Unlocking Potential: Exploring the Socio-economic Landscape of High School STEM Girls in Khulna and Rajshahi Districts

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ABSTRACT

The Board of Intermediate and Secondary Education in Bangladesh permits students to choose a specialization based on aptitude, passion, and academic excellence that equips them for the college degree of their choice. So, the students who prefer the science stream are recognized as capable in all aspects. This study aims to explore the socio-economic characteristics of the STEM girls in Khulna and Rajshahi Districts of Bangladesh who are studying in classes IX and X in the science stream at secondary school, which assesses their ability to pursue STEM education. For this, the researchers have chosen a survey design. The study utilized 410 STEM girl students for a questionnaire survey from eight girls' high schools in Bangladesh's Khulna and Rajshahi districts. The schools were selected purposefully, and the students were selected randomly from classes nine and ten. Besides this, four focus group discussions (FGD) were conducted in four selected schools, where 44 (forty-four) participants attended and gave their opinions, comments, and observations. Data and information have been collected between July 2021 and June 2023. Using descriptive statistics and qualitative methods, socio-economic strands of the STEM girls have been explored, which cover their religious affiliation, age, marital status, educational qualifications of respondents' parents, occupational status of their parents, household-based income and expenditure analysis of the respondents' parents or guardians, information about family and siblings of the STEM girls, monthly expense analysis, and residential status. It was found that most of them are ahead of the national index of Bangladesh in some indexes. So, it is logical to claim that even though some STEM girls face severe problems, they are capable of studying STEM education in Bangladesh's existing framework.

Keywords: Capability, Marital status, economic condition, Parents' education, Parents' profession, Educational expenditure.

1. INTRODUCTION

1.1 Background of the Study

Bangladesh is a developing country with a total population of 169,828,909, of which 84,077,203 (49.51%) are males, 85,653,120 (50.43%) are females, and 12,629 (0.01%) are transgender people [1]. In terms of literacy, there is a balance between males and females, but the position of females at the upper levels of education is weaker than that of males. The disparity is visible in STEM education, a science stream in Bangladesh. In 2022, the total number of students studying in classes IX and X of secondary education was 37, 50,218, out of which 20, 51,109 were female. Of 11, 60,337 students studying in classes IX and X in the science stream, 5, 79,217 (49.92%) were female students, and 5, 81,120 (50.08%) were male students [2]. The Board of Intermediate and Secondary Education in Bangladesh has allowed students to choose a stream when they start studying in class nine. Among the three, Humanities, Business Studies and Science students chose any one according to their talent, passion, and academic excellence. Those who study in the science stream at this stage only get the opportunity to study STEM subjects at the next level of education. For a good reason, guardians or the students themselves must determine which stream of education girls enroll in at this level of education.

1.2 Statement of the Problem

Science, technology, engineering, and mathematics are abbreviated as STEM. STEM education includes science, technology, engineering, and mathematics (STEM) teaching and learning at all levels, from pre-school to post-doctoral, and in both formal and informal classroom settings [3]. It is generally thought that, girls should study easy subjects. Siddiqa and Braga notes that**, f**or one, the prevalent belief that STEM fields were a male realm led even the most assertive and self-inspired girls to perceive barriers ahead of them [4].But seeing the ratio of enrollment of girls in high school level STEM education, it is assumed that girls or female participation in high school STEM education is satisfactory and almost equal to that of boys. However, after passing Secondary School Certificate (SSC) and Higher Secondary Certificate (HSC), the ratio of girls to boys decreases as they study at higher levels of education [4]. A question may reasonably be raised that STEM girls studying at the SSC level must have some problems because they cannot study STEM at higher levels of education. In this case, the general perception is that the socio-economic status of STEM girls studying at the SSC level may be at the root of this problem. An attempt has been made to investigate these issues in the present study.

1.3 Literature Review

Many studies have been conducted on the significance of STEM education in the world's developed countries. They have introduced STEM concepts in their educational settings. So, the industrialized countries continue to publish research papers [5, 6, 7, 8] from different perspectives. All these works have been done in an educational context. Many of these books and research papers are helpful for Bangladesh, and many are not. Although three decades have passed, the term STEM has not yet been formally adopted in this country's education policy. Due to the formal adoption of STEM policies, countries like the U.S. can provide higher education by creating a list of STEM-designated degree programs. However, due to the non-formal adoption of the STEM policy, STEM degrees still need to be directly awarded at the higher education level in Bangladesh [9]. However, the term "science and technology" in this country implicitly refers to STEM education, sometimes called STEM education in a broad sense. As a result, the students of this country need help to realize the importance of STEM degrees at higher levels of education. Few research papers have recently been published on STEM education in Bangladesh, but they are inadequate compared to the need. Anwar [10] did an undergraduate thesis on women in science, technology, engineering, and mathematics (STEM) in Bangladesh. However, he analyzes the scenario of SSC and HSC examination results and presents a comparative study of BRAC University on STEM-related subjects. Here, he did not discover the importance and relevance of STEM education for the upliftment of womenfolk in Bangladesh. The theme and objectives of this proposed study are missing. In 2019, Siddiqa and Braga did research titled "Barriers to STEM education for rural girls: A missing link to innovation for a better Bangladesh [4]." However, it was limited to rural girls only. Besides, the research was accomplished despite individual, institutional, and societal-level barriers. Socioeconomic variables have yet to be explored or analyzed separately in Bangladesh. It also largely fails to meet the objectives of the present study. On the other hand, the present study has explored the socio-economic variables of the respondents, which ultimately found their capability to pursue STEM education at the high school level. In 2020, Hoque and Alam wrote an article on "STEM Education and the Development of Bangladesh: Objectives, Needs, and Reality [11]." Here, they tried to identify the real needs of STEM education from the perspective of Bangladesh. Although the need for STEM education in Bangladesh is highlighted here, more should be discussed about those interested in STEM education. Since the socio-economic landscape of STEM students is essential to controlling their subsequent trajectories, a separate study is needed.So it is clear that, the content of their paper does not match the present study.

From the above discussion, it is found that no direct research has been done on the socio-economic landscape of the high school STEM girls in Khulna and Rajshahi

Districts**.** However, the earlier studies helped reach the objectives of this study. Some of the literature surveys done globally, nationally, or locally will help understand the background, phenomenon, and frame of this present study. Previous research works also help to present and discuss the results.

1.4 Objectives of the Study

The general objective of this research is to explore the standing of the high school STEM girls in Khulna and Rajshahi districts. To this end, the research was accompanied with the following specific objectives:

I. To gauge the social position of the High School STEM Girls in Khulna and Rajshahi District;
II. To measurethe economic status of the High School STEM Girls in Khulna and Rajshahi District;
III. Todetermine their ability to pursue STEM education based on socioeconomic status.

1.5 Research Questions

In light of the study question, a sound research design is reasonable. The researcher should present evidence supporting the suitability of the chosen design [12].This research has been conducted based on the following research questions:

I. What are the level of social landscapeto which the high school STEM girls belong in Khulna and Rajshahi districts?
II. What are the economic backdrop to which the high school STEM girls belong in Khulna and Rajshahi districts?
III. Is their socio-economic capability sufficient to receive STEM education?

1.6 Scope and Justification

The socio-economic standing of girls studying STEM education at the high school level has not yet been explored. Hence, the present study reveals an accurate picture of their socio-economic status. As a result, the students themselves, guardians, policymakers, and the respective authorities of the government will try to find ways to support them, which will strengthen the aspirant's STEM girls. The study findings will serve as a basis for removing the barriers and obstacles before the STEM girls studying at high schools in Bangladesh. It will ultimately increase the girls' capabilities to study STEM in high school. It is, therefore, logical and essential to carry out such a study in several ways.

2. METHODOLOGY

2.1 Research Design

Many Social researchers attempt to define research designs in various ways. Vogt et al., note that, by “designs,” we denote here to the basic approaches of collecting evidence: surveys, interviews, experiments, observations (participant and naturalistic), archival research (data and textual archives), and combinations of these methods. Since the design decision ultimately determines everything, and since it is the one most directly related to the researcher's hypotheses and study questions, design is crucial [12].

On the other hand, Creswellpoints out that, research designs are forms of inquiry that give particular guidance for procedures in a study design within qualitative, quantitative, and mixed methodologies approaches [13].

According to Vogt et al., research designs are divided into six main groups, “which are Surveys, Interviews, Experiments, Observational Research, Naturalistic and Participant Observations, Archival Research, Data and Textual Archives and Combining Designs [12].”

Based on the nature and characteristics of this research and the following important criteria, a survey design has been chosen for this study. These are: the data are best gotten directly from the respondents; brief answers to structured questions have found data; and respondents have provided trustworthy information [12].

2.2 Participants and Sampling Technique

The study has utilized 410 STEM girl students from eight girls' high schools in the Khulna and Rajshahi districts of Bangladesh. There are 8 (eight) Divisions in Bangladesh. These are Chattogram , Rajshahi , Khulna , Barishal , Sylhet , Dhaka , Rangpur, andMymensingh. Among these, Rajshahi is a division located in the country's north-western region, and Khulna is in the country's south-western region. Considering the country's socio-economic status, the socio-economic status of the STEM girls in high schools in these two districts is similar to that of STEM girls in other parts of the country. So, the schools have been selected purposefully, and the students have been selected randomly from classes nine and ten. When conducting surveys, judgment sampling is commonly employed to give a nonprobability sample some legitimacy. Three schools are from rural areas, and the other five are from the Khulna and Rajshahi metropolitan areas. Four Focus Group Discussions (FGD) have been conducted in four selected schools, where a total of 44 (forty-four) participants have attended and have provided their opinions, comments, and observations. Two FGDs have taken place in schools in rural areas. The other two FGDs have taken place in the Khulna and Rajshahi metropolitan areas.

2.3 Research Instrument

A systematic research questionnaire comprising both open-ended and closed-ended questions has been used for the study. Respondents are better able to understand open-ended questions compared to closed-ended ones. Conversely, group settings are ideal for comparing responses to closed-ended questions, which can elicit more relevant information.The students' family structure, economic status, and religious affiliation have been gathered through the questionnaire. Additionally, in-person focus group discussions (FGD) using a checklist has held purposefully.

2.4 Data Collection Procedure

After pre-testing, the questionnaire were surveyed among the STEM students in person. Before that, their consent were received. At the same time 44 (forty-four)FGD participants gave their consent.Science Teachers' Representative, School Managing Committee Member and Students Guardians' Representatives participated in Focus Group Discussion (FGDs).The participants shared their experiences directly from the field level. Along with this, they provide their observations, opinions, and various pieces of advice in the areas where they feel inclined to opine.

2.5 Data Analysis Procedure and Presentation

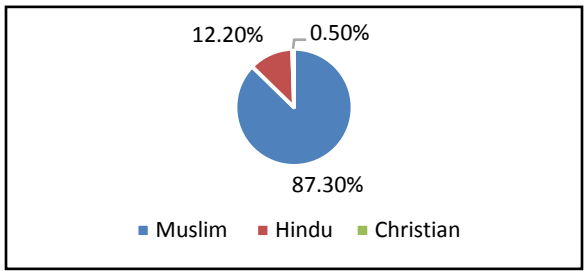
Survey research investigates the socioeconomic, demographic, and cultural status of respondents while also providing a quantitative or numerical assessment of the trends, attitudes, or opinions of a population based on a sample of that group [12, 13]. In this survey design, a focus group discussion has been included. So, qualitative data has been collected on a large scale, which has been incorporated in the result and discussion sections. So, it can be claimed that the qualitative analysis method has been applied to analyze the qualitative data collected through questionnaire surveys and FGDs. Simultaneously, descriptive statistical techniques like time series analysis, correlation, and frequency distribution have been used to analyze qualitative and quantitative data. The results are presented through tables, graphs, charts, diagrams, or mathematical equations.

3. RESULTS AND DISCUSSION

3.1 Religious Association

Religion always plays a vital role in thinking and doing work worldwide. In Bangladesh, among the total population, 91.04% are Muslims, 7.95% are Hindus, 0.61% are Buddhists, 0.30% are Christians, and 0.12% are from other religions [1]. Usually, the representation of the respondents should be like this. However, the following figure indicates that the Hindu girls spontaneously participated in the survey. It also indicates that their engagement in STEM education at the high school level is more robust than that of their Muslim counterparts. Besides this, no other religion in Bangladesh is dominant here. This study's scenario of a religious association in Bangladesh has been reflected clearly. Regarding this, a FGD participant points out that, “since people of all religions enjoy their religious rights and freedom equally in Bangladesh, they hardly face any obstacles. Moreover, there is mutual harmony among all religious communities in this country. Due to these reasons, students of all religions can pursue any education they choose [14].” Therefore, although Muslims are more numerous, the followers of other religions are not deprived at any level of getting an education

Figure 1: Religious affiliation of the selected STEM Girls



But now a question may arise: why are the Hindu girls studying STEM, or the science stream? In answer to this question, it can be said that they are minor when considering the number of population. If they want to survive with dignity, they have to prove their quality. An overall balanced scenario can be found in the account presented in this study of the religious affiliation of the people of Bangladesh.

3.2 Age

Age is always a significant factor in learning, particularly for kids and teenagers. This study's respondents were chosen from classes IX (nine), and X (ten). The chosen schools' data were gathered in 2022 and 2023. In this connection, it should be noted that the Bangladeshi government has decreed that a student's age must be at least 6 (six) plus when he or she is allowed to admit class I (one). The table below demonstrates how the schools are adhering to the government's directives. There would therefore be no bias in the educational process, with the exception of the exceptional child. It has been found in this study that the girls' views and goals are developing in the proper way.

Table 1: Year of birth of the STEM girls studying at high school level

Year of Birth	Frequency	Percent	Valid Percent
2005	12	2.9	2.9
2006	79	19.3	19.3

2007	171	41.7	41.7
2008	125	30.5	30.5
2009	23	5.6	5.6
	Total	410	100.0

It can be noted from the above table that the educational institutions in Bangladesh are currently fully complying with the government guidelines in terms of age. Institutions are admitting students who meet the minimum age bar. Moreover, parents are also taking more precautions in this regard. It can be logically claimed that the age of students does not pose any problem in taking up STEM education.

3.3 Marital Status

Marriage is a vital issue for girls all over the world. Parental encouragement of their daughters' marriages is common around the world. They hope the marriage will help them socially and financially while relieving the family of some financial pressures, although they are still children [15]. In Bangladesh, the scenario of child marriage could be more optimistic. A survey among married women ages 15–49 years found that 19.8 percent were married before age 15 [15]. But girls studying STEM at the high school level are in a safe position. This study reveals that, among all the respondents, only one is married. It conveys two messages for policymakers and their parents or guardians. The first one is that if someone intends to arrange STEM education for their daughter, the thought of her daughter's marriage should be removed from their mind during her high school-level STEM education studies. The second thing is that to retain girls in high school-level STEM education, in any case, child marriage should be prevented during STEM schooling. From the socio-economic standpoint of the respondents, it can be claimed that STEM girls' familial thinking about their marriage is very positive. Their parents or guardians think their daughters' marriage may threaten their education. So, the STEM girls can concentrate on their studies without anxiety regarding marriage. It is noted that the case of only married girl in this study is exceptional. Her age crosses over 18 when she gets married. And both her father and mother are physicians (doctors). In this case, it is explored that her parent was not agreed to her marriage. Only through her insistence on marriage they gave consent to their daughter’s wedding. So, from a socio-economic perspective, this girl’s position is excellent, and her parent is very conscious regarding their daughter’s STEM career.In this context, an FGD member argues that “early marriage is not a problem for everyone. Sometimes, early marriage is the solution to the situation created unexpectedly, but if there is familial and institutional support, a girl can continue her education [16].” So it can be said that if a girl at this age does not think of marriage, then she is more likely to continue any education.

3.4 Educational Qualifications of Respondents' Fathers

The educational qualifications of the father considerably broaden and smooth the children's path in shaping their future and educational attainment. Generally speaking, a father's educational qualifications are closely related to his daughter's studies in a developing country like Bangladesh, where women continue to struggle. Women in this country are already lagging behind men in many ways. Moreover, women lag significantly in STEM education. So the father's role is much needed for STEM education to reach the same level as men's or further. It is necessary to analyze the father's educational qualifications to determine whether he can meet that requirement. The discussed research needs to analyze the extent to which fathers' contributions are necessary for girl students' participation in STEM education and in continuing that education. It is found in this study that, fathers have two types of educational qualifications. These are degree oriented and class wise qualifications.

3.4.1 Degree-oriented educational qualification of respondents' Fathers

Table Error! No text of specified style in document.**: Degree-oriented Educational Status of the Fathers of the Respondents**

Name of the Degree	Frequency	Percent	Valid Percent
SSC or Equivalent	40	11.4	11.4
HSC or Equivalent	55	15.7	15.7
Diploma or Equivalent	4	1.1	1.1
BA or Equivalent	81	23.1	23.1
MA or Equivalent	164	46.9	46.9
Kamil or Equivalent	2	.6	.6
Others	1	.3	.3
PhD or Equivalent	3	.9	.9
Total	350	100.0	100.0

The above table demonstrates that among all the respondents, 85.40 percent of fathers have degree-oriented educational qualifications. Among them, almost half have obtained an MA or equivalent degree. The next highest degree they have is a BA or equivalent. Here, Kamil means master's degree or equivalent to a postgraduate degree. The complete form of BA is Bachelor of Arts, and MA is the acronym for Master of Arts. Let us consider the secondary-level completed or higher-educated males of this country. We can notice that among the age group 35–39, the rate is 26.94 percent, 25.78 percent for the 40–44 age group, 23.23 percent for the 45–49 age group, 21.12 percent for the 50–54 age group, 18.75 percent for the 55–59 age group, 18.12 percent for the 60–64 age group, and 16.63 percent for the 65+ age group. However, this study found that 85.40 percent of fathers have completed secondary or higher education [1]. In this context, a teacher said,“Fathers with degree-based education are very concerned about their daughters' education. They are also very careful and diligent about which stream of study their daughter can pursue for a good career [17].”So, these findings show that educationally sound fathers have a dream regarding their daughters’ education. They chose STEM education for their daughter, not arts and humanities or business education.

3.4.2 Class-wise Educational Qualification of Respondents' Fathers

Table 1: Class-wise Educational Status of the Fathers of the Respondents

Name of the Class	Frequency	Percent	Valid Percent
Self-Educated	23	38.3	38.3
Class Five	7	11.7	11.7
Class Six	2	3.3	3.3
Class Seven	2	3.3	3.3
Class Eight	15	25.0	25.0
Class Nine	6	10.0	10.0
Class Ten	5	8.3	8.3
Total	60	100.0	100.0

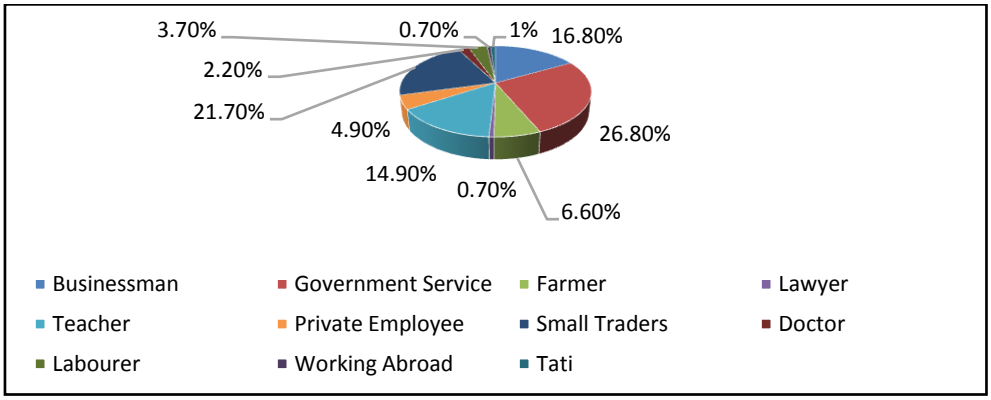
The above table displays that, among the fathers of the total respondents, only 14.60 percent have no certificate or degree-wise education rather they have class-oriented education. Among these 60 fathers, only 23 are illiterate or self-educated. Moreover, the rest of them have started studying but have yet to complete secondary education.

It should be noted that, logically, the respondents' father is 25 to 59 years old. In Bangladesh, among the population of this age group, the male literacy rate is 74.97 percent. That means 25.03 percent of males are illiterate or self-educated. However, in this study, only 5.61 percent of fathers are illiterate or self-educated. Moreover, over three-fourths of the total 350 fathers have a degree-oriented education. So, it can be claimed that STEM girls come from educationally conscious fathers. It is also significant that only some self-educated or illiterate fathers have understood that STEM education demands time from which their daughters can find soil on their feet or be self-dependent.

3.5 Occupational Positions of Respondents' Fathers

In the patriarchal society of Bangladesh, the power of decision-making as the head of the family usually belongs to men. Therefore, the father's professional position often influences his children's educational decisions. It is generally thought that girls in this country are weak in their father's profession. They want to join their father's profession if they can. Moreover, if the father wants to see her in another profession, the daughter tries to fulfill her father's dream. From the following figure, it has been found that daughters of fathers of which profession are studying STEM education.

Figure Error! No text of specified style in document.**: Occupational Status of Respondents' Fathers**



The figure shows that most of the girls have come from fathers who are doing government service. They are 110 in number. The second-highest number (89) has come from small traders, and the third-highest number (69) has come from businessmen. The teachers are in fourth place in the race to provide STEM education to their daughters. Sixty-one STEM girls have come from teachers' families. This study shows that farmers' or cultivators' daughters and laborers' or workers' daughters are studying STEM education on a tiny scale. Their representation in this education is 6.6 percent and 3.7 percent, respectively. Whereas in secondary school education, the farmers' daughters and workers' daughters represent 40.37 percent and 18.04 percent, respectively ([2]. From these findings, it has been clearly understood that girls from the fathers, engaged in lower class professions cannot study STEM education, though they represent secondary school education on a large scale. On the other hand, the daughters of government servants, small traders, businessmen, and teachers are studying STEM on a large scale. When the daughters of marginalized people are denied STEM education, which does not indicate a balanced society.

3.5 Educational Qualifications of Respondents' Mothers

The mother's educational qualifications greatly broaden and smooth the way for the child's future and educational attainment. Because the family is the first institution for a child, the mother's main responsibility for child rearing sometimes rests with her in Bangladeshi families. So if the mothers are educated, the children start getting the light of education from

home, which the educational institutions develop. Generally speaking, a mother's educational attainment is closely related to her daughter's education in a developing country like Bangladesh, where women continue to struggle. The role of the mother in sustaining the STEM student's studies is repeatedly discussed in the research. It is found in this study that, fathers have two types of educational qualifications. These are degree oriented and class wise qualifications.

3.5.1 Degree-wise educational qualification of respondents' Mothers

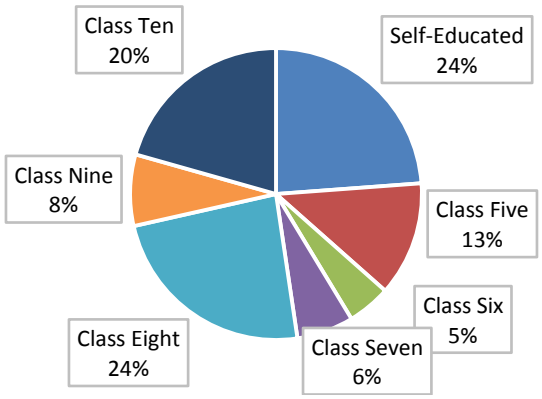
Table 2: Degree-wise Educational Status of the Mothers of the Respondents

Name of the Degree	Frequency	Percent	Valid Percent
SSC	92	26.5	26.5
HSC	63	18.2	18.2
Diploma	3	.9	.9
BA	79	22.8	22.8
MA	109	31.4	31.4
Others	1	.3	.3
Total	347	100.0	100.0

The above table expresses that among all the respondents, 84.60 percent of mothers have degree-oriented educational qualifications. Among them, almost one-third of them have obtained an MA or equivalent degree. The next highest degree they have is a SSC or equivalent. Let us consider the secondary-level completed or higher-educated females of this country. We can notice that among the age group 30–34, the rate is 24.43 percent, 19.63 percent for the 35–39 age group, 16.07 percent for the 40–44 age group, 11.95 percent for the 45–49 age group, 8.34 percent for the 50–54 age group, 6.30 percent for the 55–59 age group, 4.96 percent for the 60–64 age group, and 2.78 percent for the 65+ age group [1]. However, this study found that 84.60 percent of mothers have completed secondary or higher education. Regarding this, some mothers note that, “Those of us who think we have yet to be successful in education. However, our girls can fulfil our elusive dreams. Moreover, that is why we have enrolled girls in Science Stream [18].” These findings show that educationally sound mothers have a dream regarding their daughters’ education. They chose STEM education for their daughter, not arts and humanities or business education.

3.5.2 Class-wise Educational Qualification of Respondents’ Mothers

Figure 1: Class-wise Educational Status of the Mothers of the Respondents



The above figures presents that, among the mothers of the total respondents, only 15.40 percent have no certificate or degree-wise education rather they have class-oriented

education. Among these 63 mothers, only 15 are illiterate or self-educated. Moreover, the rest of them have started studying but have yet to complete secondary education.

It should be noted that, logically, the respondents' mother is 25 to 59 years old. In Bangladesh, among the population of this age group, the male literacy rate is 69.12 percent. That means 30.88 percent of females are illiterate or self-educated. However, in this study, only 5.85 percent of mothers are illiterate or self-educated. Moreover, over three-fourth of the total mothers, 347, have a degree-oriented education. So it can be claimed that STEM girls come from educationally conscious mothers. It is also significant that only some self-educated or illiterate mothers have understood that STEM education demands time from which their daughters can find soil on their feet or be self-dependent.

3.6 Occupational Positions of Respondents' Mothers

59.03 percent of Bangladesh's total population aged 15+ is in the labor force. Male participation is 64.73 percent, and female participation is 35.27 percent. Female participation is 21.96percent in urban areas and 49.52 percent in rural areas [19]. So naturally, the low participation of women in the labor force in this country indicates their weak professional position. So in families where mothers are engaged in multiple occupations, daughters respond positively. Such an attitude encourages those girls to study and pursue a career later in life. In the present study, the occupational status of the mothers of the respondent's STEM female students is analyzed in detail:

Table 3: Occupational Status of Respondents' Mothers

Name of the Occupation	Frequency	Percent	Valid Percent
Homemaker	328	80.0	80.0
Teacher	35	8.5	8.5
Service Holder	34	8.3	8.3
Housemaid	1	.2	.2
Businesswoman	3	.7	.7
Lawyer	1	.2	.2
Doctor	8	2.0	2.0
Total	410	100.0	100.0

The above table states that four-fifths of the girls have come from mothers not engaged in a recognized profession. However, the work they do is called housewifery. It has no monetary value, so it has yet to be recognized as a profession in Bangladesh. They are 328 in number. The second-highest number (35) has come from small traders, and the third-highest number (34) has come from service holders.Moreover, the rest of the girls have come from an insignificant number of professions. From these findings, it has been clearly understood that girls with non-professional mothers can study STEM education. In the socio-economic context of Bangladesh, a homemaker mother can guide high school-level STEM girls.

3.7 Household-based Income Analysis of the Respondents' Parents or Guardians

Table 4: Household-based Monthly Income Related Basic Information of the Respondents' Parents or Guardians

	Amount in Bangladeshi Taka (BDT)
Mean	44474.8780
Median	35000.0000
Mode	30000.00
Std. Deviation	32370.72432
Minimum	.00
Maximum	230000.00

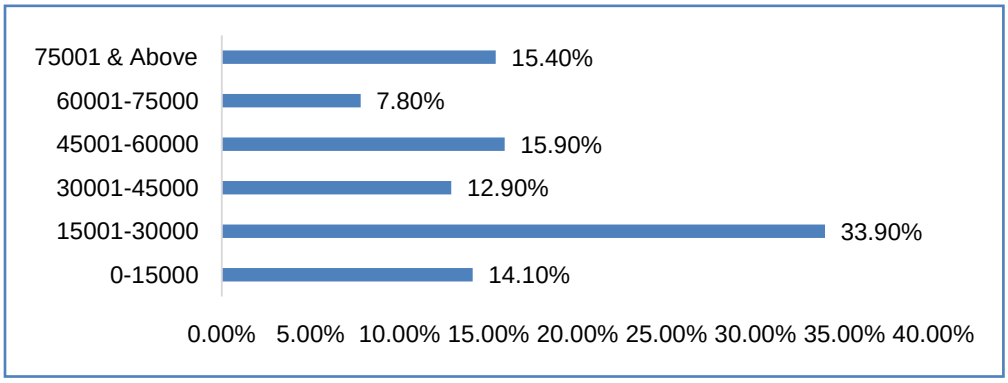
Total household	410

The above table shows some basic parameter from where a reader can understand the basic Household-based monthly Income structure of the respondents' family. Here mean income is 44474.87, which is more than higher average monthly household income (32,422) at the national level of Bangladesh [1]. Apparently it indicate a good figure. But we should bear in mind that, Bangladesh is such type of a country where income disparity is a big problem.

The household-based monthly income of the parents or guardians of STEM girls studying at the high school level needs to be presented in more depth. The survey shows that, every one household earns 5,000; 6,000; 14,000; 16,000; 16,500; 18,400; 19,500; 22,000; 22,300; 27,000; 38,000; 39,000; 65,000; 72,000; 95,000; 96,000; 1,05,000; 1,50,000; 2,25,000; and 2,30,000 Bangladeshi takas per month, respectively. Every two households earn 4,000; 9,000; 13,000; 18,000; 55,000; 1, 20,000, and 200,000 takas per month, respectively. Every three households earn 7,000; 8,000; 12,000, and 23,000 takas monthly, respectively. Only four households earn 21,000 takas per month. Every five households earn 75,000; and 90,000 takas, respectively. Every six households earn 26,000; every eight households earn 35,000; every ten households earn 45,000; every seventeen households earn 25,000 takas; every eighteen households earn 80,000 takas; every twenty-one households earn 70,000 takas; every twenty-two households earn 10,000 takas; every twenty-three households earn 15,000 takas; every twenty-six households earn 60,000 takas; every thirty households earn 1,00,000 takas; every thirty-one households earn 40,000 takas; every forty-one households earn 50,000 takas; every forty-three households earn 20,000 takas; every fifty-two households earn 30,000 takas. Note that no money is earned in two households. There is no earner in these two households. Its surviving members and STEM students make necessary expenses on someone else's income.

In order to more comprehend of the household income of the family, we can analyze it cluster-wise. From the figure below, it can be assumed easily.

Figure 2: Cluster-wise Household Income of the Respondents' Family

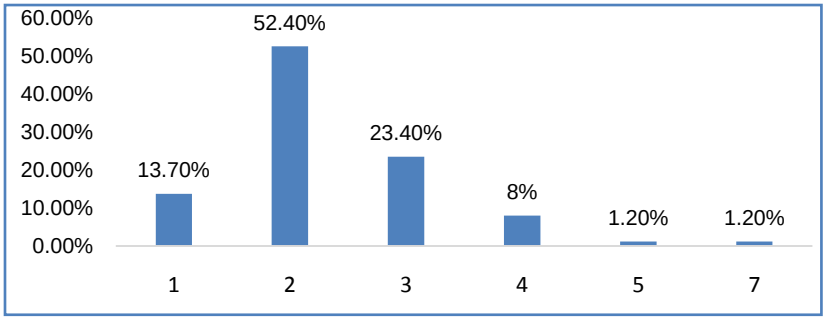


The figures finds that almost half (48 percent) of the respondents' families' monthly income lays below the average monthly household income (32,422) at the national level. It is not a good indicator of a household, where a STEM girl studies at the high school level. Because she has to spend extra money for her studies than other students, who study in Arts & Humanities or Business Studies. So, from the economic perspective, it can be claimed that, the STEM girls will have to face economic crisis.

3.8 Information about Family and Siblings

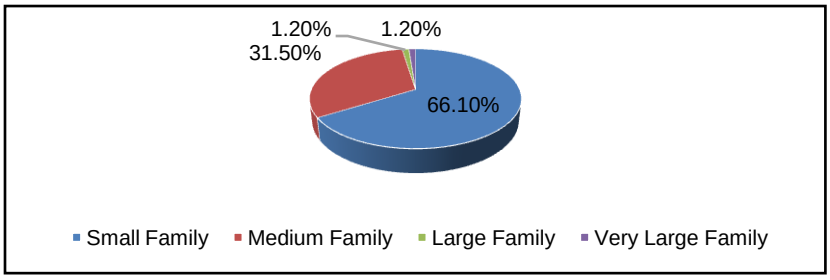
Though population can be considered resources sometimes, but not all the time. Especially in Bangladesh, most of the time, it is considered a burden. Bangladesh is an overpopulated country with a population density of 1119 per square kilometer [20]. This number is too much. However, this number can only represent the resources if the population can be converted into human resources. Since that is not yet possible, it can be called a burden. Moreover, for this reason, family information about the number of children is important in this type of exploratory research, as highlighted below.

Figure 3: Number of Siblings of the Respondents' Family



The figure above shows that the type of family the students come from consists of one to a maximum of seven children. 13.7 percent, or 56 families, have one child out of 410 families, and only five families have seven children. 52.4 percent or 215 families have two children, 23.4 percent or 96 families have three children, 8 percent or 33 families have four children, only five families have five children, no family has six children, and five families have seven children each. It is noteworthy that the highest number of students came from families with two children, numbered 215. And if we divide such families into small, medium, large, and very large, then they can be divided as follows,

Figure 4: Group-wise Number of Siblings of the Respondents' Family



The figure above shows that the largest number of students (66.1 percent or 271) has come from small size families. The second highest number of students came from medium-sized families at 31.5 percent or 129. It is worth noting that only 2.4 percent of the students came from large and very large families, noting that families with one to two children are small, families with three to four children are medium, families with five to six children are large, and families with seven or more children are considered a very large family. The hope is that the average birth rate in Bangladeshi families has decreased significantly. The total number of children in the 410 families included in the study is 966, with an average of 2.36 and a median of 2.00.

In a family, position of a child among children sometimes may be considered significant. If she is the first child in the family, her importance is not the same as other children. If she is in another position, the importance may be different. Sometimes it is seen that parents try to

fulfill their dreams through younger children if their first children do not fulfill their dreams. Therefore, in the present study, an attempt has been made to find out the position of the respondent STEM students. Their position of a family can be described in the following way,

Table 5: Position of the Respondents in Her Family

Position in a Family	Frequency	Percent	Valid Percent
First	218	53.2	53.2
Second	129	31.5	31.5
Third	47	11.5	11.5
Fourth	10	2.4	2.4
Fifth	1	.2	.2
Seventh	5	1.2	1.2
Total	410	100.0	100.0

As shown in the above table, 218 respondents are studying secondary-level STEM education as the family's first child, 129 as the second child, 47 as the third child, ten as the fourth child, one as the fifth child, and five as the seventh child.

Sometimes, a harbinger of a family may positively impact the younger siblings. So it is crucial to explore the scenario of the respondents' SSC-passing science background as brothers or sisters in a family. The table presents the scenario in the following way:

Table 6: Number of SSC Pass Science Background Brothers or Sisters of the Respondents

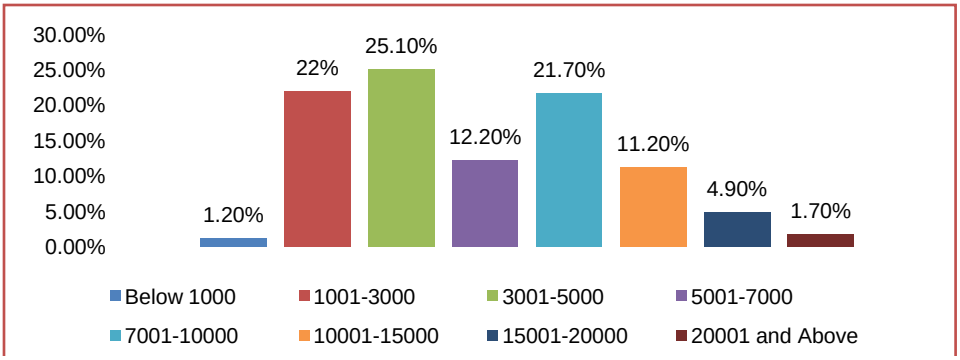
Number of SSC Pass Brothers or Sisters in a Family	In How Many Families	Number of Families from Where Siblings Have Passed SSC from Science Background	Percent of Families from Where Siblings Have Passed SSC from Science Background
1	124	109	87.91
2	42	30	71.43
3	10	5	50
4	1	-	-
5	4	3	75
Total	**181**	**147**	**81.22**

Among the selected 410 respondents, the first child is 218. As a result, excluding those families, 192 families can have only SSC-passing children. However, analysis of the above figure shows that 181 families have SSC-passing children. Children from 147 families have passed the SSC with a science stream. So it is noteworthy that among the eldest children of the family who have passed SSC with the science stream, the younger brothers and sisters of those families are studying in the science or STEM stream at the SSC level. It can be considered a significant variable for STEM respondents. Moreover, their number is 35.86 percent of the total respondents. Furthermore, it can be assumed that these students will be ahead in completing their studies in the STEM stream.

3.9 Monthly Expense Analysis of STEM Students

The Government of the People's Republic of Bangladesh provides free textbooks to all pre- and secondary students. Nevertheless, the students needed help to get out of the culture of the note or guidebook. That is why they spend a significant amount of money. In addition, a large portion of the students are seriously dependent on private tuition outside the classroom. Once a note or guide is purchased, tuition has to be allocated every month, which is like a 'dip (morarauporkhorargha) wound on death' for parents. The respondents' school salaries, books, and tuition fees are presented under an account of the money they spend only on education every month.

Figure 5: Cluster-wise Educational Expenditures of the Respondents



From the figure above, it is clear that the respondents spend a lot of money on their education. Their average expense is 7,385 Bangladeshi taka. The median expense is 6,000 taka, the minimum is 500 taka, and the maximum is 30,000 taka.In this context, some parents said that "due to teaching in the science stream, this amount of money is being spent extra on our daughters. The cost would have decreased by three-fourths if she had studied in any other stream. This is creating serious pressure for us [21]."

The most significant part of their educational expenditure is spent on tuition. It may be in a batch or at their own home. Those who can arrange house tutors for their children spend more than those who teach them in a coaching center or a batch. According to the information obtained in the field survey, 409 out of 410 respondents receive tuition outside the school. Eighty-six read to the house tutors at home, and three hundred twenty-three respondents read to the coaching centers or batches. It should be noted that most teachers at the coaching center have no training or are not even school teachers. From the cross-tabulation below, the tendency to accept tuition among the respondents can be easily understood.

Table 7: STEM Students Tendency to Take Tuition outside School

Tutors	One Subject	Two Subjects	Three Subjects	Four Subjects	Five Subjects	Six Subjects	Total
One Tutor	5	0	3	0	2	0	10
Two Tutors	0	30	3	12	12	2	59
Three Tutors	0	0	43	14	10	7	74
Four Tutors	0	0	0	71	4	1	76
Five Tutors	0	0	0	3	125	2	130
Six Tutors	0	0	0	0	2	58	60
Total	**5**	**30**	**49**	**100**	**155**	**70**	**409**

It is clear from the above table that the tendency for STEM students to take tuition is very intense, a weakness of the country's overall education system. For this purposes, they have to spend a lot of money. In this case, their average expense is 5,612 Bangladeshi taka. The median expense is 4,000 taka, the minimum is 400 taka, and the maximum is 30,000 taka. It is also a question of whether the parents can afford to spend this amount of money after considering the cost of the family. Therefore, in most cases, the child's education costs reduce other expenses. No one except the parents comes forward to cover such expenses. The analysis of the information obtained shows that the parents bear the expenses of 401 out of 410 respondents. The other nine respondents' expenses are provided by brothers or sisters, uncles, or someone else. This implies that the parents have to bear the cost of education.

3.10 Information Regarding the Residence of the Respondents

Three from the rural areas of Khulna and Rajshahi districts and five secondary girls' schools from the district headquarters were selected as samples. Local students study in schools in the village area, while on the other hand, girls from all kinds of rich and poor families in the city area, especially in the district headquarters, are studying in the city headquarters. However, no matter where the students stay, the status of their parents can easily be understood by knowing the type of accommodation presented below:

Table 8: Residential Status of the Respondents' Family

Location of the School	Building	Semi Pacca House	Tin Shed	Muddy House	Total
In the District Head Quarter	261	9	0	0	270
In the Rural Areas	90	42	4	4	140
Total	351	51	4	4	410

Analyzing the above table, it is seen that the parents of the city's parents are better than the students of schools in rural areas. Moreover, the city's girls reside in good condition since almost all students study from home.

4. CONCLUSION

It is found that, the socio-economic status of STEM girls studying at the secondary (SSC) level in Khulna and Rajshahi districts is good. Most of the indicators are above the national index of Bangladesh. The socio-economic status of most of their parents (considering monthly income, expenditure, expenditure on daughter's education, and guardian's profession) is advanced or better than other average families living in society. Considering educational indicators, the number of degree holders among their parents is insignificant (85.40 percent of fathers and 84.60 percent of mothers), while only 23 fathers are illiterate and only 15 mothers are illiterate. Considering financial capability, the monthly household income of 51.46 percent of families is higher than the higher average monthly household income (32,422) at the national level of Bangladesh. Besides, judging by their professional position, it is seen that Daughters of the country's middle-class professionals are studying STEM education in greater numbers. In terms of housing and housing conditions, their position is advanced. Overall, high school girls who study STEM education are half fair on economic status, and differences in social status do not appear to be creating great problems in their studies.Also, on the hopeful side, the small number of families at the fringes of society allowing their daughters to study STEM education in keeping with the times deserves commendation.By minimizing the economic and social problems of high school STEM girls, their potential can be utilized, and the participation of females in the country's STEM field will increase in the coming days.

Consent

As per international standards or university standards, Participants' written consent has been collected and preserved by the author(s).

4 RECOMMENDATION

On the basis of the study's findings, there have been recommendations made for capable Bangladeshi girls to study science, technology, engineering, and mathematics (STEM) in high schools, especially in Khulna and Rajshahi districts:

I. Granting special financial incentives to female students whose parents are in really bad financial standing;
II. Finding households with low educational attainment and setting up counselling sessions for the family members;
III. Discouraging private tuition for STEM teachers;
IV. Informing parents about the bright future of STEM education.

ACKNOWLEDGEMENTS

We express our gratitude to all participants who directly answered the research questionnaire and to the FGD participants who shared insightful observations, recommendations, and remarks. We also appreciate the cooperation of committees, government officials, and school administrators.

COMPETING INTERESTS

The authors have explicitly declared the absence of any conflicting interests.

AUTHORS' CONTRIBUTIONS

The authors were awarded a research grant from Khulna University's Research and Innovation Center for the fiscal year 2021–2022. By June 2023, the project was completed. The article published in this journal is a part of that research. The study's concept was developed, the research was organized, the data was acquired, and the corresponding author, MMA, wrote the paper. Another author, AAR, revised the complete article. Both authors reviewed the final manuscript. After reading it the authors approved the final manuscript.

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