Female Students' Perceptions towards Physics-Related Careers in Liberia: A Case of University of Liberia, Montserrado County, Liberia

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ABSTRACT

There are not many female students taking Physics course than Biology and Chemistry courses at the William V. S. Tubman College of Education. Physics appears to be a common fear among female students attending the College of Education. This emergence appears to be associated to the degree of challenges female students face with Physics in secondary schools throughout Liberia. The study's goal was to determine female students' perceptions of physics-related careers in post war Liberia. A mixed method approach was used based on the strengths and weaknesses of each method, as well as a realistic assessment of each method's usefulness in answering the study's questions. Two hundred (200) female students were sampled from the William V. S. Tubman College of Education, University of Liberia. Questionnaires were used to collect the data, and the data collected was analyzed using Statistical Package for Social Sciences (SPSS version 29). The findings of the study were presented in tabular form with frequency counts and narrative form. The study found that 69% of the female students who participated in the study hold a positive perception towards physics-related careers. However, there are fewer female students pursing career in Physics education and physics-related career at the college.

Keywords: Physics-related careers, Coeducational School, Single-sex Physics-Classroom

INTRODUCTION

In the 21st century, Physics is an immensely important subject. Nonetheless, educators in colleges, universities, and the Liberian government continue to be concerned about the gender gap in teaching Physics and its related careers in Liberia. The decline in female students choosing to pursue professions associated with Physics during their college and university studies, the scientific community in Liberia is deeply concerned about it. The William V. S. Tubman College of Education has seen an upsurge in the number of female graduates in biology and chemistry over the last few years compared to Physics. However, despite the country's support for female participation in the science education, this has not been the case in Physics. The lack of female students taking Physics in the nation's highest university may lead to a lack of qualified females for industrious works that contain the application of Physics knowledge and lack of female Physics teachers in secondary schools as role models for female students in secondary schools in Liberia and even in various universities in Liberia.

In 2010, women accounted for 20% of bachelor's degrees in physics and engineering in the United States of America (American Physics Society,2010). The American Physics Society blames this on the K–12 education that female students received at the high school level. Shah and Udgaonkar (2018) indicates that 75.44% of students supported female professors, 27% preferred male teachers, and 29% were neutral on the influence of teachers' gender and age on instruction. Stromquist *et al.* (2017) findings on *"Women Teachers in Africa"*

demonstrate that female educators not only lessen sexual harassment and sexual assault at different institutions but also serve as consistent, approachable professional role models. The findings claimed that female teachers, as opposed to male teachers, are kinder to students' emotional needs, particularly those of girls. The research was carried out in Africa (Liberia, Tanzania, Togo, and Uganda). Female teachers contribute to greater gains in beliefs, aspirations, investment, and test scores for girls who believe they have low mathematical ability (Evans & Nestour, 2019). Women are natural teachers because they see teaching as a component of mothering (Gillespie & Thompson, 2021).

Women are more eligible and competent to work with human development and are more benevolent because they are prepared to make greater sacrifices compared to men. Female teachers are almost non-existent in Liberia at both the junior and secondary levels (Snyder et al., 2011). Stromquist et al. (2013) conducted a study on female teachers in Liberia, and their findings revealed that cultural and institutional factors are major factors influencing female choices to pursue careers as teachers in Liberia, resulting in for the male-dominant in the teaching force and the barriers that discourage women from becoming teachers, particularly in Physics.

The Liberian government is committed to providing high-quality education to all Liberians as part of its constitutional obligation, which complements international educational conversions. It recognizes the critical role of female teachers in providing accessible role models, reducing sexual harassment and violence, and closing the gender gap in STEM (Science, Technology, and Mathematics). However, the number of female in-service and pre-service teachers in Physics is nearly non-existent.

According to Hill (2017), there are three opportunities for girls' education and girls are enthusiastic about studying sciences in Liberia. These opportunities include investing in STEM (Science, Technology, and Mathematics), establishing stipends or incentives for female educators, and funding opportunities such as scholarships, grants, and so on. The proportion of female students enrolled in Chemistry and Biology at the University of Liberia's College of Education has increased significantly by 10% to 25%; however, the number of females enrolled in Physics and Mathematics has remained disastrous (UL placement Examination Report, 2020). To reduce gender disparities in STEM, studies have advocated for female participation in science fields. How do female students at the William V. S. Tubman College of Education feel about Physics and Physics-related courses? The current situation of female students' perceptions of physics, of a single-sex physics class in a coeducational school, and of careers related to physics will be ascertained and established through this study.

Significance of the study

This study is significant because careers play a crucial role in students' lives, which serve as a turning point. A career development in life allows students to choose a career or subject to pursue in the future. This study shed light on the importance of career development for female students in Physics education. It will inform career development policy workers, policy implementers, and researchers as to how they can provide adequate support to female students in choosing a career in physics-related areas.

Theoretical Framework

Henri Tajfel's (1979) Social Network Theory, sometimes referred to as Social Identity Theory, served as the study's foundation. It says that a person's capacity to positively impact achievement is based on the capabilities the network's structure bestows upon them. The concept states that social interactions are represented by nodes and ties. Relationships are formed by nodes, or the individuals involved, and ties, or the connections between them. The social network can be used to determine a person's social competence in a given environment since it serves as a representation of all the relationships that exist between people. Social networks can define how the structures of institutions interact with one another, as well as the social relationships that executives or administrators have with one another. It looks into situations where societal acceptance is more important than individual identity. The Theory is relevant to the study because affiliation with groups can help institutions instill meaning in social conditions. As an indicator of all connections between individuals, the network defines an individual's social ability in his or her environment. Social networks define how the structures of institutions interact with one another as well as the social relationships

that executives or administrators have with one another. It looks at situations where social recognition is more important than individual identity. The Theory is relevant to the study because membership in groups can help institutions instill meaning in societal circumstances. As a result, female participation in physics teaching will help female students understand the meaning of physics-related careers, reduce sexual harassment and sexual violence in various schools, and increase role model building, all of which will lead to reduction in the gender gap in STEM.

REVIEW OF RELEVANT RELATED LITERATURE

The study investigated female students' perceptions of Physics-related careers in a coeducational at the William V. S. Tubman College of Education, University of Liberia. The researchers gathered information from theses, journals, dissertations, books, magazines, and internet websites.

Female Students' Perceptions Toward Physics Related Careers in Post-war Liberia

The relevance of Physics in female students' daily lives or professional careers is related to their attitudes towards Physics. The significance of career choices in physics related careers is a sensitive issue if one wishes to advance in life in a postwar country like Liberia. Female students' motivational beliefs about Physics in Liberia, on the other hand, may influenced their performance and continued interest in their major and career options. However, female motivational convictions in Physics are lower when societal stereotypes and biases about who belongs in Physics prevail (Li and Singh, 2021).

Despite countless efforts to get more women into science labs, half of Britain's coeducational schools lack female students taking A-level Physics, according to Day (2012). According to Kirl *et al*. (2023), despite numerous efforts by various agencies around the world, women and girls remain underrepresented in STEM education and careers. The findings further showed that factors such as a lack of female role models have a significant impact on females' decisions to enter and continue working in Physics-related careers. It is critical, according to Lissitsa and Chachashvili-Bolotin (2021), to engage with those who are underrepresented in STEM fields. This can be accomplished by forming a reach-out group that will help facilitate and serve as role models and mentors for underrepresented female students interested in Physics-related careers in Liberia as a means of involving female teachers in the teaching of Liberia. While women work on many construction sites in India, few female students choose to major in engineering when they attend college (Mohan, 2019). According to the International Bureau of Education (UNESCOIBE), in Africa, Asia, and the Pacific, women constitute only 33% of 1 million women with a university-level education worked as professionals and technicians.

Many policymakers have made reducing gender disparities in physics-related careers a policy goal. (Basile and Lopez, 2015). However, the policy's effects have yet to be seen in practice. According to Ham (2016), the accessibility of more secondary school types correlates with a larger gender gap in Physics job-related expectations. Despite initiatives across the continents aimed at reducing gender disparities and shifting the nature of opinions, views, and roles in science, there is still persistent (OECD, 2015), particularly in physics. Acceptance of gender stereotypes may result in inaccurate assessments that influence expectations for female career advancement, biasing opportunities and work outcomes (Hentschel et al. 2019). According to Kovaleva et al. (2022), there are fewer women in the tech sector than men. Science competitions are positively related to students' science career interests and admission to colleges and universities, but not for female students. In the study, the finding showed that 67.3% of the respondents feel that it is more difficulty for female to become entrepreneur considering the social factors to be the most inferential. However, effective equity measures have become a priority but female students are less successful during science Olympiad team selection (Steegh *et al*., 2021). The study findings advocated that career goals, self-efficacy and interest are connected to STEM stereotypical beliefs and are also linked to STEM achievement. Kızılay and Yamak (2023), stated that to maintain or create desire in STEM or Physics related careers, it is important that females develop strong self-efficacy in STEM and remain engaged and interested during their secondary schooling.

However, according to Gioannis *et al*. (2023) stereotypes contribute to gender disparity not only in STEM but it also shapes people's expectations on their own and performance. Moreover, despite increases in women's

participation in STEM educational and career paths (Light *et al.* 2022), women are not represented and are underrepresented in the study and teaching of Physics in Liberia.

METHODOLOGY

The study was be based on descriptive survey design using mixed-method approach. The descriptive survey method is worthy for the study since it represents current issues such as female students' perceptions of Physics-related careers in a coeducational school in the William V. S. Tubman College of Education, University of Liberia. The methodology concentrated on answering the how, what, when, and where concerns (Smith & Fieldsend, 2021).

Kothari (2009) claimed that descriptive survey methodology aims to gather relevant information on aspects of teaching and learning areas that are of interest to researchers, policy experts, and curriculum designers. A descriptive study strives to fully reflect the characteristics of a specific given situation. It concerns the perceptions, viewpoints, feelings, and perspectives of a study's chosen sample of population (Worae & Edgerton, 2023). Descriptive study is an opportunity, according to Walliman (2022), to investigate conditions to explain norms. While the population for this study is too wide to be monitored effectively due to economic and time factors, the researcher will be accepting a representation of the whole population to deduce the outcomes for the overall population, leading to detailed and significant study results. According to Siedlecki (2020) intend to properly reflect the features of a specific group or situation. It is concerned with perceptions or points of view toward a situation.

Study Locale

William V. S. Tubman College of Education, University of Liberia was the study locale. The college is the premier and the highest college of Education in Liberia that trains teachers in various disciplines.

Study Population

A targeted population is the population that the researcher wishes to consider for study (Majid & Vanstone, 2018). Asiamah *et al*. (2017), defines a targeted population as the entire group or group of all units on which a finding is to be generalized. The targeted population of this study was the entire 200 female students of the William V. S. Tubman College of Education in the Department of Secondary Education, University of Liberia.

Sample Size and Sampling Procedure

In this survey, a purposive sampling technique was used to determine the sample size of this study. The technique was used particularly for female students. The study aims to use this type of sampling technique since a special population of students from the William V. S. Tubman College of Education was targeted. Purposive sampling focuses on specific characteristics of the participants that are of concern, allowing researchers to answer research questions more effectively (Andrade, 2021). Therefore, the entire 200 female students were sampled in the study.

Findings

After analyzing the data, the researchers reduced the licker scales to three: Agree, Disagree, and Not Sure. Table 1-4 presents data and findings on the current state of female students' perceptions in a coeducational school in Liberia toward Physics-related careers in Liberia.

Table 1: Female can become a good Physics teacher

Responses	Frequency	Percent %
Agree	138	69.0
Disagree	56	28.0
Not Sure	6	3.0
Total	200	100.0

The findings in Table 1 showed that 69.0% of the female students agreed that female can become a good Physics teacher. However, 28.0% disagreed that female can become a good Physics teacher and 3.0% was not sure whether female can be a good Physics teacher. This finding indicates that female students' perception toward physics related career is positive and they can become good Physics teacher but must develop strong self-efficacy in STEM and remain engaged and interested during their secondary schooling and in colleges or universities. This finding agreed with Makarem and wang (2020), despite numerous efforts by various agencies around the world, women and girls remain underrepresented in STEM education and careers. However, gender stereotypes may result in inaccurate assessments that influence expectations for female career advancement, biasing opportunities and work outcomes as stated by (Hentschel *et al.*, 2019).

Data on 'Electrical engineering is not a good career for female' was analyzed. Table 2 presents the findings.

Table 2: Electrical Engineering is not a good career for female

Responses	**Frequency**	**Percent %**
Agree	69	34.5
Disagree	120	60.0
Not Sure	11	5.5
Total	200	100.0

Table 2 findings showed that 60.0% of female students disagreed that electrical engineering is not a good career for female. However, 34.5% agreed that electrical engineering is not a good career for female while 5.5% was not sure. This means, female students in Liberia perceptions toward physics related career is positive and they can become good electrical if the opportunities and support are given to them. This study's findings contradicted the findings of (Jugović, 2017; Makarova *et al.*, 2019). Their findings point out that, increasing amount of research indicates that women place less significance on physics as a career than do men. In addition to other characteristics, lower levels of desire and self-efficacy, regardless of academic performance in the subject, are significant contributors (Kalender *et al.*, 2019). The absence of female role models, gender stereotyped cultural expectations, male-dominated classrooms, gendered experiences and male-friendly learning styles in physics classrooms, disengaging pedagogy, and unfavourable perceptions maintained by socialisers and family are other social and contextual factors that have been identified as significant influences on females' alienation from physics.

Table 3: Civil Engineering is a male's career

Responses	**Frequency**	**Percent %**
Agree	46	23.0
Disagree	140	70.0
Not Sure	14	7.0
Total	200	100.0

The findings presented in Table 3 indicate that 70.0% of the female students disagreed Civil engineering is only a male career, while 23.0% of the female students agreed that Civil engineering is only a male career. This finding agreed with Mohan (2019). The finding points that, while women work on many construction sites in India, few female students choose to major in engineering when they attend college. A civil engineer could have multiple responsibilities. Planning and managing the building and repair of structures, as well as local and national infrastructure projects involving roads and trains, are within the purview of the civil engineer. It is a broad, multifaceted field with increased prestige. Well-certified civil engineers will always be in demand, making this one of the most futuristic careers to endure through the ages. After the civil conflict in Liberia, several females enrol in the training and volunteer for a job where they must work on a construction site because they are determined to shatter stereotypes.

Girls are often told, "***This field is not for you",*** when it comes to selecting a career path such as construction, mechanical, or electrical. But because of significant technological advancements, women can now pursue careers in civil engineering without facing this obstacle. When it comes to planning and carrying out a project,

women can offer a unique perspective that will greatly enhance the creation of aesthetically pleasing structures. Women are renowned for being adept at multitasking. It may appear difficult for women to pursue careers in civil engineering, but it's not as difficult as it looks. These days, there are several well-known female engineers who have distinguished themselves via intelligence. The subject of civil engineering presents a plethora of opportunities for female advancement. It's time to dispel the gender norms that have discouraged women from pursuing this exciting field of work. Civil engineering is an interesting and fulfilling career choice since women have the ability to contribute creativity, innovation, and a new viewpoint to the field.

Table 4: Forensic Firearms examiner is female's career

Responses	Frequency	Percent %
Agree	70	35.0
Disagree	110	55.0
Not Sure	20	10.0
Total	200	100.0

The findings in Table 4 showed that 55.0% of the female students disagreed that forensic firearms examiner is a female's career. However, 35.0% agreed that forensic firearms examiner is a female's career. Forensic science has become a vital component of criminal justice. From retinal scanning to forensic chemistry, advances in technology enable investigators to track down and analyse tiny fragments of evidence from crime scenes or indirectly associated to a crime. This enables the extraction of useful data from previously unanalysable instances, as well as the reopening of cases thought to be beyond resolution, frequently linking different crimes. These innovations not only improve the reliability of enquiries, but they also boost trust among citizens in the judiciary. As forensic techniques advance, they create new opportunities to investigate criminal behaviour and guarantee justice is served.

Therefore, forensic science studies bring together an extensive variety of investigators (biology, chemistry, medicine, physics, ballistics, genetics, entomology, botany, information technology, and others). To keep up with the ongoing requirement for forensic services, investigators must analyse an extensive number of instances, which leads to swifter outcomes and reduced expenses. Becoming an investigator is difficult; it requires extensive concentration and entails many tasks. As reported by Eurostat, in 2017, roughly 24.1 million women with a university education worked as professionals and technicians. In five European countries, women constitute a significant percentage of scientists and engineers: Lithuania (57%), Bulgaria and Latvia (53%), Portugal (51%), and Denmark (50%). In Germany (33%), Finland (29%), Hungary (25%), and Luxembourg, women constitute less than one-third of the population. Interestingly, among all STEM fields, forensic science is the only one with a majority of female graduates. However, this is not the circumstance in Liberia today. In Liberia today, efforts are being made to encourage more young girls to pursue education and careers in physics and technology, with the goal of shifting the narrative and creating a more equitable landscape. Various organisations are implementing mentorship programmes and outreach initiatives that inspire and empower girls from an early age, with the aim of providing role models.

CONCLUSION

The students' aspirations for the kind of employment and profession they wish to pursue are referred to as career perceptions. For female students, choosing a career is crucial since it shapes who they are and has a significant impact on their interpersonal interactions, families, personal lives, and environment. Regarding their opinions about careers associated with physics, most respondents have mixed opinions. But most importantly, the findings as showed Table 1 that 69% of the female students have positive perception about Physics education and other Physics-related courses. Similarly, in Table 2, the findings showed that 60% of the respondents viewed electrical engineering as a profession for anybody.

Nevertheless, some respondents may be deterred from seeking professions in physics because they believe that these fields are dominated by men and lack diversity. Additionally, female students are leaving behind because they see physics-related jobs to demand a high degree of mathematical formula and conceptual understanding,

which many female students may find less comfortable or confident in. Interestingly, many female students perceive physics-related professions as lacking chances to achieve a work-life balance, which might vary for those who prioritise family or societal responsibilities. The research also demonstrated the importance of knowing students' values, cultures, priorities, and concerns when pursuing a career in physics.

RECOMMENDATION

In line with the findings of this study, wherein participants showed positive perceptions towards physics education, the researchers recommend the following:

a. There should be strong support given to female students in the form of instructional and occupational/career counselling strategies.
b. Educational leaders should provide female students with mentors who have become successful women in physics-related professions, illustrating to the students that a job in physics is both achievable and worth living.
c. Educational administrators should highlight the extensive spectrum of physics-related career opportunities for females, such as research, academia, industries, and government, in order to demonstrate to female students, the variety of paths they can take in their careers.

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