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Female Students and Science Education in West Bengal, India : A Study of Encouraging and Discouraging Factors and Their Effects on Them

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Abstract

The low representation of women in the Science and Technology is a social, economic and cultural concern. Most of the researches concerned about women who studied under-graduate and post-graduate in science. But, very few studies interrogated about schools students. Hence, the study investigated the encouraging and discouraging factors that impacted on female students in retaining science education. In this respect, a sample of 110 respondents of 6 schools in West Bengal, India had been evaluated and recorded through survey. The paper addressed the female students from class 8 to 12 of secondary and higher secondary schools. The study found several factors such as lack of science teachers and science departments, Scarcity of science tuition, Inadequacy of the English language and others impeded them in pursuing science education. The paper also gives some suggestions based on findings to overcome the barriers encountered by students in science.

Keywords- factors, female students, school students, science education, survey

Introduction

The extensive adoption of technology in everyday life has made S.T.E.M. (Science, Technology, Engineering, Mathematics) education a prerequisite for sustainable education for all and social well-being. Rendering equal access and opportunities to women and girls is one of the key features in the agenda of the Sustainable Development Goal. Remarkably, S.D.G. 4 discusses equitable quality education and lifelong learning facilities. S.D.G. 5 demonstrates the achievement of gender equality and women's empowerment in all strata of society. However, neither S.D.G. (S.D.G. 4 or S.D.G. 5) adequately interrogates women in the S.T.E.M. sector. Women in science are underrepresented in various parts of the world. According to the World Bank (2020), even though the number of women in S.T.E.M. graduates is higher than men in S.T.E.M., women are less likely to enroll in

S.T.E.M. studies, mainly Physics, Mathematics, Computer Science, and Information and Communication Technology (I.C.T.). The women who study STEM education are likely to enroll in STEM careers and exit jobs before their male counterparts. Therefore, the participation of women in S.T.E.M. education and career is becoming lower in every stage.

Most of the works have extensively evaluated women either studying S.T.E.M. education at the undergraduate and postgraduate levels or working as faculty members in prestigious universities or institutes in India. However, it is unfortunate that this discrimination may start at the school level, and that has not been adequately investigated. We must focus on female school students and their academic problems to get more women in science. Stoet mentions that it is in that time range between 15-18 years when the instigation of choosing S.T.E.M. career is made (Stoet and Geary, 2018).

As the study has predominantly depicted the science education of female students of secondary and higher secondary students in West Bengal, it is essential to mention school education in West Bengal. Students generally study all subjects like Bengali language, English language, Mathematics, Physical Science, Life Science, History, and Geography from class VI to class X, known as secondary education. After *Madhyamik Pariksha* or secondary examination, they can choose the science, arts, and commerce streams. Remarkably, students who obtain good marks in the secondary examinations are eligible to study the science stream. In higher secondary, the pupils study Physics, Chemistry, Mathematics, Biology, Bengali, and English. Based on the marks obtained in higher secondary examinations, the students pursue an honors degree in college or university. After the higher secondary exam, those students who score high rank in JEE (Joint Entrance Examination) or NEET (National Eligibility cum Entrance Test) are to be considered in getting admission to engineering and medical colleges.

According to the survey published by the Ministry of Education in India (2023), female students at the higher secondary level of government and private schools in India constitute around 39.16 % passing out in the science stream, which is lower than male students, constituting 47.67%.In addition, in the scenario of West Bengal, it is found that female students at higher secondary levels constitute around 12.09%. In contrast, male students represent around 17.79% of passing out in the science stream. Although, in obtaining the '60% and above marks category', female students in India and West Bengal at the secondary level have achieved much more performance than male students. Hence, gender disparity is found in studying science from secondary to higher secondary.

Literature Review

Students' reluctance to take science subjects after secondary examinations has become paramount for the continuity of scientific endeavors and future generations' science literacy. Consequently, positive attitudes towards science, science learning, and scientists have been considered essential phenomena. Simpson et al. (1994) brought out an extensive examination of the attitudes of different science subjects. Remarkably, the study shows that a negative impact on a particular science subject leads students in general and female students in particular to lose

interest in science careers in the future. Therefore, awe for any difficult science subject propels students to mislead them from their entire science careers.

On the other hand, a positive attitude toward science subjects thrusts a lifelong journey in science (Simpson and Oliver, 1990**).** Besides, several studies have attempted several factors that propel towards on choosing science. These things could be categorized as personal intention, gender, socio-economic proclivities, and others. Of all these, gender may be rendered as the most crucial factor. Francis and Greer (1990**)** found that men have more positive attitudes than women towards science. Ormerod and Duckworth (1975) addressed a significant distinction between selecting physical sciences and biological sciences concerning gender, where male students favor physical sciences and female students favor life sciences. The study of Naugah and Watts (2013) showed the evaluation of teaching from four science classrooms in a school in Mauritius with particular importance on female students. The study found little opportunity to interact among students, and the lack of activity-based learning and the unilateral dimension of teaching are the determining factors that alienated them from studying science.

As the setting of science education has been considered in this study, it is essential to look at the study of India in general and West Bengal in particular. Very few studies have mentioned science education of secondary and higher secondary students in West Bengal. Sahoo (2019**)** aims to assert the recent status and challenges of girls' science education in India and provides possible suggestions for overcoming these challenges. More recently, Babu (2020**)** showed that by implementing various national schemes for students in India, the universalization of elementary education would be possible. In the case of West Bengal, Banerjee (2016) indicated the reasons behind the reluctance to effective participation of female students in science and technology in the class of XI. The study was conducted through a survey among the students of class XI in the science stream from four schools in the Hooghly district in West Bengal. Two hundred sample students (50 students for each school) were selected through a random sampling. All the students were girls. Around 15 questions were asked to collect the data. The study finds that superstitions, domestic issues, and responsibilities of the families are reluctance to effective participation of female students in science.

The Social Cognitive Theory

The decision to study S.T.E.M. education or not and the preclusion of dropping out from school is based on Albert Bandura's Social Cognitive Theory. The theory incorporates the learning that people learn something within a social setting. People can be influenced by imitating the behavior of the models they imitate. One prominent assumption of this theory is observational learning, meaning that people not only learn through individual action but also through imitating others. In this regard, factors like self-efficacy, outcome expectation, goal, and self-evaluation affect people. Remarkably, Bandura's Social Learning Theory is very relevant to female students studying science in school. The instigation for choosing a career in science is made within the age group between 15 and 18. They are highly influenced positively or negatively by noticing their models, like parents, teachers, and senior students, and they try to emulate them in their careers. Various factors may be encouraging or discouraging,

motivating them within their environmental setting. It is thus also contextually essential to mention Bandura's Bobo doll experiment. In this experiment, some pre-school children were shown in a video where an adult person hitting a Bobo doll is either rewarded or punished for that work. Seeing the adults getting awarded, some children imitate them by hitting the baby doll. Therefore, according to Bandura's Social Cognitive Theory, female students in school also try to instill observational learning by imitating others. The theory involves three main characteristics- self-efficacies, result outcome, and goal. Self-efficacy highlights the specific areas where the students are experts, where, as the outcome of the result indicates the result of their efforts and goal, it represents that through self-efficacy and the outcome of the results, they will satisfy their goal in the future. Simultaneously, female students encounter the same circumstances while studying in the school's science department. Therefore, the study has utilized Albert Bandura's Social Cognitive Theory in this empirical study. The study has also elaborately traced the factors anticipated in this theory.

Study Objectives

The gender gap in science education starts in school and prevails until the workplace. Therefore, it is necessary to find out the causes of why female students are not interested in pursuing science careers in the future. Thus, the study addresses two research questions that need to be answered.

1) What factors encouraged and discouraged female students of class (VIII-XII) in the government-aided schools of West Bengal, India?

2) Based on the findings of the research questions, what steps can be recommended to reduce the gender gap in science education?

These questions were asked to get data about encouraging and discouraging factors of girl-students

1) How do you come to school?
2) What is the source of income in your family?
3) Which science subjects are in your school?
4) Which science teacher can enthuse your interest in which subject and why?
5) Why have you opted for the science stream?
6) Do you attend school regularly? If not, why?
7) Do you take science private tuition? If yes, in which subject(s)?
8) Are there any instances of female students dropping out of your class? If so, why?
9) Is there pressure on you to discontinue study? If yes, why?
10) In your educational pursuit, who supports you the most?
11) What profession/occupation do you want to pursue? What are the reasons behind your choices?
12) Are you preparing for the A.I.E.E.E. or the NEET exam?
13) Does your school have laboratory facilities?

Table 1

Application of Survey design to obtain knowledge about encouraging factors and their reasons

Encouraging factors	Reasons/Examples
1) Self-perception 2) Self-efficacy 3) Marks 4) Senior students as role models 5) Family support and encouragement 6) General academic environment 7) Encouragement of tuition teachers in school 8) Social background 9) Availability of science-tuitions 10) School environment	1) Interest in science subjects since childhood and having an inherent nature of solving sums. 2) Intention to get good marks that lead them to study science stream 3) Encouragement from noticing senior female students pursuing science stream 4) Family supports to study science after secondary examination 5) Some school teachers and all the tuition-teachers motivate to study science 6) Students of upper-caste and upper-middle Class families are encouraged to continue

	Science Education
	7) Sufficient science tuition in urban areas helps urban students
	8) Laboratory facilities encourage students

Table 2

Methodology

The work was carried out in several stages. A structured questionnaire was given to the female students to get responses to each question. The data was collected through interviews, and female students surveyed for this study were separately interviewed in schools. The sample students belong to three districts- Purba Bardhaman, Hooghly, and Nadia in West Bengal, India. The study collected information from 110 respondents, including 60 students from Class VIII to Class X and 50 from Class XI and Class XII. Based on the result, discussion, and findings, a critical analysis of collected data is demonstrated, and proposals for reducing the existing gender gap are addressed in this study.

Application of survey design to get information about discouraging factors and their reasons

Discouraging factors	Reasons
1) Lack of science teachers 2) Lack of science department 3) Scarcity of science tuitions in rural areas 4) Insufficient knowledge about science-Related jobs 5) Shortage of funds and infrastructure for science-related jobs 6) Absence of interest in science subjects 7) Inadequate knowledge of English language 8) The absence of money to pursue science 9) Want of knowledge about scholarship, fellowship, schemes provided by government schools, so they have no sufficient 10) Deficiency of skill of science teachers' knowledge of the English language that lead them not to pursue science	1) Having insufficient science teachers and science departments in schools 2) Urban areas have science-tuitions but not in rural areas 3) Most of the parents have no idea 4) Schools informed about lack of funds and infrastructure in schools 5) Weakness in science subjects for its difficulty in the students 6) Students study in Bengali medium 7) having no enough money to continue science education of their daughters 8) Parents and teachers have no knowledge about science-related government and non-government schemes, plans 9) Most of the science teachers have no capability to learn the science subjects

Table 3

Result and Discussion

Considering the first research question, data was collected from female students who belong to six government high schools in West Bengal through the survey. The question " What factors encouraged and discouraged female students from pursuing science education?" was developed through a questionnaire and in-depth interviews with the female students. The responses were obtained from 110 female students to know the current situation of female

students who want to pursue S.T.E.M. education in the future. The sample students were taken from class 8 to class 12, where class 11 and class 12 students are studying in the science stream. The demographic picture of female students from different schools is given in **Fig.1** who responded to the survey.

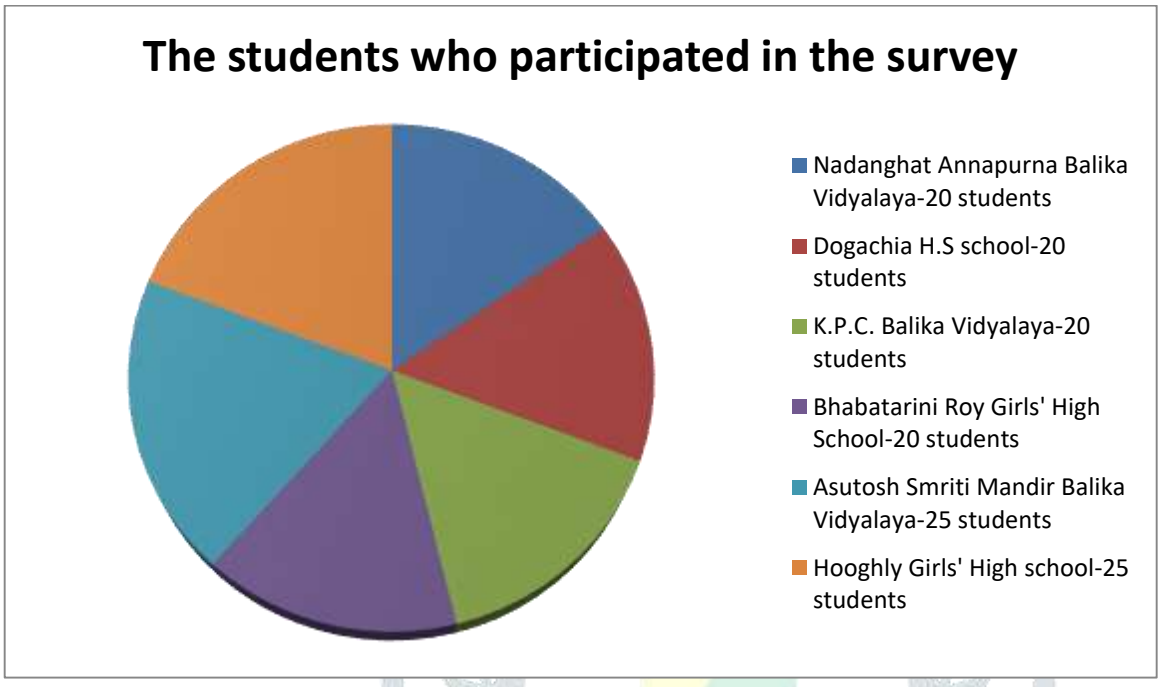

Figure 1

One of the first questions was asked to the students on the survey about the source of income in their family to collect information on socio-economic factors. It is necessary to know whether the socio-economic factors affect their science studies. The students surveyed in this study predominantly belong to rural and urban areas. The demographic profile of the source of family income of the girl-students can be depicted in **Fig.2,** where only the parents' income source is considered in this study.

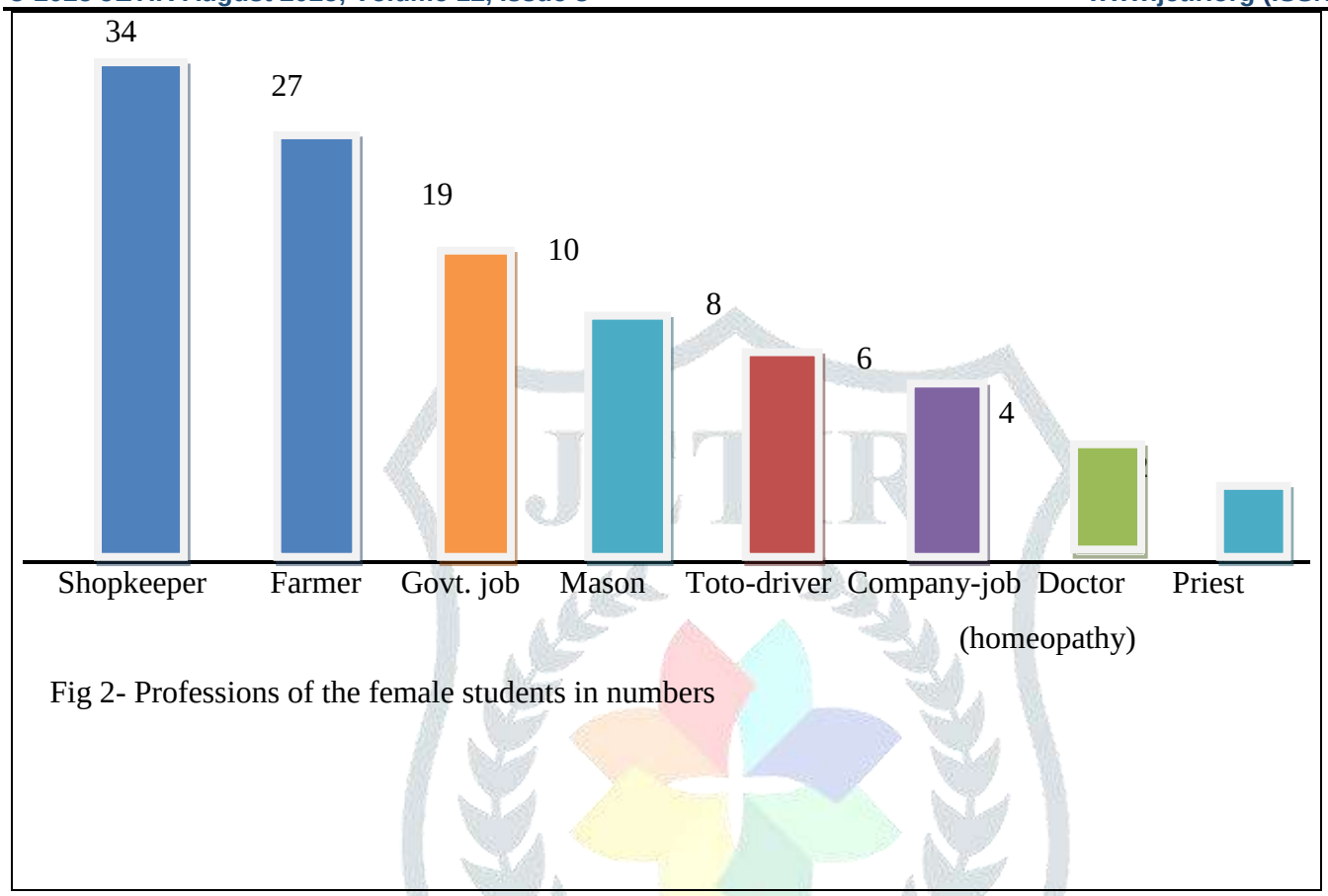

Fig 2- Professions of the female students in numbers

Figure 2

Analysis of Figure 2: Figure 2 shows the diversity of parents' professions, where nobody is directly interconnected with scientific professions except four homeopathic doctors. Also, most of the families belong to those below the poverty level. So when the students were asked about their future profession, they responded with confusion that neither of their families nor they do not know how to pursue S.T.E.M. education in the future. The parents, who are farmers, masons, and Toto drivers, entirely depend upon tuition teachers, as some students have mentioned. Therefore, socio-economic factors extensively impact on science education on the female students.

Some students replied in such a way:

- "My father works in the field the entire day. He comes in the evening. Then he goes somewhere and returns home at night. Both my mother and father studied in class six. So, whatever our tuition teachers will advise to choose the stream, I will do that".

- "Despite being a shopkeeper, my parents always encourage studying science. Although they do not know how to prevail in science education after higher secondary examination."
- "One of my maternal aunts is a doctor; I will ask her what I must do after higher secondary examination."

Table 4: Action, situation, and self-motivation that impacted the girl-students in choosing science education and careers

Attitude of other people	**Self-perception and values**	**External situations**	**Actions by tuition teachers**
			School teachers and students
1) What are the factors that motivate you to study science			
discipline, support motivation,	self-confidence, self-efficacy	talking to the senior's mentorship,	
constancy, encouragement, inspiration, support,	perseverance, curiosity	about the future of science,	
accompaniment, help,	dedication, organization	consultancy with an engineer willing to	
passion for the area, empathy, professional development	disciplines, creativity, and academic love for science	environment in tuition	
2) What are the factors that demotivate you to study science?			
scarcity of job, mockery of difficult subjects, extensive for studying in science, very competitive nature in people	pressure to obtain the highest home works, excessive memorization, self-irritation	pressure from parents, excessive rebuking, catcalls from students	marks, long distance of school and tuition, lack of science teachers, health problem

Regarding the context of **the attitude of other people,** some female students indicated that the attitude of parents and relatives positively and negatively impacted them to continue their science education in the future:

- “My father and uncle have studied in medical sciences. My mother encourages me to be a doctor by studying medical sciences than my father and uncle".
- “My father always inspires me to do whatever I love in science. He often brings books and magazines related to scientific current occurrences".

Along with these positive factors, another positive factor can be mentioned in this context. When the students were asked if someone was pressuring them to discontinue your education/science education, almost everybody said no except two responses from two female students, one from class ten and another from class 12 (studying in science stream) consecutively :

- “Despite being in first position in class nine in our class, my parents told me to take the arts stream after the secondary exam, but I intend to study in the science stream. One of the reasons for this is there is no science tuition close to our house. If I take the science stream after *Madhyamik Pariksha* (secondary exam), I will have to return home at night through an open field. I have no elder brother or uncle. My father works as an A.T.M. guard in a town. He occasionally comes home at the end of the week. Therefore, it is not possible to take science stream after secondary examination".
- "I have no father and mother. My grandfather has taught me since childhood. Now, he is not able to spend money on science tuition. So I will choose the arts/humanities stream after the higher secondary exam".

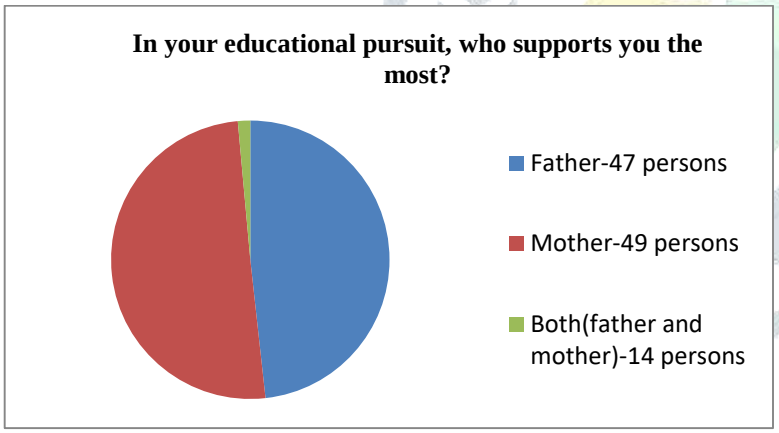

Fig.-3

- "Some relatives told me that it is futile to study in science after higher secondary. We are living in a highly competitive job market. So, without bribing money to the political leaders, getting a job is impossible".

Regarding the context of **self-perception, values, and self-motivation**, the majority of the girl-students considered that socio-economic factors, self-efficacy, self-confidence, school environment, and family environment impacted whether they would pursue a career in science or not:

- “I have chosen the science stream because I got good marks in science and other subjects."

- "My father wants me to be a doctor in the future. That's why I have chosen this science stream".
- "If I take science stream, then it will be easy to get a job because most of the questions select from science subjects and mathematics."

Some demotivating factors also discouraged them from studying in the science stream. When the students from class 8 to class 10 were asked whether they wanted to pursue a career in science in the future, some students negatively replied in this way:

- "I don't want to take science stream in class 11 because I cannot understand mathematics and physical science. Mathematics is a tough subject. I cannot understand the formula of physical science".
- "Biology is my favorite subject, but based on only biology subject, I will not take the science stream."

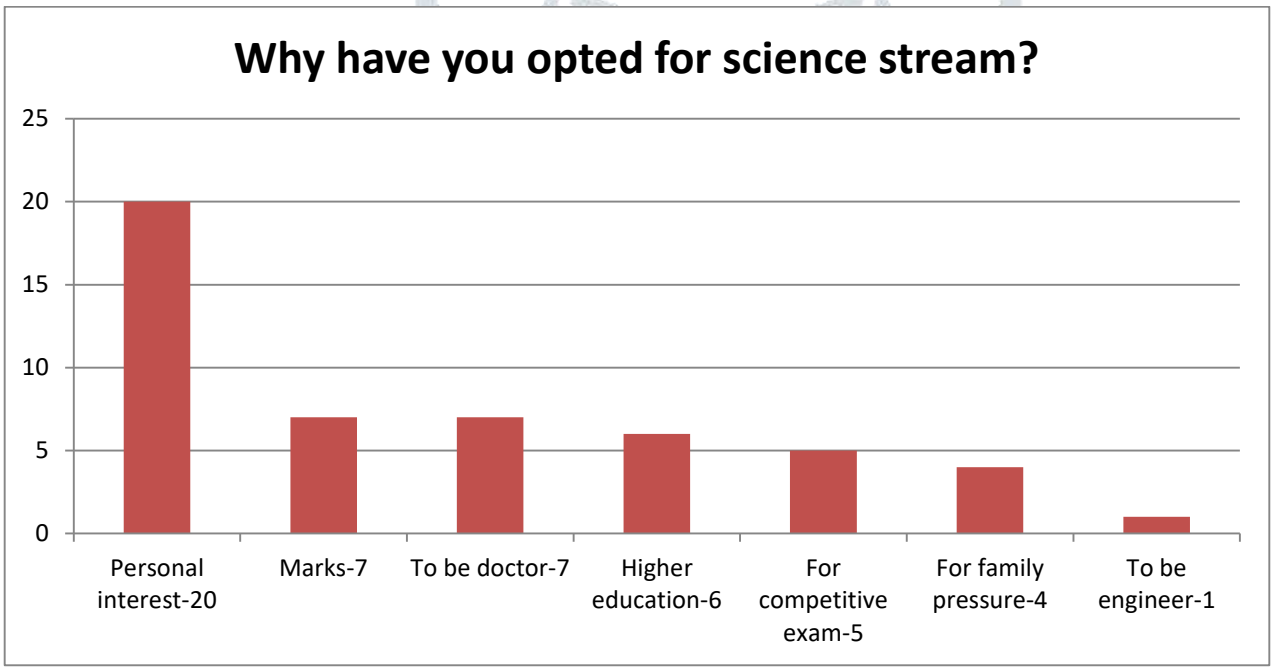

Figure-4

Analysis of Figure-4: This is an analysis of 50 responses from those who studied in the science stream in classes XI and XII. The female students were asked why they opted for the science stream after the secondary examination. This result shows their demographic profile when choosing the science department. It is evident from this figure that because of personal interest, most students chose science, and only one girl said that she had taken the science stream because she wanted to be an engineer.

One of the questions about **self-perception and values** was asked to the students regarding the occupation they want to pursue in the future. The majority of the students replied that they want to be doctors in the future. But some female students made exceptional goals in science-related careers:

- "I want to study Animal Husbandry or Veterinary science because we can tell others our problem, but animals cannot say their problem. I want to treat them".

- " My grandfather studied pharmaceutical chemistry; he told me to study in this course so that I would get a job easily because everybody studies traditional science courses; consequently, getting a job in the future would be extensively competitive."
- " I intend to be an I.A.S. officer through studying science in graduation. But now I don't know how to be possible".

Several factors have had a negative impact on choosing science-related careers to them while they were asked about their future professions:

- "Excessive pressure of tuition teachers for completing homework is making lose of interest in science. I am not able to complete it in a hurry. Therefore, I will choose Bengali or English for graduation."
- "To me, physics is a complicated subject. We have no physics teachers in school. So, I rely on the tuition teacher, but I cannot understand physics clearly to our tuition teacher. I want to change my stream after higher secondary".

Regarding the **external factors** for which female students mentioned their opinions, some factors inspired them to study science, and some factors discouraged them from pursuing S.T.E.M. in further studies. When the students were asked about whether they attend school regularly, some female students anticipated a few reasons for why they cannot attend school regularly:

- "We generally come to school on those days when we have practical classes. Guest teachers from outside our school come to teach us practical things about physics, chemistry, and biology. We do not have sufficient teachers for science subjects in our school. That's why we do not come daily except for practical classes".

Therefore, it is evident from the lines mentioned above of female students who are studying in the science stream that external features like the insufficiency of science teachers and the school environment have a negative impact on them in science education. For them, school is nothing but giving marks sheets. So, they go to tuition instead of going to school.

- "The distance of our school from our house is very long. First, I come to a bus stop by cycle, which takes around 30 minutes. Then I take the bus and go to the river bank within 20 minutes. Later, I ride on a boat and come to school on foot. In the rainy seasons, I cannot attend school regularly because, on those days, the river-side becomes so muddy that there is a chance to slip into the river".
- "When I come to school by cycle, some boys follow me and try to intimidate me. I cannot tell all these things to my parents in fear. For this reason, I cannot attend school regularly".

Apart from these reasons, most students do not come to school because of sickness, unhygienic toilets in schools, tuition, and other things.

In two schools, some students attend school regularly because of the environment. These two girls-schools have no science departments despite being interested in coming to school as there are given mid-day meals and because of the school are covered with trees.

- " School generally does not provide a mid-day meal to the students who study in class X, but our headmistress manages to provide a mid-day meal to us."
- "We have made this garden in our school; before that, our seniors have made this. Our headmistress helps us plant trees at our school boundary. We love to plant trees. So, we come to school daily. We water them, cut their leaves, and give soil to the trees every day".

Does your school provide coaching of AIEEE/NEET?		
Name of the schools	AIEEE	NEET
K.P.C Balika Vidyalaya	NO	NO
Dogachia H.S School	YES	NO
Annapurna Balika Vidyalaya	NO	NO
Tarasundari Balika Vidyalaya	YES	YES
Hooghly Girls' High School	YES	YES
Jirat Colony H.S School	NO	NO

Table-5

Analysis of Table 5: When the students were asked if their schools provide coaching for AIEEE/NEET exams, all the students responded, and their responses are displayed in Table 5, where it is seen that most of the schools do not provide coaching for both NEET and A.I.E.E. exams.

Regarding the laboratory facilities, the students were asked to speak about it whether they are benefitted from this laboratory or not. According to the opinion of the students, it was found that three girls' schools have no science departments, and other schools have science departments. So, laboratory facilities impacted the female students in their choosing science in a different way, which negatively and positively instigated them:

- "Our school has no science departments. I have heard that students in the laboratory do many scientific experiments. But I have never seen it. If I take the science stream after *the madhyamik examination*, I will have to go to another school where we will have a science laboratory."

Therefore, students in these schools where there are no science departments are not accustomed to scientific activities. Besides, these schools have no sufficient science teachers. These two determining factors may affect their career in science.

- "Despite having a science department, we are not allowed to enter science laboratories because we study in class IX. Only the students of class XI and Class XII from the science department are allowed to enter."

Now, it is essential to look at the opinion of the female students of Class IX and Class XII who have science departments in schools:

- “Our laboratory is well-infrastructure. Teachers teach us practical classes very deliberately. We regularly attend practical classes.”
- "Laboratory assistant is accommodating. When I cannot handle the instrument. He comes to help me".

Regarding **the actions by school teachers, tuition teachers, and students,** some female students mentioned the role of science teachers in schools and tuition that influenced them in pursuing science careers:

- “I like physical science because school-teacher and tuition-teacher explain physical science explicitly and mathematics is very problematic to me”.
- “Biology teacher enthuses me to study science because he teaches that if someone is affected by illness, then I would explain that it is not superstition but a disease, and from this subject, I have come to know many things by the teaching of biology-teacher so I like this subject
- ."
- "My physical science teacher has made me interested in physics as he often involves us in practical things."

Some negative factors have also impacted the students, made by teachers play an essential role in choosing the science stream:

- “Yes, I enjoy science subjects but not mathematics. I was good in mathematics before lockdown. During lockdown, I started to forget how to solve mathematics because any teacher was not teaching then”.
- “I like physical science because the teacher and tuition-teacher explain the subject matter explicitly, and mathematics is very problematic to me as whenever I make a mistake in calculation, my teacher extensively rebukes me. So, I do not go to show my sums to teachers in fear".

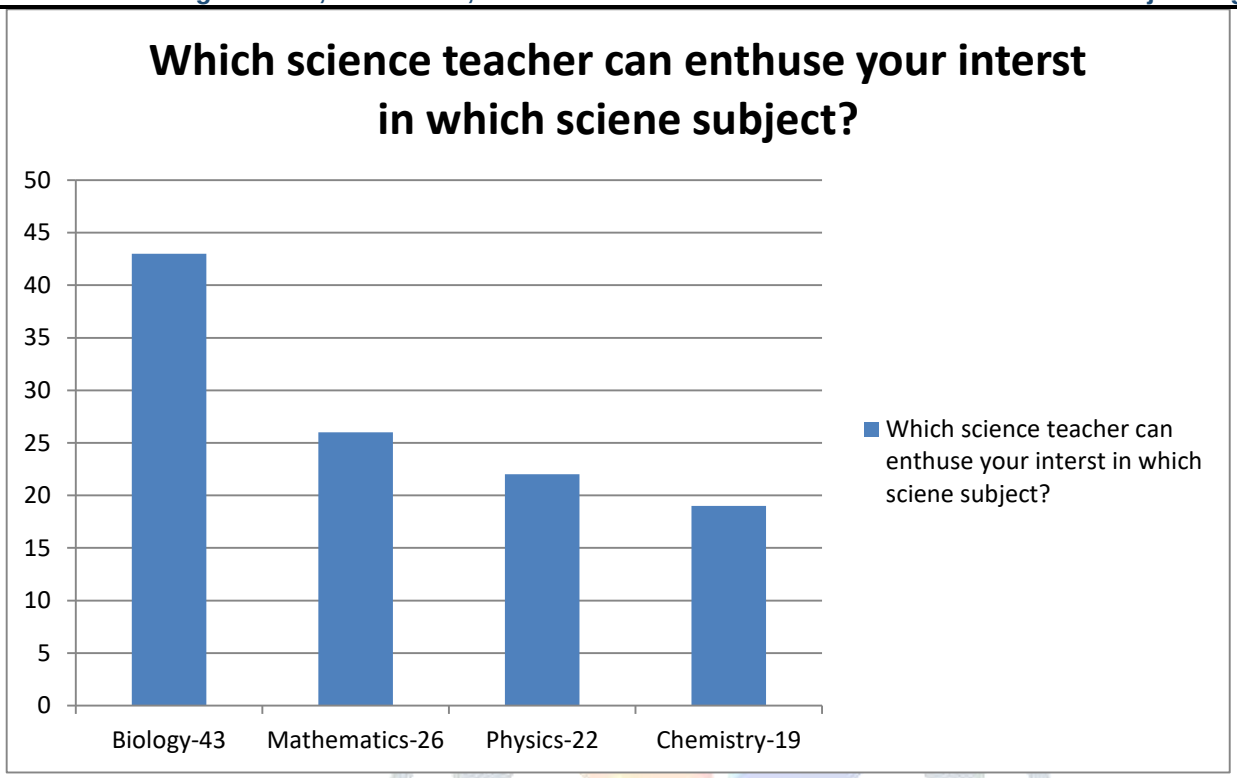

Figure-5

Analysis of Figure 5: When the students were asked about which science teacher could enthuse their interest in which science subjects, the demographic profile of their reply is shown in Figure 5, where it is evident that most female students tend to favor biology over chemistry. The lack of chemistry teachers in schools may be one of the factors that cause them to have no interest in chemistry. Sufficient biology teachers in school may be one of the reasons that make them curious about biology.

Findings

The data surveyed shows us several factors that obstruct female students from pursuing STEM careers in higher education. Much work has been done to reduce the gender gap in STEM in higher education, but very few studies have addressed the reasons why women are less in number than men in STEM jobs. Analyzing the students' responses and data, the study provides some findings that restrict female students from studying science.

Lack of science teachers: There needs to be more science teachers at girls' schools, and science classes are only offered sometimes. As a result, they are becoming less interested in science. In the two schools, the practical courses of class XI and class XII are offered by guest teachers who are hired from outside.

Absence of science department: The scientific department is exclusive to the coed school. Despite their love of science, female students are drawn to the arts because their schools do not have a scientific department. Science departments are only available in those areas where the distance from some female students' houses to schools is too long. So, they are inclined to the arts stream.

Scarcity of science tuition in rural areas: If students want to take science following their M.P. exam, they will have to move to a small town because there aren't enough science tuition options in rural areas. Then, they will have to travel through the open field at night to get home after tuition. They claimed that they would not continue it.

Want of knowledge about female role models in science: Since the pupils only have read of male scientists like J.C. Bose, P.C. Roy, Newton, Einstein, and others, their role models are teachers and nurses. They do not know of any female scientists, doctors, or engineers in India and West Bengal.

Shortage of knowledge about science-related jobs: Even how to become a doctor, engineer, or scientist is beyond their knowledge. Their lack of understanding about careers in science causes their curiosity to wane. One of the possible causes could be the meager literacy rate in their family.

Lack of funds and infrastructure-According to information provided by the headmaster or headmistress, there are insufficient resources to support the construction of a high-quality science department, science lab, and library.

The scarcity of interest in science subjects: In actuality, they are not enjoying their scientific classes; they find mathematics to be particularly challenging. Students under exam pressure in science disciplines tend to lose interest in the subject because they cannot comprehend chemistry and physics' fundamental laws and formulas. This occurs because of their deficiency in training in the science stream.

Inadequacy of the English language: All the female students are not accustomed to the English language because they come from a Bengali medium background and have learned science in the Bengali language. Therefore, they hesitate to take science after hearing that they must study science in English in higher education.

The dearth of money to pursue science: Most of the students' parents work in farming. Their source of income is meager. They've heard that becoming an engineer, doctor, or scientist is needed to cost a lot of money. Despite students' love for science, they will choose humanities and arts for this reason.

Ignorance about government initiatives to study science subjects: The government's scholarship, fellowship, and loan for B.Sc., M.Sc., M.B.B.S., and engineering degrees are unknown to the students. They are even unaware of the DST's initiatives to support women engineers and scientists in the frontier stream in S.T.E.M.

Recommendations

The study has attempted to assess the factors that encourage and discourage female students from pursuing science education as well as their intention to get into further studies. Based on the analysis of results, discussion, and findings, some recommendations are demonstrated to reduce the gender gap in S.T.E.M. education.

1) Federal and state governments should recruit an increasing number of scientific instructors in schools. It is necessary to reserve female science teachers so that female students would have enough role models in science subjects.

2) The survey revealed that there had been no science departments in most of the girls' schools. The government needs to set up science departments in female schools.

3) Another reason why female students in rural areas choose not to pursue science is the absence of science tuition in villages. The students won't have to pay extra money for tuition if it is provided by teachers, particularly for those who excel in science and economically belong to downtrodden families.

4) None of the students responded when asked to name three Bengali female scientists. In India and West Bengal, there are a lot of living and departed female scientists. Regretfully, their syllabus does not contain their names. It is imperative that their biographies should be included in the curriculum in order to instigate them by teaching about the struggles and challenges faced by women scientists and engineers.

5) Despite the desire of students to pursue science streams after *Madhyamik Pariksha*, some students remain unsure about whether to pursue a science stream in higher education. Schools must offer career counseling programs to inform students of the opportunities available to women in science.

6) Upon discussing the construction of the scientific department, the headmistress discloses a shortage of funding. Lack of funding prevents them from building a sufficient lab or library. Therefore, the government should increase funds for school education.

7) In higher education, science courses are increasingly being determined by English. However, due to female students' fear of the language and lack of fluency in English, Bengali-medium students are reluctant to enroll in science courses. In such a situation, English language learning and spoken English courses should be held in schools other than English textbooks to improve students' communication skills.

8) The government offers several programs and scholarships, such as the Women Scientist Schemes, Mobility Schemes, K.I.R.A.N., Indira Gandhi Single Girl Scholarship, Swami Vivekananda Merit Cum Means Scholarship, and others, to female students who choose to pursue research, education, or science and engineering. It should be made known to female students in order to pique their interest in science and potentially alleviate the financial hardship that they are facing.

Study limitations

The study is limited to various fields. Even though the survey has highlighted several factors that encourage and discourage female secondary and higher secondary students from pursuing their science education, they are all limited to state-aided government schools. The study was not conducted in private schools in West Bengal. Therefore, these factors may be changing in private schools. Besides, the sample students were taken from only three districts- Purba Bardhaman, Hooghly, and Nadia, among 23 districts in West Bengal. So, the factors can vary depending on geographical location, community, and socio-economic condition of the areas. Another significant limitation of this study is that the responses were merely taken from female students, not from any male students. Despite all these facts, the study is imperative as very few studies have still mentioned the reasons for the lower

number of female students in science. Apart from this, the female students whose responses were collected study the same subjects, speak the same language, maintain the same culture, and face the same kind of difficulties throughout West Bengal. Thus, it is contextually relevant to anticipate that other factors that have not been studied will be investigated in the future.

Conclusion

Based on the discussion above, the female students of West Bengal face certain difficulties; sometimes, they can speak about them, and sometimes, they cannot speak; they are silent about them. Consequently, sufficient work is not available at this time. Although the government is trying to equate the gender gap by utilizing various policies, schemes, and recommendations, its implementation is the last thing. Above all, government authorities should scrutinize how and where this implementation is conducted, whether all the sections and regions of society are getting equal opportunities in education, or whether it needs to be more balanced. By creating a supportive environment and inclusivity of education, female students can break their barriers and make social vehicles of transformation. Despite all these odds, science education should be fortified at the school level because all kinds of discrimination, adversity to learning science, barriers to pursuing science, and dropouts start from there.

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