiming at achieving gender equality and empowering all women and girls (UNESCO, 2019). All individuals irrespective of their gender aspiration need knowledge, skills, occupations, values, and attitudes that empower them to contribute to sustainable development. Education, therefore, is crucial for the achievement of sustainable development. Education for sustainable development (ESD) is about shaping a better tomorrow for all so it has to start today. ESD endow with STEM education that truly provides knowledge, skills and occupations, relevant to every individual in the light of today's challenges. So there should be equality in accessing science, technology, engineering and mathematics (STEM) education.

Equal representation in STEM fields is not only a basic human right, but also a base for prosperous, peaceful and sustainable world. Staying women away from the modern technical fields of the 21st century will be a major hindrance to global progress. It is believed that women's unused skills in STEM fields can damage their ability to innovate in society (Chan, & Cheung 2018). Underrepresentation of women in the STEM sector has many negative effects. First of all, when a society fails to engage and recruit its full potential into a rising field, the condition of the society will get worse. Second, Women as a group will suffer when they fail to access "valuable occupations". Third, if women's representation in STEM is low, a brutal circle will be formed, which may discourage young female students from pursuing education or professional progress in STEM related fields (Sjoberg,2012).

The Constitution of Pakistan specify that STEM education is a basic right of bothgenders; as a chief support of country's basic physical and organizational structures and is one of the most powerful tool for change. STEM education is the key element that enables nations to build knowledge, skills and resources to shape their future destinations. It helps the talented young minds to achieve their national goals. But with the above background, where is STEM education for female inside our society, while for a woman, the STEM participation rate presents a bleak picture. In addition to the cultural version of gender roles, this difference is due to the low value of vocational education and lake of specialized STEM institutes for female. Out of practically 200 specialized institutions in the country, there are 10-15 exclusively for female. The rate of girl's STEM enrollment is half of that of boys. Similarly, the number of higher STEM institutes, especially for female, is very small; the rate of girl's STEM enrollment in Pakistani universities has been recorded nearly 19.7% (Chaudhry, 2009).

Underrepresentation in Science, Technology and Engineering are the issues that bound the female as compared to male. Barriers include direct sending of girls to universities, cultural as well as societal obstacles, the cost of opportunities and other barriers to their entry into formal higher education (Chaudhry, 2019). According to the World Economic Forum (WEF) Global Gender Gap Report 2015, Pakistan is now ranked 133rd out of 145 countries in the Gender Inequality Index (www.weforum.org). It lags behind Bangladesh and India, ranking 71nd and 86th respectively (www.hec.gov.pk).Gender inequality in STEM education has been recognized as a major problem since the early 2000s. Worldwide, the Cambridge Assessment (2015) survey found that 28.6% of women choose psychology, 29.1% biology and 27.2% history. Only 5.3% of women enroll in engineering and technology, 6.1% study mathematics. So far, 37% of males have been found in mathematics, followed by business studies at 35.6% and physics at 30.6%. In 2015, 6,159 girls took math at the university level, compared to 23,811 boys, according to a report published by the Institute of Mathematics in 2015 (Bahlieda, 2015). Studies shows that gender bias and negative

stereotypes play a significant role in widening the gap for women in pursuing STEM fields, and consequently reducing the opportunities for technical education and training opportunities (Yeung, & Liong, 2016).

The prejudice for women in STEM is acutely ingrained in the social and cultural structure of Pakistan. Contradict to popular belief prevailed in Muslim society, the Holy Qur'an focuses primarily on female, well-being as well as their development. In Muslim societies, female have been subjected to many human rights violations. The contrast between Islamic principles and females associated proven facts are challenging in the Islamic Republic of Pakistan.

RESEARCH OBJECTIVES

1. To determine teachers' perceptions about causes of female under-representation in the subjects of Science, Technology, Engineering and Mathematics at University level.
2. To specify teachers' perceptions about causes of discipline-wise female under-representation in the subjects of Science, Technology, Engineering and Mathematics.
3. To investigate teachers' perceptions about difference of urban and rural female student's under-representation in STEM subjects.

RESEARCH QUESTIONS

1. Do the teachers perceive elusivenessof STEM subjects as a root cause of female underrepresentation at university level?
2. Is there any difference of perception among teachers regarding causes offemale underrepresentation in STEM subjects?
3. Do the teachers perceive a difference of female underrepresenting in STEM subjects coming from urban and rural areas?

RESEARCH HYPOTHESES

To achieve the objective of the study, the following null hypotheses were tested

1. H01 There is no significant difference between STEM subjects inducing female under-representation from urban and rural areas.
2. H02: There is no significant difference of perception among teachers from different universities about the impact of STEM subjects on female under-representation at university level.
3. H03: There is no significant difference of perception among male and female teachers about the impact of STEM subjects on female under-representation at university level.

RESEARCH METHODOLOGY

In order to achieve the objective of the study the researcher adopted a survey-type quantitative approach. All the teachers in the public sector universities situated in the southern districts of Khyber Pakhtunkhwa were taken as the population of the study. Out of those 161 teachers were selected randomly on L.R. Gay's sample size formula. The researchers developed a comprehensive questionnaire for data collection form respondents. The questionnaire consists of 35 items comprised various parts i.e. demographic part; questions on females' ability, family responsibilities, gender stereotyping, personal interest in STEM, discriminatory behaviors, and gender-based subjects selection. The following factors were studies in detail in this research;(i) Impact of socio cultural and traditional impediments on choosing STEM course (ii) Influence of family support, status and gender preferences (iii) Impact of attitudinal issues and liking/disliking of STEM (iv) Male's discriminative, discouraging and behavioral issues.The questionnaires were validated through pilot testing on 16 university teachers of respective universities by providing

copies of questionnaires to them before those were administered on the sample. For the purpose of data collection the one of the researcher visited all the respondents. In the light of objectives of the study, the collected data was entered in Statistical Package for Social Sciences (SPSS), tabulated analyzed and interpreted by using descriptive statistics like mean standard deviation and inferential statistics i.e. t test.

RESULTS

In order to find out the perception of teachers about thecauses of female under-representation in STEM, the respondents were given different statements and were asked to rate, using a five point scale: 1 for SDA= Strongly, Disagree,2 for DA= Disagree ,3 for U= Uncertain, 4 for A= Agree and5 for SA= Strongly Agree.

Descriptive analysis of Teachers views

Table.1 Teachers perceptions regarding Causes of Female Under-Representation in STEM in Respect of:

#	Sociocultural and Traditional Impediments	SDA (%)	DA (%)	U (%)	A (%)	SA (%)	Mean
1	Female access to STEM education is still objectionable because of centuries old unequal gender norms.	3 2.1	69 47.6	1 .7	52 35.9	20 13.8	3.12
2	Female are thought to be groomed for future roles as mothers and wives due to their inferior status.	4 2.8	6 4.1	34 23.4	88 60.7	13 9.0	3.69
3	STEM fields are traditionally thought to be men's fields hence female find them inappropriate.	4 2.8	12 8.3	6 4.1	114 7.6	9 6.2	3.77
4	Restrictions on female's mobility owing to rigid customs and traditions, causes gaps in STEM education.	5 3.4	5 3.4	37 25.5	81 55.9	17 11.7	3.69
5	Gender stereotyping, which determines the anticipated features of femininity, keep female passive in STEM.	7 4.8	15 10.3	13 9.0	96 66.2	14 9.7	3.66
6	After marriage, female in the STEM sector are burden to the organization because of their reproductive role.	6 4.1	12 8.3	11 7.6	103 71.0	13 9.0	3.72
7	Female are discouraged from pursuing STEM careers due to patriarchal decision-making constraints.	11 7.6	17 11.7	42 29.0	63 43.4	12 8.3	3.33
	Average	6 3.9	19 13.4	21 14.2	85 58.8	14 9.7	3.56

It indicates the perception of teachers of public universities about the sociocultural and traditional impediment in the cause of female under-representation in STEM subjects. The mean of every item are calculated and mentioned in the table. The average mean of all the statements is 3.56, which was more than the cut point mean scale of 3.0. Similarly, 3.9% of teachers strongly disagreed, 13.4 disagreed, 14.2% were uncertain, 58.8% agreed, and 9.7 strongly agreed. The mean of all the options and statements confirm that many university teachers perceive socio-cultural and traditional impediments affecting female students' access to STEM subjects in Khyber Pakhtunkhwa. (See table 1)

Table.2 Teachers views regarding Causes of Female Under-Representation in STEM in Respect of:

#	Family Support, Status And Gender Preferences	SDA (%)	DA (%)	U (%)	A (%)	SA (%)	Mean
1	Due to the persistent interference from family, females are unable to pursue STEM education and careers.	11 7.6	11 7.6	4 2.8	107 73.8	12 8.3	3.68
2	Inadequate financial support from the family hinders female's ability to advance and succeed in STEM.	8 5.5	10 6.9	13 9.0	104 71.7	10 6.9	3.67
3	Parental noninvolvement in Awareness Programs contributes to girl's under-representation in STEM fields.	15 10.3	15 10.3	6 4.1	93 64.1	16 11.0	3.55
4	Male outperform their female classmate in terms of technical capabilities in STEM activities.	8 5.5	11 7.6	7 4.8	103 71.0	16 11.0	3.74
5	In Pakistan, the choice of STEM is much more gender specific due to the unequal status of male and female.	13 9.0	16 11.0	9 6.2	96 66.2	11 7.6	3.52
6	Lack of female STEM teachers at school levels contributes to gender preference in STEM choices.	5 3.4	8 5.5	8 5.5	109 75.2	15 10.3	3.83
7	Enforcement of policies may promote gender equality in curricula for girl's participation in STEM.	8 5.5	11 7.6	10 6.9	107 73.8	9 6.2	3.68
	Average	10 6.7	12 8.1	8 5.6	103 70.8	13 8.8	3.66

It indicates the viewpoint of teachers of public universities about the family support, status and gender preferences in the cause of female under-representation in STEM subjects. The average mean of all the options and items are also mentioned in the table, which is 3.66 and is more than the cut point mean scale of 3.0. Similarly, 6.7% of teachers strongly disagreed, 8.1 disagreed, 5.6% were uncertain, 70.8% agreed, and 8.8 strongly agreed. The mean of all the options and statements confirm that many university teachers perceive family support, status and gender preferences affecting female students' access to STEM subjects in Khyber Pakhtunkhwa. (See table 2)

Table.3Teachers views regarding Causes of Female Under-Representation in STEM in Respect of:

#	Females Attitudinal Issues and Liking/Disliking of Subjects	SDA (%)	DA (%)	U (%)	A (%)	SA (%)	Mean
1	STEM females feel unsecured by the attitudes of male than non-STEM females.	11 7.6	3 2.1	5 3.4	107 73.8	19 13.1	3.83
2	Girls generally perceive their abilities within all-girls contexts when choosing STEM related subjects.	4 2.8	8 5.5	13 9.0	109 75.2	11 7.6	3.79
3	Majority of female like to study Humanities and Arts, due to their relatively low cost.	6 4.1	7 4.8	9 6.2	103 71.0	20 13.8	3.86
4	The dislike of STEM education is associated with anxiety and fear emanating from negative perceptions.	10 6.9	14 9.7	10 6.9	103 71.0	8 5.5	3.59
5	Guidance for female to choose STEM subjects for their future professional development is insufficient.	3 2.1	5 3.4	5 3.4	115 79.3	17 11.7	3.95
6	Lack of content in the national language has reduced female's participation in STEM.	8 5.5	1 .7	34 23.4	85 58.6	17 11.7	3.70
7	The instructional materials are not interesting enough to stimulate the interest of female in STEM subjects.	3 2.1	9 6.2	16 11.0	105 72.4	12 8.3	3.79
	Average	6 4.4	7 4.6	13 9.1	104 71.6	15 10.2	3.78

It indicates the viewpoint of teachers of public universities about the females' attitudinal issues and liking/disliking of subjects in the cause of female under-representation in STEM subjects. The mean of all the options and items are also mentioned in the table which is 3.78 and is more than the cut point mean scale of 3.0. Similarly, 4.4% of teachers strongly disagreed, 4.6 disagreed, 9.1% were uncertain, 71.6% agreed, and 10.2 strongly agreed. The mean of all the options and statements confirm that many university teachers perceive females' attitudinal issues and liking/disliking of subjects, affecting female students' access to STEM subjects in Khyber Pakhtunkhwa. (See table 3)

Table.4 Universities Teachers views regarding Causes of Female Under-Representation in STEM in Respect of:

#	Male's Discriminative, Discouraging and Behavioral Issues	SDA (%)	DA (%)	U (%)	A (%)	SA (%)	Mean
1	Enrolled female endure prejudice in STEM programs from majority of male members owing to their gender.	2 1.4	7 4.8	43 29.7	85 58.6	8 5.5	3.62
2	Parents' discriminatory behaviors lead their daughters to believe that STEM are less important for females.	4 2.8	8 5.5	11 7.6	113 77.9	8 6.2	3.79
3	Female in STEM is discouraged by teachers' behavioral pressure to compete with male for exams.	5 3.4	9 6.2	8 5.5	114 78.6	9 6.2	3.78
4	The gender-based subjects' selection in the country has reduced the participation of female in STEM.	7 4.8	9 6.2	45 31.0	68 46.9	16 11.0	3.53
5	Lack of appropriate policies to reduce discriminative, discouraging and behavior for girls in STEM.	8 5.5	8 5.5	5 3.4	107 73.8	17 11.7	3.81
6	STEM Institutions removes behavioral issues for facilitating female's access to adequate learning.	6 4.1	13 9.0	10 6.9	101 69.7	15 10.3	3.73
7	Teachers make STEM courses enticing for female in order to help them comprehend benefits of STEM.	9 6.2	11 7.6	3 2.1	114 78.6	8 5.5	3.70
	Average	6 4.0	9 6.4	18 12.3	100 69.2	12 8.1	3.70

It indicates the viewpoint of teachers of public universities about the male's discriminative, discouraging and behavioral issues in the cause of female under-representation in STEM subjects. The average mean of all the options and items are also mentioned in the table. Which is 3.70, and is more than the cut point means scale of 3.0. Similarly, 4.0% of teachers strongly disagreed, 6.4 disagreed, 12.3% were uncertain, 69.2% agreed, and 8.1 strongly agreed. The cumulative percentage and mean of all the options and statements confirm that many university teachers believe male's discriminative, discouraging and behavioral issues influence female students' access to STEM subjects in the Province of Khyber Pakhtunkhwa.(See table 4)

Discipline Wise Female Under-Representation

Table.5 Discipline wise views of teachers about female under-representation in STEM.

Discipline Wise Views		SI	CT	RC	FSSGP	FAILS	MDDBI	AAE	JORDPL	DFUP	Mean of Means
Science	Mean	3.56	3.54	3.32	3.24	3.61	3.65	3.99	3.62	3.80	3.59
Technology	Mean	3.56	3.54	3.58	3.16	3.61	3.63	4.15	3.82	4.07	3.68
Engineering	Mean	3.66	3.60	3.63	3.55	3.67	3.69	4.06	3.89	3.82	3.73
Math	Mean	3.54	3.61	3.66	3.66	3.69	3.65	3.85	3.58	3.46	3.63

This shows the discipline-wise stance of teachers about female under-representation in STEM subjects at the university level. The discipline-wise mean of all the variables as well as the mean of means is also mentioned in the table. The average mean of respondents for all the four subjects i.e., Science, Technology, Engineering, and Math are 3.59, 368, 3.73, and 3.63 respectively. Therefore, it is confirmed that many teachers believe these causes influenced female to access STEM subjects especially technology and engineering subjects at the university level as mean values in these subjects were comparatively high.

R_q-1 Do the teachers perceive elusiveness of STEM subjects as a root cause of female underrepresentation at university level?

Table .6 Perceptions of Teachers Regarding Causes of Female Under-Representation in STEM in Respect of:

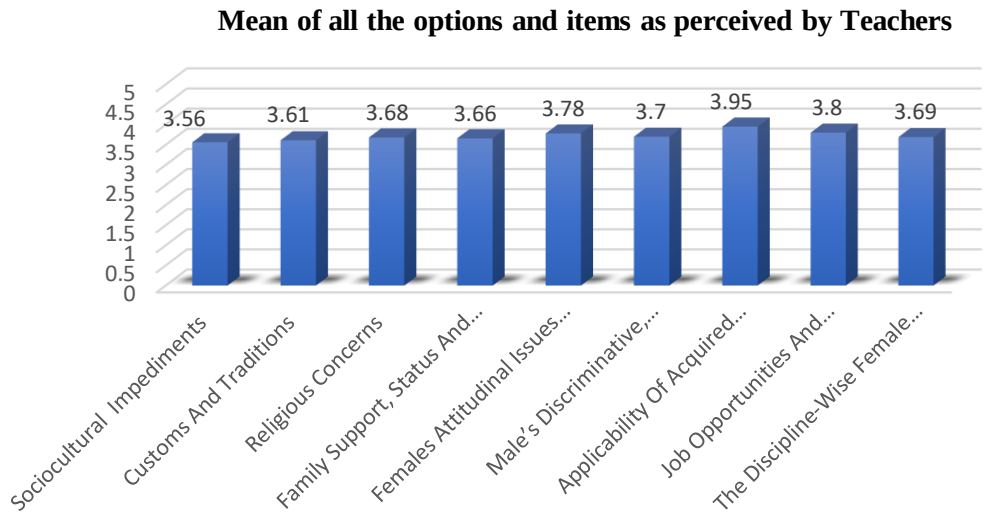
#	Elusiveness of STEM Subjects	SDA (%)	DA (%)	U (%)	A (%)	SA (%)	Mean
1	Males do better in STEM subjects because of their good mental and physical health then female.	11 7.6	3 2.1	5 3.4	107 73.8	19 13.1	3.83
2	Girls generally perceive their abilities within all-girls contexts during subjects selection.	4 2.8	8 5.5	13 9.0	109 75.2	11 7.6	3.79
3	Majority of female like to study Humanities and Arts, due to their relatively soft nature.	6 4.1	7 4.8	9 6.2	103 71.0	20 13.8	3.86
4	Female's dislike of STEM education is associated with anxiety and fear emanating from negative perceptions.	10 6.9	14 9.7	10 6.9	103 71.0	8 5.5	3.59
5	Males are good at practical projects like STEM fields while female are suitable for Social fields.	3 2.1	5 3.4	5 3.4	115 79.3	17 11.7	3.95
6	Lack of content in the national language has reduced female's participation in STEM.	8 5.5	1 .7	34 23.4	85 58.6	17 11.7	3.70
7	Female are unable to learn new STEM ideas rapidly due to comprehension difficulties.	3 2.1	9 6.2	16 11.0	105 72.4	12 8.3	3.79
	Average	6 4.4	7 4.6	13 9.1	104 71.6	15 10.2	3.78

It indicates the perceiptions of teachers of public universities about elusiveness of STEM subjects as a root cause of female underrepresentation. The percentages of all the options and the mean of every item are calculated in the table. The average percentages and mean of all the options and items are also mentioned in the table. The average mean of all the statements is 3.78, which is more than the cut point mean scale of 3.0. Similarly, 4.4% of teachers strongly disagreed, 4.6 disagreed, 9.1% were uncertain, 71.6% agreed, and 10.2 strongly agreed. The cumulative percentage and mean of all the options and statements confirm that many university teachers perceive elusiveness of STEM subjects as a root cause of female underrepresentation in the Province of Khyber Pakhtunkhwa.

R_q-2 Is there any difference of perception among teachers regarding causes of female underrepresentation in STEM subjects?

Table.7 Difference of Perception among Teachers regarding Causes of Female Underrepresentation in STEM Subjects

Variables	Mean	S.D
Sociocultural Impediments	3.56	.494
Customs And Traditions	3.61	.449
Religious Concerns	3.68	.522
Family Support, Status and Gender Preferences	3.66	.528
Females Attitudinal Issues and Liking/Disliking of Subjects	3.78	.425
Male's Discriminative, Discouraging and Behavioral Issues	3.70	.478
Applicability Of Acquired Education	3.95	.470
Job Opportunities and Respective Difficulties in Practical Life	3.80	.501



It indicates the viewpoint of teachers of public universities about nine study variables in the cause of female under-representation in STEM subjects. The mean of every cause is given in the table. The stance of teachers about female attitudinal issues and liking/disliking of subjects, male's discriminative, discouraging and behavioral issues, the applicability of acquired education, job opportunities and respective difficulties in practical life, and discipline-wise female under-representation was higher in contrast of other variables as mean values are 3.78, 3.57, 3.70, 3.63, 3.95, 4.08, 3.80, 3.69 and 3.69 & 3.92 respectively. Therefore, it is confirmed that a more significant number of university teachers believe female attitudinal issues and liking/disliking of subjects, male's discriminative, discouraging and behavioral issues, the applicability of acquired education, job opportunities and respective difficulties in practical life are common causes that influence female students' access to STEM subjects.(See table 7)

R_q-3 Do the teachers perceive a difference of female underrepresenting in STEM subjects coming from urban and rural areas?

Table.7 Locality wise difference of perceiption of teachers about Female Under-Representation in STEM Subjects.

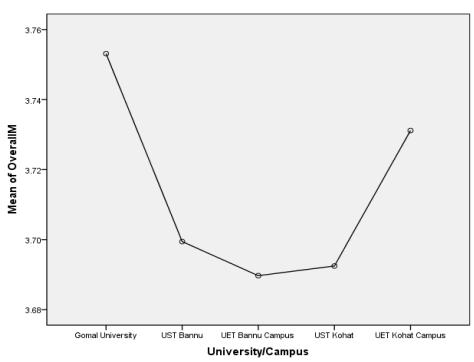
Locality wise response	N	Mean	S. D
Urban	309	3.63	.238
Rural	205	3.67	.388

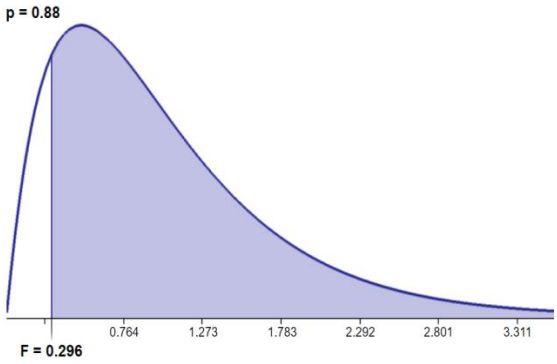
It indicates the locality-wise viewpoint of respondents about female under-representation in STEM subjects. The mean of every variable is given in the table. The mean of urban and rural respondents for the study variable were 3.63 and 3.67 having standard deviations of .238 and .388 respectively. Therefore, it is confirmed that a more significant number of university teachers perceived a difference of female underrepresenting in STEM subjects coming from urban and rural areas..

H_0-2 There is no significant difference of perception among teachers from different universities about the impact of STEM subjects on female under-representation at university level.

Table.9 University wise teachers' views about Female Under-Representation in STEM Subjects.

	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	.123	4	.031		
Within Groups	14.538	140	.104	.296	.880
Total	14.661	144			





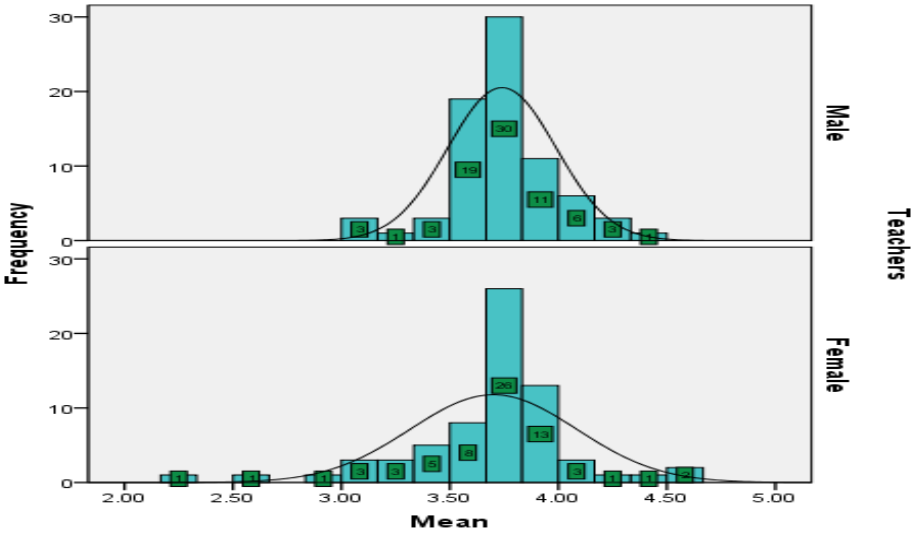
This indicates the university wise viewpoint of teachers about female under-representation in STEM subjects. The sum of squares for between and within groups are .123 and 14.538 whereas mean squares are .031 and .104 respectively. The F calculated and p values were .296 and .880 which are greater than the alpha value of 0.05 therefore, no significant difference was found among the views of respondents and the null hypothesis is hereby accepted. All the five universities teachers agreed that all the causes used in this study influenced female's access to STEM subjects. The F and P values are also presented in accepted region in the above graph.

H_0-3 There is no significant difference of perception between male and female teachers about the impact of STEM subjects on female under-representation at university level.

Table.10 Male and Female Teachers Views about Female Under-Representation in STEM Subjects

Teachers	N	Mean	S.D	$t_{calculated}$	$t_{tabulated}$	P
Male	77	3.73	.249	.724	±1.96	.471
Female	68	3.70	.383			

This indicates the gender wise viewpoint of university teachers about female under-representation in STEM subjects. The mean of male and female university teachers viewpoints for the study variable were 3.73 and 3.70 having standard deviations of .249 and .383 respectively. The t calculated and p values were .724 and .471 which are greater than the alpha value of 0.05 therefore, the null hypothesis is hereby accepted. Both male and female teachers agreed that all the causes used in this study influenced female's access to STEM subjects.



DISCUSSIONS

Globally speaking, women have made great strides in increasing their level of involvement in higher education and the workforce. Though, there remains a larger gender gap that persists at all levels of STEM fields (science, technology, engineering, and mathematics) all over the world. Unfortunately, the similar issue exists in Pakistan, where girls and women are underrepresented in these fields (Cho, 2018). The ratio of female students in Pakistan is increasing in non-STEM subjects, which is evident in HEC report which says that there is increase in the number of enrolled female students from 2001-2004 (Government-of-Pakistan, 2004) These results are further supported by The-News-Tribe (2011) which shows that the admissions of girls in universities have been increased by 400% while the admissions of boys increased by 235% in non-STEM subjects "but a decrease in the enrolment of women was also observed in STEM subjects.

The analysis reveals that if girls are given a supportive and accommodating environment then they would perform similarly well. It was also noted in the research that the poor quality of

science teaching in girls' schools is one of the main reasons why girls perform less well than boys in STEM fields. Finding competent female teachers to teach science subjects in girls' schools is challenging because the number of girls in this field are very few. However, boys excel in STEM fields because they are taught by knowledgeable and skilled individuals. The boys have stronger foundation in STEM subjects that's why they pursue higher education and careers in these subjects. The persistent belief in some societies that investing in a boy's education is more important than a girl's is another reason why fewer women choose careers in science and technology. Females are expected to sacrifice their careers and take care of their family and home. They are seen as homemaker while males are seen as earner in patriarchal cultures. Families take less interest in spending money on their daughters' education because they think that females remain at home and play a role of mother. In all around the world, Pakistan is considered as lowest performing countries in education. Females are expected to take easy subjects even they are able to study the STEM subjects. This argument is supported by Ahsan (2022).

The results of this research study are in line with the findings of He (2018), who contend that even though girls do not believe that boys performed better in STEM subjects, they still perceive science subjects as being more challenging than the social sciences, which increases the likelihood that they will abandon a career in science in the future. The results indicate that both male and female students and teachers agreed that all the causes used in this study influenced females to access STEM subjects. Matete (2021) also states that there are numerous factors that causes female underrepresentation in STEM subjects, including; socio cultural impediments, family support, status and gender preferences, psychological factors and women themselves. He argues that the involvement in STEM subjects is affected by the early marriage of women. As the women start their career, they also enter into the new responsibilities of wives and mothers which causes their drop out from science fields. The self-confidence of women in their ability to handle science-related subjects is low. Therefore, women choose arts subjects while men choose STEM subjects for their further studies.

CONCLUSIONS

It was concluded that all teachers believed female attitudinal issues and liking/disliking of subjects, male's discriminative, discouraging and behavioral issues, the applicability of acquired education, job opportunities and respective difficulties in practical life, are common causes that influence female students' access to STEM subjects. They believed STEM females feel unsecured by the attitudes of males than non-STEM females, females like to study arts and humanities, parents have discriminatory behaviors toward STEM subjects, lack of job opportunities and females are uninterested in STEM careers sinceit is difficult for them to help the community as a professional.Female are also underrepresented in science due to their poor ability to apply scientific logic. The teachers were found that these factors highly influenced bothurban and rural female students' access to STEM subjects. It was concluded that teachers believed these factors influenced female students' access, especially in technology and engineering subjects. Further, no significant variations were found in teachers views as stakeholders regarding urban and rural female underrepresentation in a STEM subject. Similarly, university-wise and gender-wise, no significant difference was found among stakeholders' views about female underrepresentation in STEM subjects.

RECOMMENDATIONS

- It is recommended that the public universities may organize proper seminars, workshops, and symposiums related to STEM subjects to develop positive attitudes and awareness among females about science subjects, especially technology and engineering.
- It is recommended that the vice-chancellors, faculty deans, and heads of departments may sit down to ponder and review the discouraging behavior of parents toward female students' access to STEM subjects and develop a road map to increase the enrollment of female students in science subjects involving government organization, community members and parents.
- It is recommended that the Provincial government may monetarily create job opportunities for female students in order to motivate them toward STEM subjects.
- It is recommended that the university may arrange meetings with parents to assist them in following the same standards of behavior for their sons and daughters in respect of discipline-wise choices in STEM subjects.
- It is recommended that university authorities motivate the Government of Pakistan to incentivize female students, especially in rural areas, to encourage them to actively participate in STEM subjects to meet the standards of excellence.

References

Ainley, J., Kos, J., & Nicolas, M. (2018).Participation in science, mathematics and technology in Australian education Camberwell, VIC: Australian Council of Educational Research (ACER).

Buccheri, G., Gürber, N.A. &Brühwiler, C. (2011).The impacts of gender on interest in science topics and the choice of scientific and technical vocations. International Journal of Science Education, 33(1), 159–178.

Bahlieda, R. (2015), The Democratic Gulag: Patriarchy, Leadership & Education, Published By: Peter Lang AG.Vol. 488, pp. 15-67

Chan, A. K., & Cheung, A. K. (2018).Gender differences in choosing STEM subjects at secondary school and university in Hong Kong, The Education University of Hong Kong.

Chaudhry, I.S. (2019), "Impact of Gender Inequality in Education on Economic Growth: An Empirical Evidence from Pakistan", the Pakistan Horizon Vol.60, No.4, 2009.

Dom, Vannak; Yi, Gihong(2018) Gender and subject choice: an empirical study on undergraduate femalestudents'online submission, asian journal of social sciences & humanities p40-47

Gay, L.R, & Airasian (2003) "Educational Research Competencies for Analysis and Application" (7th edition),Upper saddle River, NJ: Prentice Hall 28

Heather B. Gonzalez & Jeffrey J. Kuenzi (2012). Science, Technology, Engineering, and Mathematics(STEM) Education: A Primer

Javed, M. (2018). Investigating factors affecting female students' subject selection at secondary school level, International Journal of Information and Education Technology, 18(11), 815–820.

Kabeer, N. (2015). Gender Equality and Women's Empowerment: a critical analysis of the third millenniumdevelopment goal. Gender & Development, Pp, 13 -24.

Latif, A. (2017). “A Critical Analysis of School Enrollment and Literacy Rates of Girls and Women in Pakistan”, Educational Studies, Vol. 45, Issue 5. Pp. 424 – 439

Pasha, (2016). Beyond Bias & Barriers: Women of Pakistan in Science and Technology [Online][Accessed 17February 2021].

Sarseke, G. (2018). Under-Representation of women in science: From educational, feminist and scientific views,NASPA Journal, About Women in Higher Education, 11(1), 89101.

Roth, W-M, & Tobin, K. (2017).Aperies of identity in science: An Introduction. In Science, learning, identity: Socio-cultural and cultural-historical perspectives. Rotterdam: Sense Publishers.

Sasford.R. (2007). "Survey Research (2nd Edition)." London: Sage Publishers Limited.

Sinnes, A. (2006). Approaches to gender equity in science education: Three alternatives and two examples.African Journal of Research in Mathematics, Science and Technology Education, 10(1), 1-12

Sjoberg, S. (2012).Science and technology education in Europe: current challenges and possible solutions. Connect: UNESCO international science, technology and environmental education newsletter, 27, 1-5.

Taylor & Francis (2016) Gender differences in environmental concern: Reevaluating gender socialization Society & natural

UNESCO. (2018). Guidelines for inclusion: Ensuring access to education for all. UNESCO.

Wang, M. T., & Degol, J. L.(2017).Gender gap in science, technology, engineering, and mathematics (STEM):Current knowledge, implications for practice, policy, and future directions. Educational Psychology Review, 29(1), 119-140.

Wilson, N. J., Shuttleworth, R., Stancliffe, R., & Parameter, T.(2012).Masculinity theory in applied research with men and boys with intellectual disability. Intellectual and Developmental Disabilities, 50(3), 261-272.

X Tian (2020).Where Are All the Women?: Exploring the Research on the Underrepresentation of Women in Computer Science- Google scholar.

Yeung, D., &Liong, M. (2016).To STEM or Not to STEM?: Factors Influencing Adolescent Girls’Choice of STEM Subjects. Hong Kong: The Women’s Foundation Counterpoints.

https://www.usa.gov/federal-agencies/u-s-department-of-labor

https://www.weforum.org/reports/global-gender-gap-report-2016

http://library.aepam.edu.pk/Books/Pakistan%20Education%20Statistics%202016-17.pdf

https://www.worldbank.org/en/country/pakistan