WOMEN IN SCIENCE: BREAKING BARRIERS

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By

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ABSTARCT

The issue of girls' education (STEM education) is one of the key areas of research in the field of sociology. There has been a lot of studies done on women's participation in STEM education globally and have highlighted the challenges that girls confront in STEM studies and careers. However, it has remained a major problem in Pakistan which needs to be researched widely. This study examines the running trend of girls enrolling in STEM disciplines at the undergraduate and postgraduate levels in Pakistan as well as the perceptions of university students on girls' enrolment in science programme. The study was done at Quaid-i-Azam University Pakistan by conducting comprehensive interviews of 17 respondents. The respondents were female students of STEM subjects at Quaid-i-Azam University. Purposive Sampling technique was used for the selection of sample size and the data was analysed using thematic analysis technique. The findings of this study reveal that the ratio of female students in STEM is increasing significantly compared to previous years, owing to their parents' encouragement and support. The number of female students studying STEM subjects has increased purely because of parental support and motivation. Most students argued that they should pursue a career in STEM subjects because there are more opportunities in these fields based on desired skills. Furthermore, the respondent highlighted several challenges that they face in STEM, with job hunting being one of the most significant.

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CHAPTER NO. 1
INTRODUCTION

This study looks at young girls in Pakistan who are studying science. The participation of women in science and engineering is an important area of study. Even though women have been entering these fields at an increasing rate over the last two decades, a few studies have highlighted the barriers that women face when pursuing careers in science and technology. (Hill et.al, 2010).

Shoaib and Ullah, (2019) have examined the differences in the educational performance of men and women in recent decades in Pakistan. Educational results in secondary, higher, graduate, and postgraduate education outcomes reflect women's overperformance and men's' under-performance. Many studies have concluded that female students outnumber men in the arts, while boys excel in STEM subjects (Ullah, Ullah: 2021).

Educational, psychological, and social factors create barriers that resist female from pursuing scientific opportunities. Gender stereotype among parents and teachers, and beliefs about more job opportunities available to boys than girls, encompasses girls' poor performance in STEM education are the main causes. Social, economic, and psychological barriers were in the way of women's involvement in science and technology (Gregory, 2004).

The issue of girls' education (STEM education) is one of the key areas of research in the field of sociology. There has been a lot of studies done on women's participation in STEM education globally and have highlighted the challenges that girls confront in STEM studies and careers. However, it has remained a major problem in Pakistan which needs to be researched widely. This study examines the running trend of girls enrolling in STEM disciplines at the undergraduate and postgraduate levels in Pakistan as well as the perceptions of university students on girls' enrolment in science programme.

There is a plethora of literature available for this gender change in education all over the world. Aside from a few developed countries, boys have historically dominated girls, particularly in mathematics, physics, and technology.

There is many evidence suggested that generally boys are likely to do better than female students in the subjects classified as science subjects. Boys outperform girls in natural sciences, especially physics and mathematics. This trend has continued to increase over time. However, boys' performance has declined in art and humanities. The representation of girls in science and mathematics and boys in humanities is a global phenomenon. The

performance of girls has always been accessible to boys in western science subjects. The gap in science subjects namely math, engineering, and technology, once widened for male students and is now narrowing. Although there are few studies that confirm girls' performance in STEM studies, they are still lagging boys in developed and developing countries (Asante, 2010).

In Pakistan, girls are also poorly represented in science. Even though women are breaking down barriers in STEM fields and are more likely to emerge in science subjects than a few decades ago, they are still lagging boys. They can perform better if given a good and favourable environment

1.1 Statement of the Problem

The issue of girls in sciences education or STEM education is one of the key areas of research in sociology of education. Much research has been done on women's participation in STEM education that highlights the barriers to the situations that girls and women face in STEM studies and careers. Scanning the literature from previous studies, it is discovered that females are involved and participate at a lower rate than males in the STEM sector for social, cultural, and psychological reasons.

There is a lot of research being done on women's catch in STEM education in northern countries. However, in Pakistan, those lessons no longer exist and remain unspoken. Girls outperform boys in education all over the world; however, historically, boys have dominated girls, particularly in math, physics, and technology, apart from a few developed countries.

Women have been observed to cross the barrier and are more likely to appear in STEM studies than in previous years. Many successful interventions have encouraged women to participate actively in STEM education. This study investigates the trend of women becoming involved in science education, as well as the perspectives of university students on this trend of girls in science

1.2 The Objectives of Study

This study embarks on the following objectives:

1) To examine the running trend of girls' enrolment into undergraduate and postgraduate Science Subjects/ Disciplines at Quaid-i-Azam University, Islamabad.
2) To explore the university students' perspectives on this trend of girls in science.

1.3 Research Questions

1) How do female STEM students explain their interest in science subjects?

1.4 Significance of the Study

This study has both theoretical and practical significance and the findings will make excellent reading material for classroom teaching and discussion. Furthermore, the outcomes of the current study would be a valuable resource for future researchers. Current research addresses the need to explore best practices to promote female enrolment and retention in STEM programs.

The research has added a voice to the efforts of those committed to improving the status of women around the world and specifically in Pakistan. In practice, the study findings provide a good starting point for policymakers and experts looking to motivate women in the job market. Information collected and analysed from the female student through the interview process will be passed on to educators and parents. The information can be used by educators to create programs that will stimulate interest and achievement for girls in STEM areas. This information can also be used by parents to ensure that they understand how outside-of-the-classroom influences and motives play an important role in girls' STEM decision-making.

1.5 Organization of the study

Chapter one gives the introduction to the topic of study, objectives of study, statement of the problem, research question, and significance of study and thesis outline.

Chapter two consists of the background and literature study of the area. The need for the research can be better understood in this chapter by reviewing previous research papers and applying theory.

The chapter three describes the methodology used to conduct the study including tools, method of collection, analysis of data, and lastly ethical consideration of the research was discussed.

Chapter four reports the findings and detailed discussions of the study.

Chapter five summarizes the conclusions based on this study, limitations of the study, and future recommendations are also presented for future study in this field.

CHAPTER NO. 2
REVIEW OF THE LITERATURE

The first chapter introduced the study and outlined the study's objective, research questions and statement of the problem. This chapter presents comprehensive literature review on the topic under research. This chapter is divided into two parts: part one is empirical review and the part two consists of theoretical review.

2.1 Part one: Empirical studies

Women account for roughly half of the world's population, therefore, their rights to an education cannot be ignored, as they constitute significant global resources. (Somani, 2017). In today's world, it is now a well-known fact that girls are outperforming in a wide range of academic subjects (Ullah, 2019).

Girls are outperforming in school and college level examinations (Ullah et al. 2020). In 1970s and 1980s, the debate and key focus of research in the developed and developing countries was the issue underperformance in education. After mid-1990s, due to feminist struggle and favourable learning environment, there has been reversal change in educational performance (Ullah et al. 2021).

Parvazian, (2017) also analysed that women's participation in education has increased due to sociocultural changes. Shoaib & Ullah, (2019) observed a variation in male and female educational performance in recent decades across Pakistan. Educational results in secondary, higher, graduate and post graduate level shows females' outperformance and males' underperformance in education.

David, (2015) noticed that there had been changes in the higher education and women's life due to social transformation. Women are now more participating in education and employment. He argues that although many changes are welcomed in education, but still no gender equality has been achieved. Despite feminist involvement has been increased, patriarchy and hegemonic masculinity is still strongly experienced in education.

Ullah et al., (2021) argued that the boy's underperformance in education is due to parental unconditional and unlimited love, parental absence, and excessive use of social media by boys, free mobility and unrestrained outdoor activities and the work burden of boys, in addition to their studies. According to Gallagher (1997), girls' optimistic attitudes toward schools lead to their outperforming in school and distinguish them from boys in educational achievement. Gallagher goes on to say that in England, Scotland, and New Zealand, a

shortage of male teachers, gender stereotyping by teachers, appraisal favouring girls, boys resisting authority, and a girls-friendly and favourable atmosphere are all contributing factors to boys' underperformance. Bawden (2007) goes even further, arguing that the feminization of the teaching profession at the secondary level has resulted in a lack of male role models, which has a negative effect on boys' educational success, especially at the secondary level.

Science and engineering are very important for modern societies. They are connected to powerful social institutions, particularly to the government and to the economy, and they have broad and deep consequences for the present and future in areas including health and healthcare, communication and data banks, consumer goods, transportation, irrigation, energy, pollution, and environmental controls (Fox, 2006; Sonnert and Holton, 2002 as cited in Sonnert et al. 2007).

Science and engineering careers play an important role in every work force. In these careers women are underrepresented as compared to men. Thus, women's participation as undergraduate majors and degree recipients in science and engineering is an important area of analysis (Sonnert et al. 2007).

Baker and Leary, (1995) stated that over the years many factors have been investigated to understand why few women choose science careers. These factors influence girls to choose or reject a scientific career. A few studies have concluded that female students outperform male in arts humanities, while boys are better performing in STEM subjects (Ullah, et al., 2021). Girls are performing well and had surpassed boys in humanities (O'Donnell & Sharpe 2002 as cited in Ullah, Ullah:2021). Valian, (2007) observed that there are few women in science, especially at top. A smaller percentage of women's get advanced degrees in natural sciences.

He further asserted that one of the explanations for underrepresentation of women in natural sciences and math is that they are less talented than men. Another reason for underperformance of women in science is that they are less interested in professional carrier in science than men. Ullah, Ullah & Ahmed, (2020) reveal that in industrializing and least industrializing countries boys underperform in arts and humanities due to social construction that they are only for science subjects, so they do not take interest in arts subjects. The

performance of Girls and boys in education is affected by sociocultural context and environment. Girls' performance in science subject had not been improved compared to arts and humanities (Ullah, Ullah & Ahmed, 2020).

Only those girls, who had a close friend or family member engaged in science related field, with-hold from stereotypes, and presented positive images of both scientists and science related careers (Baker and Leary, 1995). Ullah et al. (2020) argues that although girls are outperforming in school and college level examination, they are underperforming than boys in science subjects. He further explained that the evidence from Khyber Pakhtunkhwa (Pakistan) shows that the main reason for girls' underperformance in science subject is due to traditional beliefs that science subjects are male dominated subjects. Gender stereotype among parents and teachers, and the belief about more job opportunities available to boys than girls, encompass girls' underperformance in science subject. Girls can perform well in science subject if favourable environment is given to them.

Ullah, Ullah & Bilal (2020) explained that in the context of developed countries boys dominated girls in science, technology, engineering, and mathematics (STEM). Biological essentialist argues girl's underperformance in STEM is due to biological factors while feminists associate girls' underperformance in STEM with social factors. According to Ullah, social factors, rather than biological factors, influence more girls' underperformance in STEM education. Sociocultural factors have a great impact in girls' underachievement in science subjects.

He asserted that girls and boys are equal by birth and there are no innate differences that affect their performance in education. After birth they developed according to the society in which they live. These gendered and traditional practices of socialization have resulted into girls' underperformance in science subject. In an article (Kilmer, 2010) the biological essentialists' and feminists' reasons for girls' underperformance in STEM are outlined. Resultantly, the article compared the two methods, their underlying concepts, and the empirical data they use to support their positions. The authors' study of both approaches helps them to better understand the relationship between gender and educational success. The performance of girls in STEM subjects is affected by social rather than biological

factors, according to this study. Thus, it was concluded in this research article that sociocultural factors are to blame for girls' poor performance in STEM subjects.

Ullah et al.2020 explained that traditionally, STEM remains male dominated and masculine field (Hedges & Nowell, 1995: Ullah & Ullah ,2019 as cited in Ullah et al., 2020). He further revealed that in developed countries girls outshine boys in the subject of science (Machin & McNally ,2005: Clark Blickenstaff, 2005).

Except few developed countries, girls fall behind in science subject (Asante, 2010). Researcher concluded that boys perform better than girls in STEM due to their reasoning abilities while girls do better in arts and humanities due to their verbal abilities (Hedge & Nowell, 1995: Wang & Degol, 2017 as cited in Ullah et al., 2020). Based on the argument of Ullah et al. (2020), In developing societies STEM is dominated as masculine field which discourages girls, so they lose their interest and underperform in STEM education.

Empirical evidence from the developed and under developing countries suggested that girls are outperforming boys in education. Girls are although performing better than boys but they are not doing well in science technology engineering and math (STEM). Boys are performing well in STEM education, but they are not well performing in arts and humanities. Girls in STEM education lag not only in high school and college, but also at the university level. (Ullah, Ullah & Ahmed, 2020). In their study they mentioned that the grades of girls are very low in STEM education, but they are performing good in literature and other social sciences.

Only few girls have shown good performance in cities and urban environment. “Girls in rural areas do not get helpful and friendly environment for science subjects and that’s the main reasons of their poor performance and low grades in such setting” (Chamdimba, 2003). The reason for the loss of high ability of women from SME (Science, Mathematics and Engineering) major is not well understood however researcher indicated an early loss of confidence in their ability to choose science among such women. Women who leave science major greatly exceed than men (Seymour, 1995).

According to Hill et al. (2010), women are becoming more prevalent in science and engineering, but men continue to outnumber women, particularly at the upper levels of these professions. Girls’ achievements and interest in Math and Science is shaped by the

environment in which they are living. He further argues that in research it was found that when teachers and parents tell girls that their intelligence can expand with experience and learning, girls do better on math tests and are more likely to say that they want to continue to study math in the future.

Today, the interest of girls in math and science subjects is affected by the stereotype that boys are better than girls in math and science. Cultural factors have been found to limit girls' interest in mathematics and mathematically careers and course. If girls grow up in an environment that enhances their success in science and math with spatial skills training, they are more likely to develop their skills as well as their confidence and consider a future in a STEM field. Implicit biases against women in science prevent girls and women from pursuing science from the beginning.

In women, manly masculine stereotypes about STEM, parents' expectations of daughters, peer norms, and lack of fit with personal goals make young ladies move away from STEM fields. In early adulthood, feeling like a misfit in STEM classes, being vastly outnumbered male peers, and lacking female role model causes women to stay away from STEM majors or leave rashly. Evidence-based projects and approaches can eliminate hindrances for female in STEM. The leaky pipeline (the way in which women become underrepresented in the STEM fields) starts early**.**

From middle school through college, female students do not perform better on some types of science and mathematics tests compared to male peers and report less confidence and aspiration. Moreover, parents are early socializers of their children's academic interests, and they influence children interest in STEM. If girls get interest in STEM, they cannot continue their interest in higher education due to signal that they do not belong to STEM career, especially physical sciences, computer science, engineering, and mathematics. These things, in turn hinder women's achievement, engagement, and persistence in STEM majors by making them question whether their abilities, interests, and aspirations are compatible with STEM (Dasgupta & Stout, 2014). Hall, (2018) revealed that in the science community female face several forms of gender-based biases and discrimination. These hurdles create difficult circumstances for them to develop positive science identities.

National Science Foundation, Division of Science Resources Statistics, 2009 shows that women earned 48,001 biological science degrees in 2007, compared with only 7,944 computer science degrees, 2,109 electrical engineering degrees, and1,024 physics degrees. In comparison, men earned 31,347 biological science degrees, 34,652 computer science degrees, 16,438 electrical engineering degrees, and 3,846 physics degrees (Hill et al., 2010). This witness that women appear less in computer science, electrical engineering and physics degree as compared to men.

Cronin and Roger (1998) discovered that the proportion of females in Scottish higher institutes (1995-1996) who progressed from undergraduate to professor level in SET (science, engineering, and technology) was 0.32 (undergraduates in SET), 0.28 (postgraduates in SET), 0.17 (lecturers in SET), 0.06 (senior lecturers in SET), and 0.04. (Professors in SET). This reveals that total number of females who entered SET courses decreases because they are filtered out at each stage.

The proportion of female in SET diminishes continuously as they progress in higher education. Women underrepresentation in retention and recruitment in SET in higher education is due to many reasons like, the stress and isolation of being in a minority, negative attitudes of male peers, lecturers and other staff, lack of opportunities for cooperative or interactive learning and many more. Male science undergraduates still outnumber female science undergraduates, but the gap has narrowed in the recent decay.

Even though women have been entering these fields at an increasing rate over the last two decades, a few studies have highlighted the barriers that women face when pursuing careers in science and technology. (Hill et.al, 2010).

Shoaib and Ullah, (2019) have examined the differences in the educational performance of men and women in recent decades in Pakistan. Educational results in secondary, higher, graduate, and postgraduate education outcomes reflect women's overperformance and men’s’ under-performance. Many studies have concluded that female students outnumber men in the arts, while boys excel in STEM subjects (Ullah, Ullah: 2021).

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STEM education are the main causes. Social, economic, and psychological barriers were in the way of women's involvement in science and technology (Gregory, 2004).

The issue of girls' education (STEM education) is one of the key areas of research in the field of sociology. There has been a lot of studies done on women's participation in STEM education globally and have highlighted the challenges that girls confront in STEM studies and careers. However, it has remained a major problem in Pakistan which needs to be researched widely. This study examines the running trend of girls enrolling in STEM disciplines at the undergraduate and postgraduate levels in Pakistan as well as the perceptions of university students on girls' enrolment in science programme.

There is a plethora of literature available for this gender change in education all over the world. Aside from a few developed countries, boys have historically dominated girls, particularly in mathematics, physics, and technology.

There is many evidence suggested that generally boys are likely to do better than female students in the subjects classified as science subjects. Boys outperform girls in natural sciences, especially physics and mathematics. This trend has continued to increase over time. However, boys' performance has declined in art and humanities. The representation of girls in science and mathematics and boys in humanities is a global phenomenon. The performance of girls has always been accessible to boys in western science subjects. The gap in science subjects namely math, engineering, and technology, once widened for male students and is now narrowing. Although there are few studies that confirm girls' performance in STEM studies, they are still lagging boys in developed and developing countries (Asante, 2010).

In Pakistan, girls are also poorly represented in science. Even though women are breaking down barriers in STEM fields and are more likely to emerge in science subjects than a few decades ago, they are still lagging boys. They can perform better if given a good and favourable environment

Personal choices, theory, lack of role models, and cultural norms influence women's choice in higher education, while gender discrimination hiring, hiring and inspection procedures, restrictive rules and procedures, evictions networks, male-dominated culture, and workplace and family disputes have a large direct gap effects on various aspects of women's work

development. In addition, women face several additional obstacles affecting their performance and continuity in the workplace, such as such as lack of access to information, funding or institutional support, biased research evaluation processes, and low recognition in the field. Several countries have recognized the importance of these restrictions and have recognized them we have used policy tools to overcome and promote gender equality in science. Despite these efforts, differences in participation, productivity, and educational development and the technical stairs continue (Castillo et al., 2014).

Pell, (1996) stated that although the number of women graduating from doctoral and academic positions has increased over the past 20 years, women are still under-represented in universities. The extent and causes of this inequality are discussed. There are four critical times that affect women's retention in science: childhood, adolescence, college, and graduation. Over the past three seasons, the paper discusses the relationship between self-esteem and work performance, quality and impact of classroom interaction, and the role of counsellor / mentor.

In addition, some of the difficulties involved in combining work and family responsibilities are considered. Effective communication and counselling play an important role at the level of intelligence. If our goal is to have a scientific community that is equally open to all members of society at large, it is necessary to keep young girls involved in mathematics and science and to maintain their self-esteem. The new intelligence needs to be fully integrated into the activities of the department and the specialist through both formal processes and good interaction in the name of existing intelligence.

Ladies address around half of the total populace so their right of instruction can't be disregarded as they structure huge worldwide assets (Somani, 2017). In the present world, it is currently a verifiable truth that young ladies are beating in a wide scope of scholarly subjects (Ullah, 2019). Girls are outflanking in school and school level assessments (Ullah et al. 2020).

In 1970s and 1980s, the discussion and key focal point of exploration in the created and non-industrial nations was the issue underperformance in instruction. After mid-1990s, because of women's activist battle and ideal learning climate, there has been inversion change in instructive execution (Ullah et al. 2021). Parvazian, (2017) additionally broke down that

ladies' cooperation in instruction has expanded because of sociocultural changes. Shoaib and Ullah, (2019) noticed a variety in male and female instructive execution in ongoing a very long time across Pakistan. Instructive outcomes in optional, higher, graduate and post alumni level shows females' outperformance and guys' underperformance in schooling.

David, (2015) saw that there had been changes in the advanced education and ladies' life because of social change. Ladies are currently more taking an interest in schooling and business. He contends that albeit many changes are invited in schooling, yet no sexual orientation balance has been accomplished. Regardless of Feminist association has been expanded, still male-controlled society and authoritative manliness is still firmly knowledgeable about training. Ullah et al., (2021) contended that the kid's underperformance in training is because of parental genuine and limitless love, parental nonappearance, unreasonable utilization of web-based media by young men, free portability and over the top outside exercises and the work weight of young men, notwithstanding their examinations.

As per Gallagher (1997), young ladies' hopeful mentalities toward schools lead to their beating in school and recognizes them from young men in instructive accomplishment. Gallagher proceeds to say that in England, Scotland, and New Zealand, a deficiency of male educators, sexual orientation generalizing by instructors, evaluation inclining toward young ladies, young men opposing power, and a young lady’s cordial and ideal environment are on the whole contributing variables to young men's underperformance. Bawden (2007) goes significantly further, contending that the feminization of the showing calling at the optional level has brought about an absence of male good examples, which negatively affects young men's instructive achievement, particularly at the auxiliary level.

Science and designing are vital for present day cultures. They are associated with incredible social organizations, especially to the public authority and to the economy, and they have wide and profound ramifications for the present and future in regions including wellbeing and medical care, correspondence and information banks, customer products, transportation, water system, energy, contamination, and ecological controls (Fox, 2006; Sonnert and Holton, 2002 as referred to in Sonnert et al. 2007). Science and designing professions assume significant part in each work power. In these vocations ladies are underrepresented when contrasted with men. Accordingly, ladies' investment as undergrad majors and degree

beneficiaries in science and designing is a significant space of investigation (Sonnert et al. 2007).

Bread cook and Leary, (1995) expressed that throughout the long term many variables have been explored to comprehend the reason why not many ladies pick science vocations. These elements impact young ladies to pick or reject a logical vocation. A couple of studies have reasoned that female understudy beat male in expressions humanities, while young men are better acting in STEM subjects (Ullah, et al., 2021). Young ladies are performing admirably and had outperformed young men in humanities (O'Donnell and Sharpe 2002 as referred to in Ullah, Ullah:2021). Valian, (2007) saw that there are not many ladies in science, particularly at top. A more modest level of ladies' get postgraduate educations in inherent sciences.

He further declared that one of the clarifications for underrepresentation of ladies in innate sciences and math is that they are less skilled than men. One more justification for underperformance of ladies in science is that they are less keen on proficient transporter in science than men. Ullah, Ullah and Ahmed, (2020) uncover that in industrializing and least industrializing nations young men fail to meet expectations in expressions and humanities because of social development that they are just for science subjects, so they don't check out expression's subjects. The presentation of Girls and young men in schooling is impacted by Sociocultural setting and climate. Young ladies' presentation in science subject had not been improved as contrast and expressions and humanities (Ullah, Ullah and Ahmed, 2020).

Just those young ladies, who had a dear companion or relative occupied with science related field, with-hold from generalizations, and introduced positive pictures of the two researchers and science-related vocations (Baker and Leary, 1995). Ullah et al. (2020) contends that although young ladies are outflanking in school and school level assessment, they are failing to meet expectations than young men in science subjects.

He further clarified that the confirmations from Khyber Pakhtunkhwa (Pakistan) shows that the principle justification behind young ladies' underperformance in science subject is because of customary convictions that science subjects are male overwhelmed subjects. Sexual orientation generalization among guardians and instructors, and conviction about more open positions accessible to young men than young ladies, incorporate young ladies'

underperformance in science subject. Young ladies can perform well in science subject in the event that positive climate is given to them.

Ullah, Ullah and Bilal (2020) clarified that with regards to created nations young men ruled young ladies in science, innovation, designing, and math (STEM). Natural essentialist contends young lady's underperformance in STEM is because of organic variables while women's activists' partner young ladies' underperformance in STEM with social elements. Ullah contended that rather than natural factors, the social variables impact younger lady's underperformance in STEM Education.

Sociocultural elements have an extraordinary effect in young ladies' underachievement in science subjects. He stated that young ladies and young men are equivalent by birth and there are no inborn contrasts that impact their presentation in instruction. After birth they are created by society in which they live. These gendered and customary acts of socialization have come about into young ladies' underperformance in science subject. In an article (Kilmer, 2010) the natural essentialists' and women's activists' purposes behind young ladies' underperformance in STEM are illustrated.

Resultantly, the article thought about the two techniques, their hidden ideas, and the observational information they use to help their positions. The creators' investigation of the two methodologies assists them with bettering comprehend the connection among sex and instructive achievement. The exhibition of young ladies in STEM subjects is impacted by friendly rather than organic variables, as indicated by this review. Consequently, it was deduced in this exploration article that sociocultural elements are at fault for young ladies' lackluster showing in STEM subjects.

Ullah et al.2020 clarified that generally, STEM stays male ruled and manly field (Hedges and Nowell, 1995: Ullah and Ullah ,2019 as referred to in Ullah et al., 2020). He further uncovered that in created nations young ladies dominate young men in the subject of science (Machin and McNally ,2005: Clark Blickenstaff, 2005). But hardly any created nations, young ladies fall behind in science subject (Asante, 2010). Scientist presumed that young men perform better compared to young ladies in STEM because of their thinking capacities while young ladies improve in expressions and humanities because of their verbal capacities (Hedge and Nowell, 1995: Wang and Degol, 2017 as referred to in Ullah et al., 2020). In

light of the contention of Ullah et al. (2020), I state that in creating social orders STEM is ruled as manly field which debilitate young ladies, so they lose their advantage and fail to meet expectations in STEM training.

Exact confirmations from the created and under emerging nations recommended that young ladies are beating young men in training. Young ladies are although performing better compared to young men however they are not doing admirably in science innovation designing and math (STEM). Young men are performing great in STEM instruction; however, they are not well acting in expressions and humanities. Young ladies' exhibition in STEM and kid's presentation in expressions isn't palatable.

Young ladies in STEM training stay behind not at school and school level but rather additionally at college level (Ullah, Ullah and Ahmed, 2020). In their review they referenced that the grades of young ladies are extremely low in STEM schooling, however they are performing great in writing and other sociologies. Just couple of young ladies have shown great execution in urban areas and metropolitan climate. "Young ladies in provincial regions don't get supportive and agreeable climate for science subjects and that is the primary reasons of their lackluster showing and low grades in such setting" (Chamdimba, 2003). The justification for the deficiency of high capacity of ladies from SME (Science, Mathematics and Engineering) major isn't surely known anyway specialist demonstrated an early loss of trust in their capacity to pick science among such ladies. Ladies who leave science major extraordinarily surpass than men (Seymour, 1995).

Slope et al., (2010) examined that lady in science and designing are expanding yet men keep on dwarfing ladies, particularly at the upper level of these callings. Young ladies' Achievements and Interest in Math and Science is Shaped by the Environment in which they are living. He further contends that in research it was tracked down that when instructors and guardians let young ladies know that their knowledge can extend with experience and learning, young ladies improve on numerical tests and are bound to say that they need to keep on concentrating on math later. Today, the interest of young ladies in math and science subjects is impacted by the generalization that young men are superior to young ladies in math and science.

In ladies, masculine manly generalizations about STEM, guardians' assumptions for little girls, peer standards, and absence of fit with individual objectives make youngsters get away from STEM fields. In early adulthood, feeling like a nonconformist in STEM classes, being incomprehensibly dwarfed male friends, and lacking female good example makes ladies avoid STEM majors or leave thoughtlessly. Proof based ventures and approaches can kill impediments for female in STEM. The flawed pipeline (the manner by which ladies become underrepresented in the STEM fields) begins early.

From center school through school, female understudies don't perform better on certain kinds of science and math tests contrasted with male companions and report less certainty and desire. Also, guardians are early socializers of their kids' scholastic advantages, and they impact kids interest in STEM. Assuming young ladies get interest in STEM, they can't proceed with their advantage in advanced education because of sign that they don't have a place with STEM vocation, particularly actual sciences, software engineering, designing, and math. These things, thusly prevent ladies' accomplishment, commitment, and diligence in STEM majors by making them question whether their capacities, interests, and goals are viable with STEM (Dasgupta and Stout, 2014). Lobby, (2018) uncovered that in the science local area female face a few types of sexual orientation-based predispositions and separation. These obstacles make troublesome conditions for them to foster positive science personalities.

Public Science Foundation, Division of Science Resources Statistics, 2009 shows that ladies procured 48,001 natural science certifications in 2007, contrasted and just 7,944 software engineering certificates, 2,109 electrical science certificates, and1,024 physical science certifications. In correlation, men acquired 31,347 natural science certificates, 34,652 software engineering certificates, 16,438 electrical science certifications, and 3,846 physical science certificates (Hill et al., 2010). This observer that ladies show up less in software engineering, electrical designing and physical science certification when contrasted with men.

Cronin and Roger (1998) found that the extent of females in Scottish higher organizations (1995-1996) who advanced from undergrad to educator level in SET (science, designing, and innovation) was 0.32 (students in SET), 0.28 (postgraduates in SET), 0.17 (instructors

in SET), 0.06 (senior teachers in SET), and 0.04. (Educators in SET). This uncovers that absolute number of females who entered SET courses diminishes in light of the fact that they are sifted through at each stage.

The extent of female in SET lessens persistently as they progress in advanced education. Ladies' underrepresentation in maintenance and enrollment in SET in advanced education is because of many reasons like, the pressure and disengagement of being in a minority, negative perspectives of male companions, speakers and other staff, absence of chances for agreeable or intelligent learning and some more. Male science students dwarf female science students, yet the hole has limited in the new rot.

Despite the fact that ladies have been entering these fields at an expanding rate throughout the most recent twenty years, a couple of studies have featured the hindrances that ladies face when seeking after professions in science and innovation. (Slope et.al, 2010).

Shoaib and Ullah, (2019) have inspected the distinctions in the instructive exhibition of people in ongoing a long time in Pakistan. Instructive outcomes in optional, higher, graduate, and postgraduate training results mirror ladies' overperformance and men's under-execution. Many investigations have reasoned that female understudy dwarf men in artistic expression, while young men dominate in STEM subjects (Ullah, Ullah: 2021).

Instructive, mental, and social elements make boundaries that oppose female from seeking after logical freedoms. Sexual orientation generalization among guardians and educators, and convictions about more open positions accessible to young men than young ladies, incorporates young ladies' horrible showing in STEM training are the primary driver. Social, financial, and mental boundaries were impeding ladies' association in science and innovation (Gregory, 2004).

Clark Blickenstaff, (2005) explained that the problem of female under-representation in STEM careers and majors is due to many factors that remove women from the STEM pipeline. This is due to the lack of positive experiences with science in childhood, lack of female scientist/engineers as role model, cultural pressure on women and pedagogy of science favours male students. A complex problem like this requires a multi-faceted solution, and time to allow innovations to take effect. Over time, individual actions by sympathetic educators will assist females to break down the filter in the STEM pipeline and result in

equal participation, which will be useful for STEM and useful for society in the long term. Orser et al., (2012) researched the barrier that women perceived in career development in the advanced technology sector. They examined that Canadian woman faced high proportion of the challenges they encountered to gender, and they resolve these challenges through personal, or 'do-it-yourself', solutions. According to Buck et al. (2008), students are more likely to choose careers when they can identify a role model in that career path. Girls face a lack of role models in science and are underrepresented in STEM fields.

Pell (1996) observed that while the number of women receiving doctorates and academic positions has increased in the past, women continue to be under-represented in university faculty in science subjects. The retention of women in science subject is influence by early childhood, adolescence, college, and the graduate school/job entry period, role of the advisor/mentor, and self-esteem. He further suggested that scientific community should be open equally to all members of the general population, it is necessary to keep adolescent girls involved in math and science and to maintain their self-esteem.

Castillo et al. (2014) explained in his research that with the advancement of jobs, women are facing additional obstacles — some new and some already existing explained. These barriers are closely related to access to networks, a culture dominated by men, superstitions, and personal and professional health disputes. The network plays an important role in the development of academic or scientific work jobs, such as new job opportunities or grants are often distributed over networks. However, letters indicate that women are often excluded from social media. Incomplete exploitation of women's skills in STEM areas creates significant losses a social opportunity. However, women face many barriers to their employment, retention, and promotion throughout STEM work. Depending on the stage of work, many obstacles have been identified in the literature, especially in relation to developed countries.

A Research (Scragg & Smith, 1998) was designed to find out why so few women graduate in computer science programme. The study was conducted within the range of their campus. And the key findings showed that the question isn't really one's retention. Less number of women, plan to continue their studies with computer science as their major subject. While some of the literatures suggested barriers do exist, they are less important than the low entry

rates. Women's retention in major is more, but it comes to bringing women into the major in the first place. As a result, the most successful options would be those that focus on recruiting rather than retention.

Historically, boys have outperformed girls in math, but in the recent few decades the gender gap has narrowed, and today girls are doing as well as boys in math on average (Hill et al., 2010). There has been noticeable increase in rates of women's participation and presence in managerial positions within the SET (science, engineering, and technology) fields. While rates of participation have increased, rates of retention and advancement of women to executive levels within the SET fields, especially in the private sector, remains limited. Women continue to feel hindered by the masculine culture of the SET sectors (Servon & Visser, 2011).

To alleviate these pressures as well as to promote women within these professions, policies aimed at promoting changes in organizational culture including promoting more female executives and expanding recruitment patterns to include more female applicants should be adopted by companies. Such programme may help to increase the presence of females in the corporate workplace while helping to change organizational culture through the introduction of more diverse perspectives in high level management positions. In research it was found that many women in the later stages of their graduate studies felt overwhelmed by the brutal work pressures which cause impossibility of women to get ahead.

Women are breaking barriers in the field of science and technology. This literature survey is throwing light on various studies which shows that women are outperforming men in science. However, a few studies are highlighting the barriers that women are facing in pursuing their career in science and technology.

Another research (Salzman & Lowell, 2012) outlines the universities' transformational efforts to increase participation of women and inclusion in academic S&E. These programmers addressed advance's main goal in three ways: growing the number of women in the pipeline, improving institutional structures and processes related to academic career transition points like recruitment, promotion, and tenure, and better equipping women to advance effectively across the pipeline.

Mentoring, coaching, networking, education and training, job and professional growth, leadership development, and special funding and opportunities were some of the pipeline programmes used to enhance individual career trajectories. Furthermore, work-climate impacts have been linked to many important organizational outcomes, including satisfaction, productivity and performance, retention, and emotional support via schooling, training, and development at advance universities, as well as initiatives to make departments (micro-climates) more collegial, inclusive, equal, and open, male colleagues' knowledge and practices were improved.

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According to (Steinke, 1997), barriers for young girls as well as women opting their careers in science are generated by educational, attitude, and sociocultural factors. One of the most important of these barriers has been identified as gender norms in science. This study primarily looks at a television show in the United States that questions gender roles in science. The images in this series, according to the study, challenge perceptions of women (Adler et al. 1992) scientists that have been documented in the US media by highlighting

their expertise, showing options for juggling the pressures of their workplace and home, as well as providing role models that have excelled in fields dominated by men. Furthermore, the findings is explored considering the gender schema principle, also there is a need for more research into the effect of successful woman role models on young women's interest in science.

A research (Scragg & Smith, 1998) was designed to find out why so few women graduate in computer science programme. The study was conducted within the range of their campus. And the key findings showed that the question isn't really one of retention. Less number of women, plan to continue their studies with computer science as their major subject. While some of the literatures suggested barriers do exist, that are less important than the low entry rates. Women's retention in major is more, but it comes to bringing women into the major in the first place. As a result, the most successful options would be those that focus on recruiting rather than retention (including outreach to secondary schools).

A review (Ullah, 2019) analysis was carried to provide a concise image of segregation in education in different social and cultural contexts around the world. According to the results of several studies across various cultures (Antlová, 2015), the pattern show that girls are outperforming while boys underperforming in education across the world, according to this study. Furthermore, this study shows that girls show extraordinary results not only in school and college, but also in higher education. The differences in genetics and the brain claim that girls are weak and less intellectual compared to boys, thus lack in education. It has been questioned by building on the results of current research. As a result of this research, it is proposed that girls will be just as successful in school as boys if they are given the same opportunities to prove themselves as boys.

In an article (Kilmer, 2010) the biological essentialists' and feminists' reasons for girls' underperformance in STEM are outlined. Resultantly, the article compared the two methods, their underlying concepts, and the empirical data they use to support their positions. The authors' study of both approaches helps them to better understand the relationship between gender and educational success. The performance of girls in STEM subjects is affected by social rather than biological factors, according to this study. Thus, it was concluded in this

research article that sociocultural factors are to blame for girls' poor performance in STEM subjects.

According to the study on Trends in Educational Equity of Girls & Women (Bogoiavlenski et al. 2010) it has been seen that across the world, girls are doing great in terms of academic achievement. This is a fascinating and noteworthy shift that can be seen in both the north and south in the world. This paper aims to provide clear evidence of inequality in educational performance in different cultural and societal contexts around the world. Furthermore, the results of the report illustrate the global gender reversal change in education. It also elucidates the factors that contribute to boys' underperformance and girls' outperformance in various societies. Boys are outperforming than girls in educational success in both industrialized and developing countries, according to a few reports. Boys and men consistently outperform girls and women in the field of spatial skills, which is one of the most significant gender gaps in cognitive ability.

Many people believe that spatial abilities are crucial for success in engineering and other science fields. However, research discussed in this study shows that a simple training course can develop people's spatial skills significantly in a short period of time. Girls who grow up in an atmosphere that promotes mathematics and science achievement through spatial skills training are more prone to learning new skills gain trust and consider a career in STEM fields.

(Ullah, 2019) studied the factors that contribute to girls' educational success and boys' educational failure around the world for a variety of reasons, girls outperform boys in education in developing countries. In the United States of America, for example, the role of parents is a major factor in their female children's outperformance. As point out, parents' educational success is a significant factor in their female children's education. However, according to this, girls with educated parents do well in school. Similarly, in Canada, the United Kingdom, and Australia, boys' educational underachievement is primarily related to the patriarchal approach to teaching them. Parents in England have higher educational aspirations for their daughters, according to the results of a study of 137000 parents and 280000 students in 500 secondary schools. Boys' underachievement in Northern Ireland is due to their anti-school and non-serious conduct.

According to Gallagher (1997), girls' optimistic attitudes toward schools lead to their outperforming in school and distinguishes them from boys in educational achievement. Gallagher goes on to say that in England, Scotland, and New Zealand, a shortage of male teachers, gender stereotyping by teachers, appraisal favouring girls, boys resisting authority, and a girls-friendly and favourable atmosphere are all contributing factors to boys' underperformance. According to Wilce (2007), male teachers have never been assigned to children aged 7 to 11.

Similarly, another study by Brockner (Brockner et al. 2006) states that workplaces must become more inclusive in order to increase the representation and participation of women and other minorities in organizations. Organizations must actively break down barriers to women's involvement and effectiveness, strengthen their current frameworks, strategies, and processes, and engender climate change for any change to be meaningful and sustainable.

Furthermore, this article describes the experience of 19 U.S. institutions that have adopted systemic change for better gender equality and inclusion in science and engineering disciplines. It includes a transformation model that any organization can use to build a diverse and productive workplace, as well as facilitating causes, programmed strategies, institutionalization, and outcomes of their transformation.

Another study looks at how institutions are changing to increase women's involvement and inclusion of science and engineering in academia. in order to stop the leaks and remove the obstacles listed above, the NSF initiated the advance institutional transformation programme in 2001 to increase the participation and contributions of women in the workforce ,the advance it awards were developed to promote ground-breaking initiatives that would result in “full participation of women at all levels of faculty and academic administration, especially at the senior academic ranks, through the transformation of institutional processes, policies, environment, and culture.” To date, 32 universities (referred to as advance institutions) have received funding. For the purposes of this report, we looked at the transformational strategies and outcomes of the 19 first- and second-round advance organizations for which data was available.

(Salzman & Lowell, 2012) studied the outcomes of institutional transformation. A place where people can come up with new ideas and initiatives and test them for efficacy,

acceptability, and long-term viability, according to this concept of an organizational change project. Such initiatives must succeed not only in achieving results in the short period they are operational, but also in sustaining and exploiting those results in the future, infusing value into the institutional system for future generations. Weaving changes into the socio-structural framework of the organization (institutionalization) is a significant mechanism in the transition models suggested by Lewin (1947), Judson (1991), Kotter (1995), and Eckel and Kezar (2003).

According to Model of Institutional Transformation (Heerden, 2011), the Women's and Other Minorities' Representation and Inclusion depicts the advance universities' institutional transformation experiences in a simplified organizational transformation model that incorporates enabling causes, study and assessment, reform programme, institution-building, and outcomes. Further than advance universities, the model can be applied to academic, corporate, and non-profit organizations that want to increase the representation and inclusion of women and other minorities. This model provides a particular approach for organizations that want to build an inclusive workplace by sharing many features (for example, leadership, vision, participation of other key stakeholders, and communication) with current, more generic organizational change models.

Other change models place a greater emphasis on internal organizational strength to drive change. External forces (such as industry trade groups, professional societies, funding agencies, and peer organizations) can be successful partners and progress drivers, in addition to the internal facilitating factors listed in the literature. External collaboration is particularly beneficial for transformations that include both organizational and social change. Women's and other minorities' inclusion are an issue that affects all organizations.

It has social roots, and to eradicate systemic, structural underrepresentation and inequity, greater social change is needed Industry wide partnerships may help achieve these objectives by increasing the awareness and credibility of reform initiatives among workers and the public. Furthermore, the model also emphasizes analysis and evaluation to aid transition aimed at increasing the addition of women and other underrepresented ethnic groups in the workforce.

Conducting surveys on best practices and gathering employee survey data on resource diversity and inclusion are examples of such analysis. Research helps to avoid making assumptions about the experiences of women and other minorities in the workplace, to rethink the problem to design solutions, to get input on the efficacy of interventions, and to monitor overall progress.

This model contextualizes and builds on Kotter's (1995) general steps for organizational change, which include creating a sense of urgency, establishing a powerful steering coalition, identifying and communicating a vision, encouraging others to act by eliminating obstacles and modifying processes or structures that jeopardize the vision, and planning for organizational transformation by articulating the links between new behaviours and performance, as well as integrating the changes into existing systems and practices.

Moreover, this model shows that putting in place and institutionalizing change programme with both an individual and organizational emphasis contributes to effective and long-term increases in the representation and inclusion of women and other minorities, eliminating any obstacles to their participation and improving the climate for all. Furthermore, this model indicates that these are structural change contingencies by putting transformation facilitating variables and research and evaluation in dashed boxes.

Similarly, this study explores (Buchmann et al., 2004) the degree to which family processes can explain a female-favourable pattern in college completion in the United States. Changes in the impact of the same-sex parent's schooling on the child's likelihood of completing college, according to studies of repeated cross-sections of the General Social Sample, account for a large portion of the relative female benefit.

Furthermore, it was observed that only in the minority of households where both parents were college educated did daughters have the same chances of completing college as sons in the mid-twentieth century. Sons who grew up in families with less qualified parents were more likely to complete college. However, for cohorts born after the mid-1960s, this trend shifted, and the education level of the same-sex parent became a more significant determinant of educational attainment, with females gaining more education than males when neither parent was a college graduate.

Women are breaking barriers in the field of science and technology. This Literature survey is throwing light on various studies which shows that women are outperforming than men in science. However, a few studies are highlighting the barriers that women are facing in pursuing their career in science and technology. Bawden (2007) goes even further, arguing that the feminization of the teaching profession at the secondary level has resulted in a lack of male role models, which has a negative effect on boys' educational success, especially at the secondary level. In Pakistan, one of the study's writers is conducting research into the causes of boy's underperformance.

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A study (Sally Gregory 2004), was conducted highlighting the social, economic, and intellectual barriers that have stood in their path, women's involvement in science and technology. It has been stated that these barriers remain consistent but with irregular trends throughout history. According to statistics, the number of females in science has grown in fits and starts over the last half-century. However, objective reports, personal accounts show that the segregation in opportunities, wages, and career development continues to be a problem that must be tackled.

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facilitating factors listed in the literature. External collaboration is particularly beneficial for transformations that include both organizational and social change.

Women's and other minorities' inclusion is an issue that affects all organizations. It has social roots, and to eradicate systemic, structural underrepresentation and inequity, greater social change is needed Industry wide partnerships may help achieve these objectives by increasing the awareness and credibility of reform initiatives among workers and the public.

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The images in this series, according to the study, challenge perceptions of women. (Adler et al., 1992) argue that scientists that have been documented in the US media by highlighting their expertise, showing options for juggling the pressures of their workplace and home, as well as providing role models that have excelled in fields dominated by men. Furthermore, the findings are explored considering the gender schema principle; also, there is a need for more research into the effect of successful woman role models on young women's interest in science.

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In today’s world, it is now a well-known fact that girls are outperforming in a wide range of academic subjects (Ullah, 2019).Girls are outperforming in school and college level examinations (Ullah et al. 2020). In 1970s and 1980s, the debate and key focus of research in the developed and developing countries was the issue underperformance in education. After mid-1990s, due to feminist struggle and favourable learning environment, there has

been reversal change in educational performance (Ullah et al. 2021). Parvazian, (2017) also analysed that women's participation in education has increased due to sociocultural changes. Shoaib & Ullah, (2019) observed a variation in male and female educational performance in recent decades across Pakistan. Educational results in secondary, higher, graduate and post graduate level shows females' outperformance and males' underperformance in education.

David, (2015) noticed that there had been changes in the higher education and women's life due to social transformation. Women are now more participating in education and employment. He argues that although many changes are welcomed in education, but still no gender equality has been achieved. Despite Feminist involvement has been increased, still patriarchy and hegemonic masculinity is still strongly experienced in education. Ullah et al., (2021) argued that the boy's underperformance in education is due to parental unconditional and unlimited love, parental absence, excessive use of social media by boys, free mobility and unrestrained outdoor activities and the work burden of boys, in addition to their studies.

According to Gallagher (1997), girls' optimistic attitudes toward schools lead to their outperforming in school and distinguishes them from boys in educational achievement. Gallagher goes on to say that in England, Scotland, and New Zealand, a shortage of male teachers, gender stereotyping by teachers, appraisal favouring girls, boys resisting authority, and a girls-friendly and favourable atmosphere are all contributing factors to boys' underperformance. Bawden (2007) goes even further, arguing that the feminization of the teaching profession at the secondary level has resulted in a lack of male role models, which has a negative effect on boys' educational success, especially at the secondary level.

Science and engineering are very important for modern societies. They are connected to powerful social institutions, particularly to the government and to the economy, and they have broad and deep consequences for the present and future in areas including health and healthcare, communication and data banks, consumer goods, transportation, irrigation, energy, pollution, and environmental controls (Fox, 2006; Sonnert and Holton, 2002 as cited in Sonnert et al. 2007). Science and engineering careers play important role in every work force. In these careers women are underrepresented as compared to men. Thus, women's participation as undergraduate majors and degree recipients in science and engineering is an important area of analysis (Sonnert et al. 2007).

Baker and Leary, (1995) stated that over the years many factors have been investigated to understand why few women choose science careers. These factors influence girls to choose or reject a scientific career. A number of studies have concluded that female students outperform male in arts humanities, while boys are better performing in STEM subjects (Ullah, et al., 2021). Girls are performing well and had surpassed boys in humanities (O'Donnell & Sharpe 2002 as cited in Ullah, Ullah:2021). Valian, (2007) observed that there are few women in science, especially at top. A smaller percentage of women's get advanced degrees in natural sciences.

He further asserted that one of the explanations for underrepresentation of women in natural sciences and math is that they are less talented than men. Another reason for underperformance of women in science is that they are less interested in professional carrier in science than men. Ullah, Ullah & Ahmed, (2020) reveal that in industrializing and least industrializing countries boys underperform in arts and humanities due to social construction that they are only for science subjects, so they don't take interest in arts subjects. The performance of Girls and boys in education is affected by Sociocultural context and environment. Girls' performance in science subject had not been improved as compare with arts and humanities (Ullah, Ullah & Ahmed, 2020).

Only those girls, who had a close friend or family member engaged in science related field, with-hold from stereotypes, and presented positive images of both scientists and science-related careers (Baker and Leary, 1995). Ullah et al. (2020) argues that although girls are outperforming in school and college level examination, they are underperforming than boys in science subjects. He further explained that the evidence from Khyber Pakhtunkhwa (Pakistan) shows that the main reason for girls' underperformance in science subject is due to traditional beliefs that science subjects are male dominated subjects. Gender stereotype among parents and teachers, and belief about more job opportunities available to boys than girls, encompass girls' underperformance in science subject. Girls can perform well in science subject if favourable environment is given to them.

Ullah, Ullah & Bilal (2020) explained that in the context of developed countries boys dominated girls in science, technology, engineering, and mathematics (STEM). Biological essentialist argues girl's underperformance in STEM is due to biological factors while

feminists associate girls' underperformance in STEM with social factors. Ullah argued that rather than biological factors, the social factors influence more girl's underperformance in STEM Education. Sociocultural factors have a great impact in girls' underachievement in science subjects.

He asserted that girls and boys are equal by birth and there are no innate differences that effect their performance in education. After birth they are developed according to society in which they live. These gendered and traditional practices of socialization have resulted into girls' underperformance in science subject. In an article (Kilmer, 2010) the biological essentialists' and feminists' reasons for girls' underperformance in STEM are outlined. Resultantly, the article compared the two methods, their underlying concepts, and the empirical data they use to support their positions.

The authors' study of both approaches helps them to better understand the relationship between gender and educational success. The performance of girls in STEM subjects is affected by social rather than biological factors, according to this study. Thus, it was concluded in this research article that sociocultural factors are to blame for girls' poor performance in STEM subjects.

Ullah et al.2020 explained that traditionally, STEM remains male dominated and masculine field (Hedges & Nowell, 1995: Ullah & Ullah ,2019 as cited in Ullah et al., 2020). He further revealed that in developed countries girls outshine boys in the subject of science (Machin & McNally ,2005: Clark Blickenstaff, 2005). Except few developed countries, girls fall behind in science subject (Asante, 2010). Researcher concluded that boys perform better than girls in STEM due to their reasoning abilities while girls do better in arts and humanities due to their verbal abilities (Hedge & Nowell, 1995: Wang & Degol, 2017 as cited in Ullah et al., 2020). Based on the argument of Ullah et al. (2020), I assert that in developing societies STEM is dominated as masculine field which discourages girls, so they lose their interest and underperform in STEM education.

Empirical evidence from the developed and under developing countries suggested that girls are outperforming boys in education. Girls are although performing better than boys but they are not doing well in science technology engineering and math (STEM). Boys are performing good in STEM education, but they are not well performing in arts and

humanities. Girls' performance in STEM and boy's performance in arts is not satisfactory. Girls in STEM education remain behind not at school and college level but also at university level (Ullah, Ullah & Ahmed, 2020).

In their study they mentioned that the grades of girls are very low in STEM education, but they are performing good in literature and other social sciences. Only few girls have shown good performance in cities and urban environment. "Girls in rural areas do not get helpful and friendly environment for science subjects and that's the main reasons of their poor performance and low grades in such setting" (Chamdimba, 2003). The reason for the loss of high ability of women from SME (Science, Mathematics and Engineering) major is not well understood however researcher indicated an early loss of confidence in their ability to choose science among such women. Women who leave science major greatly exceed than men (Seymour, 1995).

Hill et al., (2010) analysed that woman in science and engineering are increasing but men continue to outnumber women, especially at the upper level of these professions. Girls' Achievements and Interest in Math and Science is Shaped by the Environment in which they are living. He further argues that in research it was found that when teachers and parents tell girls that their intelligence can expand with experience and learning, girls do better on math tests and are more likely to say that they want to continue to study math in the future.

Today, the interest of girls in math and science subjects is affected by the stereotype that boys are better than girls in math and science. Cultural factors have been found to limit girls' interest in mathematics and mathematically careers and course. If girls grow up in an environment that enhances their success in science and math with spatial skills training, they are more likely to develop their skills as well as their confidence and consider a future in a STEM field. Implicit biases against women in science prevent girls and women from pursuing science from the beginning.

In women, manly masculine stereotypes about STEM, parents' expectations of daughters, peer norms, and lack of fit with personal goals make young ladies move away from STEM fields. In early adulthood, feeling like a misfit in STEM classes, being vastly outnumbered male peers, and lacking female role model causes women to stay away from STEM majors or leave rashly. Evidence-based projects and approaches can eliminate hindrances for female

in STEM. The leaky pipeline (the way in which women become underrepresented in the STEM fields) starts early. From middle school through college, female students do not perform good on some types of science and mathematics tests compared with male peers and report less confidence and aspiration.

Moreover, parents are early socializers of their children's academic interests, and they influence children interest in STEM. If girls get interest in STEM, they cannot continue their interest in higher education due to signal that they do not belong to STEM career, especially physical sciences, computer science, engineering, and mathematics.

These things, in turn hinder women's achievement, engagement, and persistence in STEM majors by making them question whether their abilities, interests, and aspirations are compatible with STEM (Dasgupta & Stout, 2014). Hall, (2018) revealed that in the science community female face several forms of gender-based biases and discrimination. These hurdles create difficult circumstances for them to develop positive science identities.

National Science Foundation, Division of Science Resources Statistics, 2009 shows that women earned 48,001 biological science degrees in 2007, compared with only 7,944 computer science degrees, 2,109 electrical engineering degrees, and1,024 physics degrees. In comparison, men earned 31,347 biological science degrees, 34,652 computer science degrees, 16,438 electrical engineering degrees, and 3,846 physics degrees (Hill et al., 2010). This shows that women appear less in computer science, electrical engineering and physics degree as compared with men.

Cronin and Roger, (1998) analysed that the proportion of female in Scottish higher institute (1995-1996), who progress from undergraduate level to professor level in SET(science , engineering and technology) was 0.32 (Undergraduates in SET) ,0.28 (Postgraduate in SET) , 0.17 (lecturers in SET) ,0.06 (senior lecturers in SET) and 0.04 (Professors in SET).This shows that total number of females who entered SET courses decreases because they are filtered out at each stage .The proportion of female in SET diminishes continuously as they progress in higher education. Women underrepresentation in retention and recruitment in SET in higher education is due to many reasons like, the stress and isolation of being in a minority, negative attitudes of male peers, lecturers and other staff, lack of opportunities for

cooperative or interactive learning and many more. Male science undergraduates still outnumber female science undergraduates, but the gap has narrowed in the recent decay.

Clark Blickenstaff, (2005) explained that the problem of female under-representation in STEM careers and majors is due to many factors that remove women from the STEM pipeline. This is due to lack of positive experiences with science in childhood, lack of female scientist/engineers as role model, cultural pressure on women and pedagogy of science favours male students.

In this day and age, it is currently a verifiable truth that young ladies are beating in a wide scope of scholarly subjects (Ullah, 2019). Girls are outflanking in school and school level assessments (Ullah et al. 2020). In 1970s and 1980s, the discussion and key focal point of exploration in the created and emerging nations was the issue underperformance in schooling. After mid-1990s, because of women's activist battle and ideal learning climate, there has been inversion change in instructive execution (Ullah et al. 2021). Parvazian, (2017) likewise broke down that ladies' cooperation in instruction has expanded because of sociocultural changes. Shoaib and Ullah, (2019) noticed a variety in male and female instructive execution in ongoing a very long time across Pakistan. Instructive outcomes in optional, higher, graduate and post alumni level shows females' outperformance and guys' underperformance in training.

David, (2015) saw that there had been changes in the advanced education and ladies' life because of social change. Ladies are presently more taking part in instruction and business. He contends that albeit many changes are invited in schooling, yet no sexual orientation equity has been accomplished. Regardless of Feminist contribution has been expanded, still man centric society and domineering manliness is still unequivocally knowledgeable about schooling. Ullah et al., (2021) contended that the kid's underperformance in instruction is because of parental unrestricted and limitless love, parental nonappearance, exorbitant utilization of web-based media by young men, free versatility and excessive open-air exercises and the work weight of young men, notwithstanding their examinations.

As per Gallagher (1997), young ladies' hopeful perspectives toward schools lead to their beating in school and recognizes them from young men in instructive accomplishment. Gallagher proceeds to say that in England, Scotland, and New Zealand, a lack of male

educators, sexual orientation generalizing by instructors, examination inclining toward young ladies, young men opposing power, and a young lady's cordial and positive air are for the most part contributing variables to young men's underperformance. Bawden (2007) goes much further, contending that the feminization of the showing calling at the auxiliary level has brought about an absence of male good examples, which negatively affects young men's instructive achievement, particularly at the optional level.

A complex problem like this requires a multi-faceted solution, and time to allow innovations to take effect. Over time, individual actions by sympathetic educators will assist females to break down the filter in the STEM pipeline and result in equal participation, which will be useful for STEM and useful for society in the long term. Orser et al., (2012) researched the barrier that women perceived in career development in the advanced technology sector.

They examined that Canadian woman faced high proportion of the challenges they encountered to gender, and they resolve these challenges through personal, or 'do-it-yourself', solutions. Buck et al., (2008) asserted that Studies have shown that students are more likely to select careers when they can identify a role model in that career path. Girls lack role model in science and are under-represented in science subjects.

Pell, (1996) observed that over the past the number of women who received doctorates and academic position has increased but still women are under-represented in university faculty in science subject. The retention of women in science subject is influence by early childhood, adolescence, college, and the graduate school/job entry period, role of the advisor/mentor, and self-esteem. He further suggested that Scientific community should be open equally to all members of the general population, it is necessary to keep adolescent girls involved in math and science and to maintain their self-esteem.

A research (Scragg & Smith, 1998) was designed to find out why so few women graduate in computer science programme. The study was conducted within the range of their campus. And the key findings showed that the question isn't really one of retention. Less number of women, plan to continue their studies with computer science as their major subject. While some of the literatures suggested barriers do exist, that are less important than the low entry rates. Women's retention in major is more, but it comes to bringing women into the major in

the first place. As a result, the most successful options would be those that focus on recruiting rather than retention

Historically, boys have outperformed girls in math, but in the recent few decades the gender gap has narrowed, and today girls are doing as well as boys in math on average (Hill et al., 2010). There has been notice increase in rates of women's participation and presence in managerial positions within the SET (science, engineering, and technology) fields. While rates of participation have increased, rates of retention and advancement of women to executive levels within the SET fields, especially in the private sector, remains limited. Women continue to feel hindered by the masculine culture of the SET sectors (Servon & Visser, 2011).

To alleviate these pressures as well as to promote women within these professions, policies aimed at promoting changes in organizational culture including promoting more female executives and expanding recruitment patterns to include more female applicants should be adopted by companies. Such programme may help to increase the presence of females in the corporate workplace while helping to change organizational culture through the introduction of more diverse perspectives in high level management positions. In research it was found that many women in the later stages of their graduate studies felt overwhelmed by the brutal work pressures which causes impossibility of women to get ahead.

Women are breaking barriers in the field of science and technology. This Literature survey is throwing light on various studies which shows that women are outperforming men in science. However, a few studies are highlighting the barriers that women are facing in pursuing their career in science and technology.

Another research (Salzman & Lowell, 2012) outlines the universities' transformational efforts to increase participation of women and inclusion in academic S&E. These programmers addressed advance's main goal in three ways: growing the number of women in the pipeline, improving institutional structures and processes related to academic career transition points like recruitment, promotion, and tenure, and better equipping women to advance effectively across the pipeline. Mentoring, coaching, networking, education and training, job and professional growth, leadership development, and special funding and

opportunities were some of the pipeline programmes used to enhance individual career trajectories.

Furthermore, work-climate impacts have been linked to many important organizational outcomes, including satisfaction, productivity and performance, retention, and emotional support via schooling, training, and development at advance universities, as well as initiatives to make departments (micro-climates) more collegial, inclusive, equal, and open, male colleagues' knowledge and practices were improved.

According to (Steinke, 1997), barriers for young girls as well as women opting their careers in science are generated by educational, attitude, and sociocultural factors. One of the most important of these barriers has been identified as gender norms in science. This study primarily looks at a television show in the United States that questions gender roles in science.

The images in this series, according to the study, challenge perceptions of women. (Adler et al., 1992) argue that scientists that have been documented in the US media by highlighting their expertise, showing options for juggling the pressures of their workplace and home, as well as providing role models that have excelled in fields dominated by men. Furthermore, the findings are explored considering the gender schema principle, also there is a need for more research into the effect of successful woman role models on young women's interest in science.

A study (Sally Gregory 2004), was conducted highlighting the social, economic, and intellectual barriers that have stood in their path, women's involvement in science and technology. It has been stated that these barriers remain consistent but with irregular trends throughout history. According to statistics, the number of females in science has grown in fits and starts over the last half-century. However, objective reports, personal accounts show that the segregation in opportunities, wages, and career development continues to be a problem that must be tackled.

Castillo et al. (2014) stated that the unused power of fully trained and certified women who may be interested in STEM but choose not to pursue degrees in these fields or who decide to change careers because of obstacles, real or imagined, represent a significant opportunity lost. Female study participants cited colleagues or peers (65%), personal friends or family

members (60%), and advisors (38%) as the three most effective resources for victory in STEM. The three resources most cited by the male participants were colleagues or peers (61%), personal friends or family members (40%), and grant relationships (40%). Study participants cited grants / relationships (53% f and 55% m), counselors (50% f and 33% m), professional communities (36% f and 28% m), and partners or peers (36% f and 27% m) as the four resources they most wished would have received more support from overcoming obstacles.

The majority (83%) of survey participants knew about their partner leaving the field of science because of the obstacle. Women may be aware of women leaving field (98%) and men are likely to know about men (93%). The four main barriers that led to male colleagues leaving the field of science were grants / subsidies, lack of job creation, low wages, and health and employment balance. In contrast, the reasons given why their female colleagues left the profession were very different. The nine barriers listed, the top four were to balance life and work, to / raise children, grants / subsidies, and gender bias. Male survey participants were more likely to recommend scientific work both men and women than women participants (81% m vs. 72% f).

In contrast, female participants are more likely to recommend scientific work to a male than they were men of the survey group (6% f vs. 3% m). The majority (74%) of study participants indicated that they had given up their goals to achieve their professional goals.

The majority (64% to 65%) of women in the study feel that both government and companies should take part in breaking down barriers for women scientists when they are less than half (45% to 46%) of male participants think that government and companies should be the same affected. More than three-quarters (77% f and 85% m) of study participants reported that their lab or the work group has gender differences. However, it should be noted that both female and male perceptions about what gender diversity involves seemingly different (L’Oréal, 2010).

(Ullah, 2019) studied the factors that contribute to girls' educational success and boys' educational failure around the world for a variety of reasons, girls outperform boys in education in developing countries. In the United States of America, for example, the role of parents is a major factor in their female children's outperformance. As point out, parents'

educational success is a significant factor in their female children's education. However, according to this, girls with educated parents do well in school.

Similarly, in Canada, the United Kingdom, and Australia, boys' educational underachievement is primarily related to the patriarchal approach to teaching them. Parents in England have higher educational aspirations for their daughters, according to the results of a study of 137000 parents and 280000 students in 500 secondary schools. Boys' underachievement in Northern Ireland is due to their anti-school and non-serious conduct.

According to Gallagher (1997), girls' optimistic attitudes toward schools lead to their outperforming in school and distinguishes them from boys in educational achievement. Gallagher goes on to say that in England, Scotland, and New Zealand, a shortage of male teachers, gender stereotyping by teachers, appraisal favouring girls, boys resisting authority, and a girls-friendly and favourable atmosphere are all contributing factors to boys' underperformance. According to Wilce (2007), male teachers have never been assigned to children aged 7 to 11.

Similarly, another study by Brockner (Brockner et al. 2006) states that workplaces must become more inclusive in order to increase the representation and participation of women and other minorities in organizations. Organizations must actively break down barriers to women's involvement and effectiveness, strengthen their current frameworks, strategies, and processes, and engender climate change for any change to be meaningful and sustainable.

Furthermore, this article describes the experience of 19 U.S. institutions that have adopted systemic change for better gender equality and inclusion in science and engineering disciplines. It includes a transformation model that any organization can use to build a diverse and productive workplace, as well as facilitating causes, programmed strategies, institutionalization, and outcomes of their transformation.

Another study looks at how institutions are changing to increase women's involvement and inclusion of science and engineering in academia. in order to stop the leaks and remove the obstacles listed above, the NSF initiated the advance institutional transformation programme in 2001 to increase the participation and contributions of women in the workforce ,the advance it awards were developed to promote ground-breaking initiatives that would result in “full participation of women at all levels of faculty and academic administration,

especially at the senior academic ranks, through the transformation of institutional processes, policies, environment, and culture." To date, 32 universities (referred to as advance institutions) have received funding. For the purposes of this report, we looked at the transformational strategies and outcomes of the 19 first- and second-round advance organizations for which data was available.

(Salzman & Lowell, 2012) studied the outcomes of institutional transformation. A place where people can come up with new ideas and initiatives and test them for efficacy, acceptability, and long-term viability, according to this concept of an organizational change project. Such initiatives must succeed not only in achieving results in the short period they are operational, but also in sustaining and exploiting those results in the future, infusing value into the institutional system for future generations. Weaving changes into the socio-structural framework of the organization (institutionalization) is a significant mechanism in the transition models suggested by Lewin (1947), Judson (1991), Kotter (1995), and Eckel and Kezar (2003).

According to Model of Institutional Transformation (Heerden, 2011), the Women's and Other Minorities' Representation and Inclusion depicts the advance universities' institutional transformation experiences in a simplified organizational transformation model that incorporates enabling causes, study and assessment, reform programme, institution-building, and outcomes.

Further than advance universities, the model can be applied to academic, corporate, and non-profit organizations that want to increase the representation and inclusion of women and other minorities. This model provides a particular approach for organizations that want to build an inclusive workplace by sharing many features (for example, leadership, vision, participation of other key stakeholders, and communication) with current, more generic organizational change models. Other change models place a greater emphasis on internal organizational strength to drive change. External forces (such as industry trade groups, professional societies, funding agencies, and peer organizations) can be successful partners and progress drivers, in addition to the internal facilitating factors listed in the literature. External collaboration is particularly beneficial for transformations that include both

organizational and social change. Women's and other minorities' inclusion is an issue that affects all organizations.

It has social roots, and to eradicate systemic, structural underrepresentation and inequity, greater social change is needed Industry wide partnerships may help achieve these objectives by increasing the awareness and credibility of reform initiatives among workers and the general public. Furthermore, the model also emphasizes analysis and evaluation to aid transition aimed at increasing the addition of women and other underrepresented ethnic groups in the workforce. Conducting surveys on best practices and gathering employee survey data on resource diversity and inclusion are examples of such analysis. Research helps to avoid making assumptions about the experiences of women and other minorities in the workplace, to rethink the problem in order to design solutions, to get input on the efficacy of interventions, and to monitor overall progress.

This model contextualizes and builds on Kotter's (1995) general steps for organizational change, which include creating a sense of urgency, establishing a powerful steering coalition, identifying and communicating a vision, encouraging others to act by eliminating obstacles and modifying processes or structures that jeopardize the vision, and planning for organizational transformation by articulating the links between new behaviours and performance, as well as integrating the changes into existing systems and practices.

Moreover, this model shows that putting in place and institutionalizing change programme with both an individual and organizational emphasis contributes to effective and long-term increases in the representation and inclusion of women and other minorities, eliminating any obstacles to their participation and improving the climate for all. Furthermore, this model indicates that these are structural change contingencies by putting transformation facilitating variables and research and evaluation in dashed boxes.

Similarly, this study explores (Buchmann et al., 2004) the degree to which family processes can explain a female-favourable pattern in college completion in the United States. Changes in the impact of the same-sex parent's schooling on the child's likelihood of completing college, according to studies of repeated cross-sections of the General Social Sample, account for a large portion of the relative female benefit.

Furthermore, it was observed that only in the minority of households where both parents were college educated did daughters have the same chances of completing college as sons in the mid-twentieth century. Sons who grew up in families with less qualified parents were more likely to complete college. However, for cohorts born after the mid-1960s, this trend shifted, and the education level of the same-sex parent became a more significant determinant of educational attainment, with females gaining more education than males when neither parent was a college graduate.

Servon, 2011 indicated that in the last two decades have seen an increase in the levels of participation and participation of women management positions within the fields of science, engineering, and technology. However, while the standards participation has increased, retention rates and women's development at higher levels within the SET sectors, especially in the private sector, it remains limited. As a result, many SET private sector for-profit firms have begun to raise concerns about the shortage of women presence in leadership and executive positions within sectors.

The study seeks enlightenment certain features that help both simplify and create obstacles in the end as well the advancement of women within these firms and within the SET field. The findings suggest a unique process and set of procedures that emphasize expertise for women in the SET sector. Such habits and practices are strongly influenced by a man behavioral tendency can also lead to feelings of discrimination, segregation, and over-expansion women in the fields of work. Such pressures result in women often resorting to methods of mind control where they begin to incorporate professional practices that promote competition among and among other female employees or which may result in selection and strategies, which may have had a detrimental effect on the development of the work of women managers.

Considering the importance gender diversity in science-related fields and the importance of these fields in US technological and economic development, we argue that private corporate firms should address these ethical principles and procedures if they wish to maintain them high-skilled female workers. Such efforts should see the flexibility of family / work, at the same time redesigning practices that are more gender specific expertise is often expressed in private SET organizations. Together and a consistent effort on the part of firms to

understand the unique experiences of women effective, efficient, and effective personnel, systems and policies will be essential to strengthening Success rates for women in SET career ladders (Servon, 2011).

Clark Blickenstaff, (2005) stated that a common metaphor used to describe the fact that women are not well represented science, technology, engineering, and mathematics (STEM) to propose as a 'leaky pipe' that transports students from high school through university to further education job in STEM. This pipeline rewards students in various categories: emerging students' interest in science jobs sometimes changes their minds when applying for college and universities and choose other study areas. Some start post-secondary education in the STEM program but change majors before graduation.

Finally, some students leave the pipe after graduating with STEM degrees when they choose another sector as a profession. One interesting aspect of this leak is that women are getting out more than men. The effect of a different leak is to create a sex-based filter removes one sex from the stream and leaves the other to reach the end of the pipeline. No one in the power station near the pipeline decided to filter women from the STEM stream, but a growing result of many different however related factors lead to gender inequality in STEM seen today.

A study (Sally Gregory 2004), was conducted highlighting the social, economic, and intellectual barriers that have stood in their path, women's involvement in science and technology. It has been stated that these barriers remain consistent but with irregular trends throughout history. According to statistics, the number of females in science has grown in fits and starts over the last half-century. However, objective reports, personal accounts show that the segregation in opportunities, wages, and career development continues to be a problem that must be tackled.

CHAPTER NO. 3
THEORETICAL FRAMEWORK

The theoretical framework is regarded as the most crucial tool for effective research. Focusing on imagination, forming ideas, and then developing ideas that will be tested later with mathematical tools. The theory is seen as providing guidance and direction for research and proving what is being thought.

Multiple theories explain the issue of girls in science subjects. Theories of "gender socialization" and "peer group" are closely related to the current topic of study.

3.1 Gender Socialization theory

It states that girls and boys are socialized differently. This is usually based on previously seen ideas of gender roles. Gender roles are behaviours, attitudes, and personality traits that are expected and encouraged by the individual depending on his/her gender. Boys are raised to fit in with the male role, and girls are raised matching the role of female.

Theories of gender roles and human relationships are directly related to the concept of the gender gap in the STEM field because researchers always find evidence of gender stereotype related to STEM work.

Women leave the STEM pipeline before entering the official STEM profession. This STEM pipeline situation is losing women who could be the next generation of scientists, engineers, and technology creators. One of the reasons why women leave the STEM field is because women are plagued negative ideas such as they cannot do better in STEM.

These mentalities and stereotypes passed on to girls at an early age by their parents and teachers, sometimes unknowingly. Regardless of the conscious or unconscious, these gender stereotypes shape girls ultimately reduce their interest in STEM fields. It can be argued that because of these stereotypes women are poorly represented in the STEM field.

Social interactions, parents' beliefs and perceptions influence children's outcomes and activity choices, skills and interests of the children". Much research displays the theory of gender socialization which marginalizes women in STEM fields (Regner et al., 2014)

Thus, gender stereotype in the field of education like all other fields are shaking and receiving. This study also attempts to see how stereotype are embedded and functional in the context of Pakistan.

3.2 Theory Peer Groups

While socialization may play a role in the leaky pipeline for girls in STEM fields, other researchers focus on the peer relationships and pressure felt in the adolescent years. It was found that, for all adolescents, enrolment in STEM was associated to close friends. These associations tended to be stronger toward the end of high school and weaker among adolescents with a prior record of failure in school. Each of these patterns was somewhat more consistent among girls.

During adolescence, students want to perform as their peers, which could be associated with the "in group" acceptance that is critically important during the adolescent years. Peers have an important influence on the behaviour and development of adolescents. The child's acceptance within the peer group is one of the key measures of positive/negative school experiences (You, 2011).

Perceived support from peers can give students a sense of motivation and help students see the importance of pursuing academic success such as STEM related courses. Adolescents are influenced by peers and are vulnerable to peer feedback. When peers provide positive feedback, their behaviour shifts toward more prosocial behaviours. Positive behaviours, on the other hand, decrease when peers provide no or negative feedback. Adolescents rely on peers and their judgments to know what to do, how to engage in their school.

Therefore, when very few girls enter STEM content courses, the peer feedback, through words, inaction can be perceived as negative. Girls' motivation in math and science courses during the adolescent years is positively associated to peer support. Overall, peer groups have been found to influence the academic success of individuals.

However, the peer group influence can also turn girls away from STEM courses if their "in group" does not academically succeed in the STEM related courses. Overall, peers play an important role in the engagement or disengagement in STEM related courses.

In this study it was attempted to explore how young girls in STEM are influenced by their peer group to enter STEM subjects.

CHAPTER NO. 4
RSEARCH METHODOLOGY

A research methodology is a structure through which the research has been done while conducting a research study. The research methodology entails the research tools and techniques which the researcher used for data collection. This section involves the research design, universe, unit of analysis, sample size, sampling techniques, tools, and data collection techniques, and data analysis.

4.1 Introduction

This section describes the tools and the techniques used in this research process. This research used Qualitative research methods. The purpose and reason of opting qualitative approach was to explore the issue deeply. Thus, the study was qualitative in nature. Purposive sampling technique was used for selection of respondent.

The decision to go with qualitative research approach was based upon the facts that we were looking to explore university student's perspectives on the trend of girls in science in Pakistani university. After through the review of literature, making a well-planned research design is a fundamental part of any scientific research. This section describes tools and techniques used in research process. I used Qualitative research method for this research.

4.2 Research Design

According to the nature of the study and data required, the I opted qualitative approach. The purpose and reason of opting qualitative approach was to explore the issue deeply. To deeply explore and explain the phenomenon, I wanted an in-depth insight that was just possible by looking from qualitative aspects.

4.3 Locale of Study

This research has been conducted in a public university in Islamabad which accommodates students from across Pakistan.

4.4 Sampling and Sampling size

I used Purposive Sampling technique for the selection of sample size because the population under study was those female students who were associated with STEM.

The sample size consisted of 17 respondents. All respondents were female students who were studying science subjects. I stopped the data collection process on meeting the point of saturation.

4.5 Tool of Data collection

I used interview guide as a tool of data collecting. The interview guide was made up of relevant questions that were related to my research topic. It consists of 8 questions. The questions aimed to address the main objectives of the study when answered by the respondent. Some questions were originated from the literature and some from my personal experience.

4.6 Method of Data collection

The data was collected through face-to-face interview. For this purpose, the I selected 17 respondents who were females and enrolled in STEM. I have conducted 17 faces to face In-depth interviews by using open-ended questions in which I spoke less and listen carefully. It helped me to observe and understand the verbal and non-verbal impressions i.e., body language, gestures, information, provided by respondents. It is important to mention here that all interviews were recorded with the help of cell phone.

4.7 Analysis of the Data

The collected data was analysed in line with question and result. The data analysis uses c. At the very outset of data analysis, all recorded interviews were transcribed. The transcribed data was coded. Relevant codes were clubs together for generation of broader themes. Broader themes were later defined into narrow themes. Relevant data under each theme was presented and discussed.

4.8 Ethical Considerations

I followed all ethical protocols of research ethics. Respondents' confidentiality has been maintained. They were given the promise that the data will be used for academic purposes.

4.9 The Limitations and Opportunities of Study

For the present study, there are some limitations and opportunities, where this research helps the researcher to improve the research skills, knowledge to persuade people and level of interaction. Secondly, this research gives the practical experiences of conducting any research study in an organized manner.

On the other hand, this study has also some of the limitations, where due to COVID-19 university has been closed and all the academic activities have been shifted to online where students, especially, those who were doing their research were more suffered. Firstly, students were facing difficulty in the data collection process, because of closed of the university.

CHAPTER NO. 5
FINDINGS AND DATA PRESENTATION

This chapter deals with the detailed interpretations and analysis of data gathered from the in-depth interviews with the respondents. The analysis represents the views of respondents about their experiences in STEM. While exploring university student perspectives on the trend of girls in science, their father and mother education and residential background was recorded. Their education was represented in the following frequency table.

Table 4.1: Respondent's Father Education Level

Category	**Frequency**	**Percentage**
Matric	4	23.52
Intermediate	5	29.41
Bachelors	2	11.76
Masters	3	17.64
MPhil	3	17.64
Total	17	100.0

Table No. 4.1 shows respondent education level, where 23.52% respondents' father were matric qualified, 29.41% have done Intermediate, 11.76 % have done Bachelors, 17.64% have done Masters, 17.64% have done MPhil. The conclusion of the table showed that, majority of respondents' father were with different in their level of education.

Table 4.2: Respondent Mother Education level

Category	Frequency	Percentage
Illiterate	4	23.52
Primary	1	5.88
Middle	2	11.76
Matric	4	23.52
Intermediate	4	23.52
Bachelors	1	5.88
Masters	1	5.88
Total	17	100.0

Table No. 4.2 shows the mothers' education level of the respondent, where 23.52% respondents' mother were illiterate, 5.88% have passed primary,11.76% have passed middle, 23.52% have qualified Matric,23.52% have done Intermediate, 5.88% have done Bachelors, 5.88% were educated with Masters. The conclusion of the table showed that, majority of respondent's mothers were with different level of education.

Table 4.3: Residential Background of the respondent

Residence	Frequency	Percentage
Urban	16	94.11
Rural	1	5.88
Total	17	100.0

Table No. 4.3 shows the residential background of the respondent, 94.11% lives in Urban area, whereas 5.88% lived in rural settings. It is vividly clear that majority of the respondent were from urban areas.

5.1 Girls in STEM

In Recent years there have been an increase in number of young women in STEM subjects. It was attempted to know the reasons and motivation behind this new trend. A great majority of the respondents revealed that they are encouraged by their families (father, mother, and other member of the family) to study in STEM. One of the respondents argued:

> "My family, especially my elder brother, encouraged me to get education, as they know that education is basic and necessary right for girls. My mother is religious scholar, and she knows the value of education in Islam. My parents are too supportive in education. They motivate, support, and encourage me in every field of education like what subjects I want to choose in intermediate in which program i want to enroll in graduation. They always used to guide me in right direction. They financially support me in every step of

my education. I did my graduation in information technology. Also, my pervious education is in science subjects".

Studies have shown that parental pressure is negatively, and parental support is positively associated with variety of learning outcomes, such as school involvement, motivation, and success (Hofrichter & Rauf elder 2019).

The engagement of parents plays a key role for girls in STEM. Some parents from the early childhood develop interest of their daughters in STEM subjects. One of the respondents stated that "... from starting it was decided by my parents to choose science subjects, so there was no other option for me." Another respondent asserted that, "My parents encouraged me to get advanced education. They are always a support system for me. They truly built my confidence level and polished my skills."

While talking about encouragement in STEM subjects one of the respondents stated that, "Definitely my parents, both are supportive enough to encourage me for STEM education. "In some families, parent encourage their children to go for subjects that are not studied by their other family members. While sharing such a view one of the respondents argued that:

> "My cousin sister got admission into a medical college. So, my parents encouraged me not to enrol in medical subjects as one of the family members is studying medical subjects. They motivated me get admission in Science and Technology subjects."

Another interviewee asserted that:

> "My father is an engineer. He had faced a lot of hard ship and challenges to achieve his goal. His life is a role model for all of us. He wants his children to be in a noble profession, in a noble state with peace of mind, so he used to encourage me from childhood. He is the world's best career consulter for me. Whenever I faced any difficulty in my degree or life, he used to console me. He is a good mentor for me as well."

Family, especially fathers and brothers, play significant role for women's education in general and science subject particularly. One of respondent asserted that she was motivated and guided by her parents to study STEM.

An extract from most of the respondents' opinion is presented as:

> "From the early stage they were engaged by their parents in STEM subjects and get higher education in these subjects so that they would be capable enough to at least support themselves in the absence of their parents. Most of the girls are motivated by the interest of their parents."

Majority of the respondents shared their views that they were encouraged and inspired by their family especially parents and got admission in STEM. Only two of the students revealed that they choose STEM because of their own interest. They argued "My interest and my own spirit encouraged me to choose STEM. STEM enabled me to think critically so due to its key importance in life, I developed passion to get admission in this subject."

One respondent elaborated that she wanted to be a role model for upcoming generation.

She said, "I noticed that there are less women that go to STEM field as they think that there are less opportunities in STEM field, but I decided to choose that field and become a role model for them so that women approach to STEM should increase." Other respondents said that they were encouraged by women role model in STEM field "...I am inspired from those women who want to serve their country."

Teacher also play vital role in encouragement of girls in STEM. One respondent was motivated by her teachers to get admission in STEM.

The above responses reveal that with family support and encouragement women have increased in STEM subjects. They are motivated by their parents. In society, women role model in STEM has increased which play important role in motivating and encouraging girls in STEM.

5.2 Girls in STEM and equal Opportunities

Girls are visible in STEM subjects. The concern is that whether they will have equal opportunities in the job market or not. Some respondents revealed that they have equal work opportunity in STEM while majority of respondents argued that don't have. The opportunities are unequally available to women.

One of respondent stated that:

> "When we talk about equal work opportunities available to men and women especially in Pakistani society, I think it's NO, because in most of rural areas women are uneducated. They don't even have access to primary education. When a woman in our society is not educated how she will get an equal opportunity. Women in Pakistan never get equal work opportunities in my opinion because in every institution there is quota system and there are more seats available for the men."

Due to patriarchal mindset of the society, women have less opportunities as compared to men. One interviewee argues:

> "No in our society man are always represented over woman even in some areas parents don't allow their daughters to go for night job but boys get permission and on other hand to some extend gender discrimination occurs and it always says that this job is not for female."

Similarly, another said that "Female can do equal work to men but there is less opportunity to do so because of mind of society." Women are upcoming in every field day by day and getting equal opportunities. One respondent said, "Not at all stage women are facing discrimination at every level, but in past two decades the approach is changing now.

Women are getting chances to participate in different domains."

Some respondents believe that women are now entering in every field of life and there are equal work opportunities available for men and women. A respondent argued, "Absolutely now women are not stepped behind, then men. They are provided with equal and more

opportunities than past decades. By following ethical and moral values, women and men are each step together."

Another student argues that:

> "l think competition is increasing day by day in every domain of life. Now a days women are much more compatible and courage to avail every sort of working availability. yeah, men and women both do have equal opportunity to work in any field."

One student argues that to find or get an opportunity, is based on skills. "I think everyone had equal opportunities. It's depended on skills of the student not on gender." One of the students shared that to Somehow, women have equal work opportunities to men.

From above responses it is asserted that as compared to past, now a days women have more work opportunities. Some respondent argues that due to male dominated society, women have less opportunities available. Other share their views that opportunities are available equally to men and women, but to avail the opportunity, it depends upon skills.

5.3 Future planning with degree

Jobs related to STEM subjects are not considered suitable for girls in our community. Girls do not participate in these studies because they thought that the jobs they would get after the STEM courses will not be accepted by the society. Some girls enrolled in STEM but didn't continue it. Now this trend has been changed. More girls are enrolling in STEM subjects and getting more jobs than past decades.

One of respondent argued that "I will do a job in chemical industry and apply for MPhil in my subject". A similar point of view was held by another respondent, "I am planning for my better future as i want a good job related to my field. I am Student of information technology, and I am interested in Web designing. So, I will go for it. One respondent stated that, "I will give my services for betterment of environment by working in EPA (Environmental protection agency)."

Some respondent said that they will run their own businesses after completion of their degree. "I am planning to do business." Similarly, another said, "…starting a new pharmacy

in future." One respondent argued that "...with knowledge and degree I have, I would like to put an effort to do the practical work for the place and society where I live." While telling about future, one of the respondents said that:

> "I will apply it to bring relief for humanity. I think degree is just a piece of paper and it can never decide your future but is an essential component for success in one's life. So, l would try to go to the career which would be most suitable to my capabilities".

While taking interview and asking about future planning, majority of the student stated that after degree, their plan is to get a job and go for higher education.

5.4 Girls in STEM and Challenges encountered

For many young girls with interest in STEM (Science, Technology, Engineering, Mathematics), the path to a successful career is fraught with difficulties and challenges, unsupportive society, lack of good mentors and role models, gender discrimination and harassment in the workplace. All of these factors contribute to women 's lack in science and technology.

In past women experiences of abuse, gender stereotype, sexual harassment was common and had negative consequence for women in STEM.

These forms of structural and social abuses lead women to view their organization in a more negative light (H. Settle, 2014). Now, the representation of women in STEM has increased dramatically since 1970(Carlton, 2021). In fact, the number of women working in the STEM sector has increased but they still they have to catch-up challenges in future.

Most of the respondents explained that they are experiencing less challenges, but they feel that they may face more challenges in the future. One of them elaborated that "it's not too much difficult for me as my parents are too supportive, although chemistry is tough subject but with the motivation of my parents, I will work hard". Another student argued that "Job hunting is a challenge for every fresh graduate, so I am planning to do some internships in order to gain experience and then I will go for proper job."

One respondent said that challenge she faced till now was learning experience but in future the more challenges are apprehended to faced regarding job hunting. "…the challenges i

experienced during my education were the part of my learning but i think in future to get a good job, i may face more of them." Similarly sharing the same views, one respondent stated that "As my parents had supported me so I think I haven't faced much challenge but in future I think I would face more challenges in job market as less opportunities are available to women." Another said "As for the future I think it would be hard to get a good job. As Far as I think, it will be a challenging and time taking phase."

One of the challenges that respondent apprehended to be encountered in the future would be day by day increasing competition among students. One student said that "…great competition level which l would be going to face in future but hopefully I will try my best to solve the problems with patience"

While talking about challenges one of the respondents stated that "Many relatives in my family stopped me to take admission in this field as they told me that less opportunities for women are available in these fields, but I tried hard and had been strong enough to handle future challenges."

Most of the respondent argue that availability of less opportunities is a big challenge to be faced in future as one of respondent revealed that, "I may experience challenge of less encouraging environment in my profession plus lack of resources or opportunities to continue my project due to lack of interest in health care site of Biotechnology in

Pakistan."

Today women are working in every field of life. Due to male-dominated society woman face many challenges. Without support and motivation, it is difficult for them to encourage themselves in STEM field. One of the students shared that without support of someone it is difficult for women to do a job. She explained it in such a way, "I have experienced not a hard challenge till now, but I think, I will face the challenges in the future related to job.

As without support it is tough for women to do a job. "One respondent shared her views that, "Hostel life was big challenge during M.Sc. In future, maintenance of routine and being punctual will be a challenge."

Above responses reveal that the challenges that woman must face now a days, are relatively more than past. Job hunting is one of the biggest challenges that is apprehended in future.

CHAPTER NO. 6
CONCLUSION AND RECOMMENDATIONS

This chapter sum up the study. It presents summary of the argument, reflection on the themes and implication of the research. The chapter ends with some future research recommendation.

6.1 Summary of the arguments

In many South Asian countries women's participation in higher education (HE) is equal to or higher than men in recent years. However, this practice is not evident in STEM subjects (Science, Technology, Engineering and Mathematics) (Hollows, Rabb, Schulze: 2011). In past women experiences of abuse, gender stereotype, sexual harassment was common and had negative consequence for women in STEM. These forms of structural and social abuses lead women to view their organization in a more negative light (H. Settle, 2014). Now, the representation of women in STEM has increased dramatically since 1970(Carlton, 2021). Research shows that girls are beginning to respond positively to the message that they can do it as boys in stem courses (Mbano & Nolan, 2017).

The issue of girls' education (STEM education) is one of the key areas of research in the field of sociology. There has been a lot of studies done on women's participation in STEM education globally and have highlighted the challenges that girls confront in STEM studies and careers. However, it has remained a major problem in Pakistan which needs to be researched widely. This study examines the running trend of girls enrolling in STEM disciplines at the undergraduate and postgraduate levels in Pakistan as well as the perceptions of university students on girls' enrolment in science programme.

Women are breaking the barriers that existed in the past. The study finding revealed that most of the girls are taking admission in STEM subjects because of their parents' encouragement. Other factors such as their families, friends also play an important role. They are gradually getting equal opportunities STEM job market. In fact, the number of women working in the STEM specialized job area has increased. Nevertheless, they still have to catch-up men and grapple with challenges in future.

. The findings of this study reveal that the ratio of female students in STEM is increasing significantly compared to previous years, owing to their parents' encouragement and support. The number of female students studying STEM subjects has increased purely because of

parental support and motivation. Most students argued that they should pursue a career in STEM subjects because there are more opportunities in these fields based on desired skills. Furthermore, the respondent highlighted several challenges that they face in STEM, with job hunting being one of the most significant.

6.2 Reflection on the themes

The number of young women in STEM subjects is increasing day by day. The study findings analysed various reasons for increase in number of girls in STEM. Majority of the students are encouraged and inspired by their family especially by their parents to take admission in STEM subjects. Only few students take admission in STEM because of their own interest. With family support and encouragement women enrolment have increased in STEM subjects. In society, women role model in STEM has increased which play important role in motivating and encouraging girls in STEM.

As girls are increasing in STEM subjects so the issue is that whether they would have equal work opportunities or not. As compared to past, now a days women have more work opportunities. Opportunities are available equally but to avail an opportunity it depends upon the skills and socio-cultural environment that an individual has.

In past, there were less job opportunities for women in STEM, but now the trend has been changed. More girls are enrolling themselves in STEM subjects. With inspiration, motivation and support of parents, girls are availing more opportunities. Now the plan of majority of student is to get a job after degree, and then proceed toward higher education.

Jobs related to STEM subjects are not considered suitable for girls in our community. Girls do not participate in these studies because they thought that the jobs they would get after the STEM courses will not be accepted by the society.

Some girls enrolled in STEM but didn't continue it. Now this trend has been changed. More girls are enrolling in STEM subjects and getting more jobs than past decades. The number of women working in the STEM sector is increasing but still they have to catch-up challenges in future. Job hunting is one of the biggest challenges that is apprehended in future.

6.3 Study Implication

This research is conducted with a small sample size. The finding of this research is good reading material for classroom teaching and discussion. The study finding is great source of reference for other researchers. Information collected and analysed from the female student through the interview process passed on to educators and parents. The findings can be used by educators to create programs that stimulates interest and achievement for girls in STEM areas.

This information can also be used by parents to ensure that parents understand how influences and motives from outside the classroom play an important role in girls' decision-making in STEM field. This research is helpful for researchers, educational scholars, and policy makers to identify or set up development plans or policies to improve women's representations in STEM fields.

6.4 Recommendation for the further Research

The study was conducted at Quaid-i-Azam University to look at the running trend of girls' enrolment into undergraduate and postgraduate Science Subjects and female student perspective in their studying Science subjects. Based on findings following recommendations have been proposed:

1. The experience of young women in STEM subjects need to explore extremely as the current study was restricted to one university.

2. Based on the research studies more job opportunities in STEM should be created for women.

3. There is need to explore STEM trend in backward areas. For this further research can be conducted.

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Interview guide

S. NO	QUESTIONS	RESPONSES
1	Your father Education	
2	Your mother Education	
3	Your family Residence (urban / Rural)	
4	Who encouraged you to get into STEM education?	
5	How were you encouraged to get into STEM education?	
6	Do you think you work have equal opportunities to men?	

7	What are you planning to do with your degree?	
8	What challenges did you experienced or apprehend to experience in future?	