Gender and Education in Ghana: A Case Study of Science, Technology, Engineering and Mathematics (STEM) Programs in the University of Education, Winneba

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DOI: https://dx.doi.org/10.47772/IJRISS.2025.90300114

Received: 20 February 2025; Accepted: 27 February 2025; Published: 03 April 2025

ABSTRACT

The purpose of this article is to investigate the perception of STEM students in the (mathematics and ICT education) programs at the University of Education Winneba. As such the best research approach is to use qualitative research approach since it scientifically allow researchers to deduce reasons that undergirds the actions and inactions of people towards a social phenomenon (Creswell, 2014). Based on the focus of this paper and it peculiar objective, the study employed the case study design as the case study design involves a researcher inquiring into a process, an event, activity, programs or experience within a real-life, contemporary setting or context (Yin, 2009). In doing a qualitative case study, the researcher explores a real-life, modern-day restricted system (a case) or several restricted systems (cases) over a period of time, through detailed, comprehensive collection of several sources of data (Creswell, 2014). This study is a single case as it investigates the issues of STEM (Mathematics and Information and Communication Technology education) female students' perception of their programs of study in the University of Education, Winneba by deploying observation, document analysis and semi-structured interviews as data collection instruments over a period of three months.

INTRODUCTION

Gender as a sociocultural construction, which determines the roles, behaviors, and attitudes expected of both males and females has become a key determinant in how we organize society including access to formal education in Ghana. Gender roles brings about inequalities in all sectors of our social structure as certain opportunities become available to men and women based on the roles given them within the sociocultural environment. Some significant strives have been made in terms of bridging the gender gap that exist between women and men in relation to education and work, however, Chilala (2022) insist that women still face gender related issues in their workplace with the most prominent issue being the gender wage gap and the glass ceiling.

Albeit Ghana as a developing country has implemented a free education policy to her citizens from basic school level to the high school level, many people argue that the policy has failed to deliver the expected results due to some challenges that has confronted the policy (Atuahene, 2014).

One of the major concerns in education development in several developing countries such as Ghana have to do with gender inequality and the effects of socio economic and socio cultural differences in the provision of learning opportunities for both boys and girls. One of such concern is the unequal position of women in comparison to men and by extension girls as compared to boys in basic education participation in relation to enrolment and school attendance (Atuahene, 2014). Several developing countries are faced with huge challenges of eliminating gender inequality within basic education and were bent on dealing with this canker by 2015, albeit these countries found it difficult to achieve gender equality in terms of enrolment and attendance of students (UNDP, 2015).

Gender inequality differentials that exist in educating students are more pronounced in terms of students' participation and internal efficiency and in cognitive performance with girls being the most affected as compared

to boys. Realizing the existing gender-based disparities, successive governments in developing countries, in collaboration with public universities in these countries, have put in place several affirmative action policies to increase female participation at the tertiary education levels. For example, public universities have introduced affirmative action policies to close the gender disparity gap by relaxing admissions standards for female applicants although this policy has faced some strong opposition from some men and even women who feel the bar is being lowered for females because there is a perception that they are not academically good as compared to males (Atuahene, 2014).

Some interventions have been designed to deal with the education inequalities that exist between boys and girls in developing countries. For instance, in Kenya, one of such intervention included taking affirmative action in support of girl-child education, expansion and improvement of classrooms, providing boarding facilities and water and sanitation to create conducive and gender responsive environments (UNDP, 2015).

Atuahene (2014) avers that, historically, women when compared to men in Ghana, have had less access to tertiary education and even those who have had access to tertiary education perceived that the few women they see within the tertiary does not serve as a motivation factor for them to also pursue higher education. As women's access to tertiary education has been an issue, the government of Ghana through public universities have devised intervention measures with policies and programs that has specifically centered on improving access to women's tertiary education (Atuahene, 2014). Albeit the gender-based affirmative action policies implemented by public universities have not eradicated completely, the disparities in women's access to tertiary education in Ghana, data shows that, these policies have contributed to an increase in female participation rates in tertiary institutions (Atuahene, 2014). For instance, a 30 year data analysis of students' enrolment in the University of Education Winneba from the 1992/1993 academic year to 2021/2022 academic year shows that, undergraduate students' enrolment in terms of gender has seen a drastic increase as the enrolment of female students increased from 23.3% in 1992 to 40% in 2022 (UEW basic statistics, 2023). The basic statistical data of the University of Education Winneba further indicates that, from the 1992/1993 academic year to the 2021/2022 academic year, graduate students' enrolment and graduation in terms of gender, also saw a sharp increase as female graduate students who got admitted and completed their post graduate studies in the university jumped from 25% in 1992 to 36.4% in 2022. This indicates that, the gender based affirmative policy of the government of Ghana and the gender mainstreaming policy of the University of Education, Winneba is effectively implemented as the policy seems to achieve some desired results (UEW basic statistics, 2023).

There has been some changing of social and labor force trends in current Ghanaian gender discourse. Bosak, Eagly, Diekman, and Sczesny (2018) indicated that, for half a century spanning between the periods 1960 and 2010, the participation of women in the Ghanaian labor force has seen a 15.5% increase from 54.5% to 70%. The gender changes in the labor market also reflects in the changes of perceptions of gender roles and stereotypical characteristics.

Bosak *et al.* (2018) albeit have indicated that, there is a change in gender stereotypical behaviors in Ghana as in recent times, both males and females move beyond the sociocultural gender construction of males or females expected to be in certain trades, careers and gender roles. However, when it comes to higher education, the gender stereotypical behavior of the females avoiding certain programs of study is still evident due to the fact that the females perceive certain programs in the tertiary to be masculine and difficult and as such they do not have enough interest pursuing those programs. Again, Bosak *et al.* (2018) aver that, even both male and female tertiary students and the larger Ghanaian society perceive males who study programs such as Home economics as exhibiting feminine tendencies as they believe those programs are for females.

Statement of Problem

Gender as a sociocultural construction, which determines the roles, behaviors, and attitudes expected of both males and females has become a key determinant in how we organize society including access to formal education in Ghana. Gender roles brings about inequalities in all sectors of our social structure as certain opportunities become available to men and women based on the roles given them within the sociocultural environment.

Alhassan and Odame (2015) conducted a qualitative study that examined household and contextual factors that militate against the effort of achieving quality and gender equality in enrolment and attendance in basic schools in the northern region of Ghana. Alhassan and Odame's (2015) study revealed that, socio-cultural practices such as parents' preference for boy child education, early marriage, polygyny, menstruation and attendance of festival celebrations are the main factors that hinders against quality and gender equality in basic schools in the northern region of Ghana.

Maanu (2008) conducted a qualitative study that investigated the gender gap in access to higher education in Ghana and the factors that contribute to gender inequality in higher education. Using feminists theory and interviews, the study revealed that, the major challenge of girls' access to higher education in Ghana are poverty, poor economic conditions of families, socio-cultural factors such as parents preference for boys' higher education to girls. Acheampong (2014) using qualitative study approach hinged on case study design, investigated the inequality of gender participation of females in STEM disciplines in the Kwame Nkrumah University of Science and Technology. The study found that, some traditional beliefs and social constructions of roles expected of females by both their families and the larger society are the main obstacles that militate against Ghanaian females in pursuing STEM education. Amponsah and Mohammed (2019) using a quantitative approach investigated the differences and perceptions among female students pursuing STEM programmes in Kwame Nkrumah University of Science and Technology. Using 328 students in their final year programs of Information and Communication Technology, Engineering, Pharmacy and Medicine as the study sample, the study used the descriptive cross-sectional survey and questionnaire as data collection instrument. The study revealed that, female students in STEM majors were focused on achieving their goals and were extraordinarily impressive in terms of their academics but were not able to have fun and enjoy other co-curricular activities as compared to their male counterparts due to the loaded nature of the STEM curriculum.

In a qualitative study, Bosak, Eagly, Diekman and Sczesny (2018) investigated the gender dynamism and stereotypes in Ghana. Using interviews and document analysis, the study revealed that, there exist a gender dynamism in Ghana as women now subvert gender stereotypes by adopting some masculine personality and cognitive traits as males venture into pursuing female perceived tertiary programs such as nursing. The study also indicates that, within the labor market, women, just like men are also playing the financial roles of providing for their households as breadwinners. Atuahene (2014) also investigated how men and women both get access to tertiary education in Ghana. The study revealed that, the gender-based affirmative policies implemented by government and public universities has increased enrolment of women in tertiary institutions in Ghana although, women had less access to some tertiary programs of study in the tertiary institutions as compared to their male counterparts. Nordensvard (2014) qualitatively explored the impact of economic discourse on how girls' dropout rates from formal education are determined by girls' social and economic roles in the informal Ghanaian community. The study revealed that, as children play a huge role in keeping household work running by taking care of younger babies, cooking, fetching water and sometimes participating in informal paid employment, girls are the ones hardly hit as it affects their enrolment in formal education.

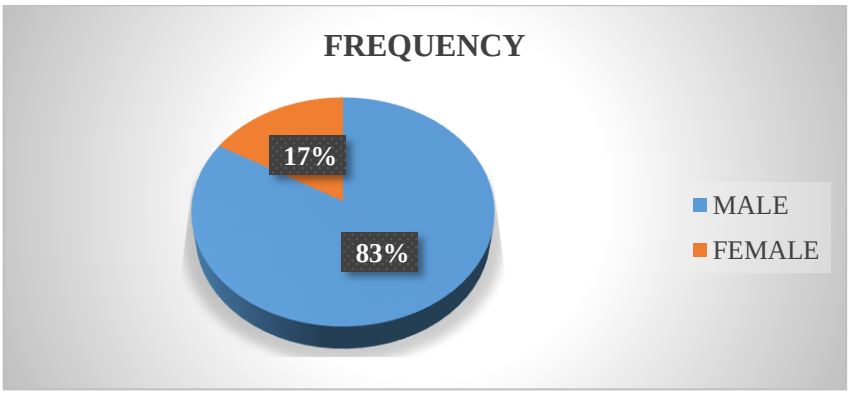
The extant literature however shows that, although studies have been conducted to investigate the role of gender and education, particularly STEM education in Ghana, minimal studies exist on the phenomenon of gender and STEM education in a teacher training university such as the University of Education Winneba. This paper therefore, seeks to investigate the perception of students of Mathematics education and Information and Communication Technology education regarding their STEM programs of study at the University of Education Winneba using the case study approach. As such the study is guided by these research questions; (a) what is the perception of female students of Mathematics education and Information and Communication Technology education on their selected programs at the University of Education Winneba?

METHODOLOGY

The purpose of this article is to investigate the perception of STEM students in the (mathematics and ICT education) programs at the University of Education Winneba. As such the best research approach is to use qualitative research approach since it scientifically allow researchers to deduce reasons that undergirds the actions and inactions of people towards a social phenomenon (Creswell, 2014). Based on the focus of this paper

and it peculiar objective, the study employed the case study design as the case study design involves a researcher inquiring into a process, an event, activity, programs or experience within a real-life, contemporary setting or context (Yin, 2009). In doing a qualitative case study, the researcher explores a real-life, modern-day restricted system (a case) or several restricted systems (cases) over a period of time, through detailed, comprehensive collection of several sources of data (Creswell, 2014). This study is a single case as it investigates the issues of STEM (Mathematics and Information and Communication Technology education) female students' perception of their programs of study in the University of Education, Winneba by deploying observation, document analysis and semi-structured interviews as data collection instruments over a period of three months. Sampling in qualitative study inquiries demand researchers to use a sampling strategy that guides the choices of what to observe and whom to interview. In line with this, the current study employed the purposive sampling strategy in selecting twelve (14) first year female students both in the Mathematics and ICT classes as study participants as the underlining principle of getting rich and in-depth information (Daymon & Holloway, 2011). The analysis of the data for this study was done thematically based on the assertion of Stake (2010) that, qualitative researchers try to be sensitive to data that cannot be taken apart and yet they analyse the data separately and intuitively with the aim of putting the facts "into new wholes, new interpretations and new patches" (p. 134). The data analysis started from the analysis of the document, followed by the observation in the selected STEM classes and finally the semi-structured interviews conducted by the researcher.

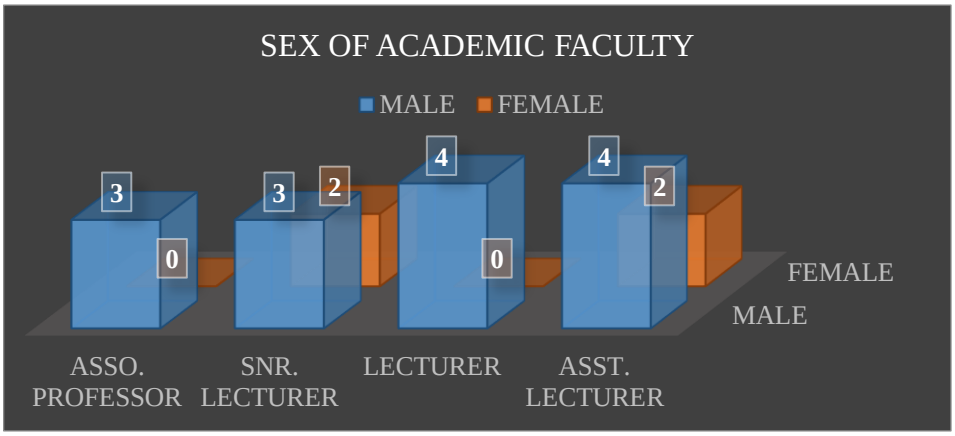
Table 1: Sex distribution of Mathematics education students



Source: (field data, 2023).

The above pie chart describes the sex distribution of students in the first year mathematics education programs. The chart indicates that, 65 out of the 395 students representing 16.5% were females while 330 out of the 395 students representing 83.5% were males. The data indicates that although the University of Education Winneba has a general male-female students' enrolment parity at about 53% to 47% for the 2022/2023 academic year, the STEM classes has lower enrolment parity as the mathematics class is dominated by the male students.

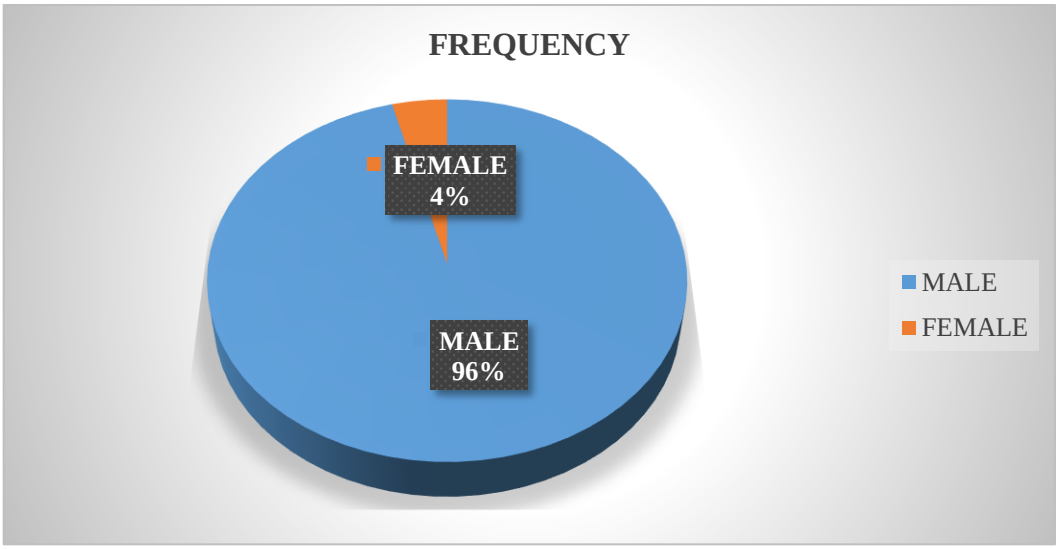
Table 2: Sex of academic faculty in Mathematics education department.



Source: (University of Education Winneba basic statistics, 2023).

The above table represents the sex of academic faculty at the department of mathematics education in the university of education Winneba. The data shows that, out of the total 18 academic faculty at the department, 3 males are associate professors representing 16.7% with no female being an associate professor. Male and female senior lecturers in the department are 3 and 2 representing 16.7% and 11.1% respectively. There are 4 lecturers in the department representing 22.2% with no female lecturer. The data again shows that, when it comes to assistant lecturers, the department has 4 males representing 22.2% and 2 females representing 11.1%. The data analysis indicates that there is a huge gender disparity in terms of academic faculty at the department as 14 academic staff representing 77.8% are males while only 4 academic staff representing 22.2% are females.

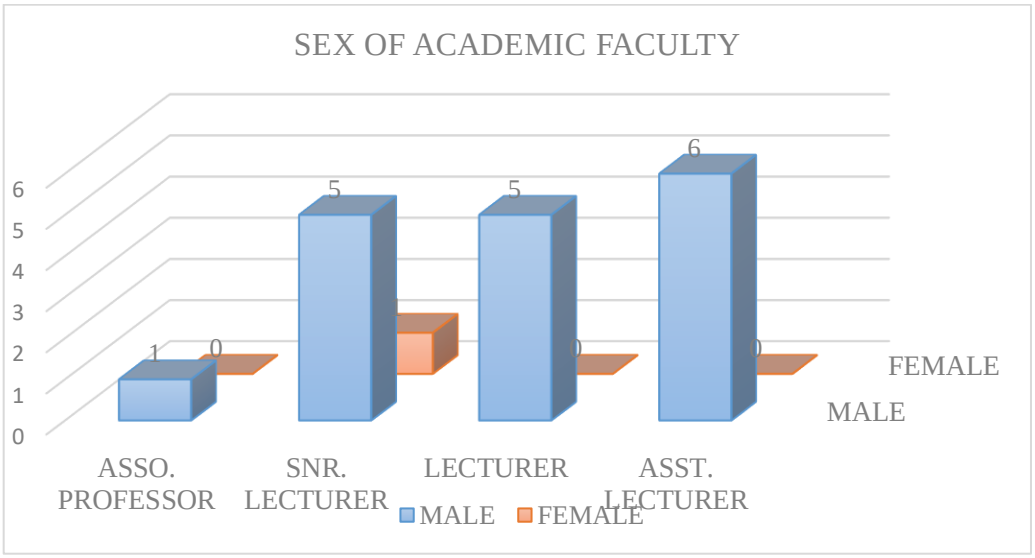
Table 3: Sex distribution of ICT education students.



Source: (field data, 2023).

The above pie chart describes the sex distribution of students in the first year Information and Communication Technology (ICT) education programs. The chart indicates that, 12 out of the 290 students representing 4% were females while 284 out of the 290 students representing 96% were males. The data indicates that although the University of Education Winneba has a general male-female students' enrolment parity at about 53% to 47% for the 2022/2023 academic year, the STEM classes has lower gender enrolment parity as the Information and Communication Technology (ICT) education programs is dominated by the male students.

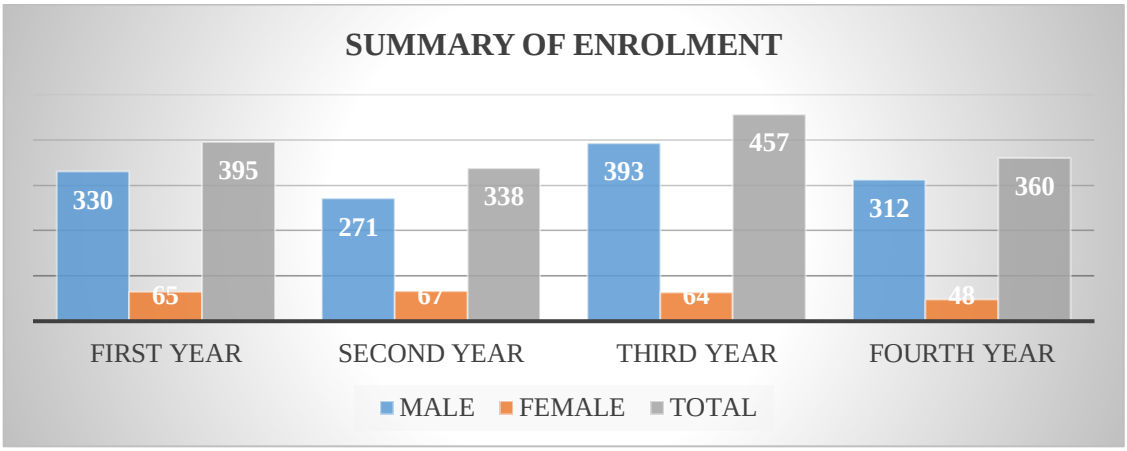
Table 4: Sex of academic faculty in Information and Communication Technology (ICT) education department.



Source: (University of Education, Winneba basic statistics, 2023).

The above chart is a data presentation of the sex of academic faculty at the Information and Communication Technology education department in the University of Education, Winneba. The data shows that, out of the total 17 academic faculty at the department, 1 male is an associate professors representing 5.9% with no female being an associate professor. There are 5 Male senior lecturers representing 29.4% and 1 female senior lecturer in the department representing 5.9%. The data shows that 5 lecturers in the department out of the total 17 representing 29.4% are males with no female lecturer. The data again shows that, when it comes to assistant lecturers in the department, there are 6 males out of the total 17 representing 35.3% and no female assistant lecturer. Cumulatively, the data analysis indicates that there is a huge gender disparity in terms of academic faculty at the ICT department as 16 academic staff representing 94.1% are males while only 1 academic staff representing 5.9% is a female.

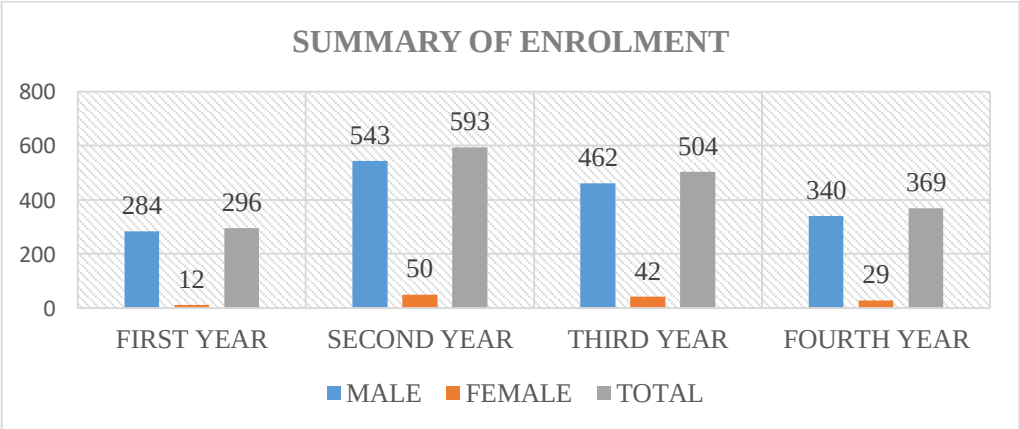
Table 5: Summary of mathematics education students' enrolment from first year to fourth year, 2021/2022



Source: (University of Education Winneba basic statistics, 2023).

The figure above represents the data of students' enrolment in the mathematics education department from the first year to the fourth year. The data shows that, out of the total 395 students in the first year class, 330 were males representing 83.5% while 65 are female students representing 16.5%. In the second year class, the data shows that out of the total 338 students, 271 are males representing 80.2% while 67 are female students representing 19.8%. The data indicates that in the third year class, 393 students out of the total 457 students are males representing 86% while 64 are female students representing 14%. In the fourth year class, the data shows that, 312 students out of the total 360 students are males representing 86.7% while 48 students representing 13.3% are females. The data analysis indicates that, consistently, the gender disparity in terms of enrolment in the mathematics education department class keeps widening as mostly the classes are dominated by male students.

Table 6: Summary of ICT education students' enrolment from first year to fourth year, 2021/2022



Source: (University of Education Winneba basic statistics, 2023).

The above figure is a representation of the data of students' enrolment in the mathematics education department from the first year to the fourth year. The data shows that, out of the total 296 students in the first year class, 284 are males representing 95.9% while 12 are female students representing 4.1%. In the second year class, the data shows that out of the total 593 students, 543 are males representing 91.6% while 50 are female students representing 8.4%. The data indicates that in the third year class, 462 students out of the total 504 students are males representing 91.7% while 42 are female students representing 8.3%. In the fourth year class, the data shows that, 340 students out of the total 369 students are males representing 92.1% while 29 students representing 7.9% are females. The data analysis indicates that, consistently, the gender disparity gap in terms of enrolment in the mathematics education department class keeps widening as mostly the classes are dominated by male students.

FINDINGS AND DISCUSSIONS

The objective of this article is to investigate the perception of STEM students in the (mathematics and ICT education) programs at the University of Education Winneba. The data was analysed thematically and thoroughly to reflect the study objective and research question underpinning the study. The study was underpinned by one research question; (a) what is the perception of female students of Mathematics education and Information and Communication Technology education on their selected programs at the University of Education Winneba? This paper seeks to answer the question on how female students in the STEM programs at the University of Education, Winneba perceive the courses they are pursuing. The paper therefore asked the question: what is the perception of female students of Mathematics education and Information and Communication Technology education on their selected programs at the University of Education Winneba? The data analysis was done qualitatively as the study transcribed and analysed the interviews with the study participants to derive the themes. The dominant themes that emerged out of the data analysis were challenging nature, gender imbalances, and a lack of female faculty as role models.

Challenging nature

After analyzing the data, the analysis indicates that, the female students pursuing the selected STEM in the University of Education, Winneba perceived the programs they are studying as a challenging one. The following data excerpts indicates this;

"…there is a notion out there that maths is a difficult subject. And coming to study maths in the university, I now I understand why people say it's a difficult subject. I remember my mum telling me to change my programs of study when I complained to her that the programs is difficult. The course is not easy at all but we are managing it. Even the guys in the class see the course as a difficult one, how much more we the females".

(Interview, Ama)

"hmmm….mostly the programs is very difficult to understand. I wanted to quit the programs after the first semester but my dad encouraged me to continue. We sometime rely on our male classmates to assist us in getting a better understanding after the lecturer has taught us. ….For the guys, they mostly like computers so they don't see anything difficult about the ICT course, but for us it's a huge challenge. You can't even enjoy other social lifestyle".

(Interview, Adwoa)

From the data excerpts above, the analysis shows that, the female students pursuing the selected STEM programs at the University of Education, Winneba believe the programs are very challenging and as such they do not find enough time to even enjoy social lifestyles. This finding is buttressed by Amponsah and Mohammed's (2019) study, which revealed that, female students pursuing STEM programs at the Kwame Nkrumah University of Science and Technology were focused on achieving their goals and were extraordinarily impressive in terms of their academics but were not able to have fun and enjoy other co-curricular activities as compared to their male counterparts due to the loaded and difficult nature of the STEM curriculum.

The analysis shows that some of the perception held by these female students emanates from the society as the respondents indicate that, the moment they tell their families and friends that they are facing challenges in pursuing the STEM programs in the university, they are advised that the course is a difficult one and that they should change the programs. The data analysis indicates that, it is mostly the female parent of these students who advise their female daughters pursuing the STEM programs to switch to a new one. This finding is in line with Acheampong's (2014) study which indicate that, some traditional beliefs and social constructions of roles expected of females by both their families and the larger society are the main obstacles that militate against Ghanaian females in pursuing STEM education.

The analysis of the data further indicates that, whereas the female parents of these female students advise them to switch their programs of study due to the difficulty nature, the male parents encourage their daughters facing challenges in pursuing the STEM programs to continue with the programs. The data analysis also shows that, the female students perceive that their male counterparts in class do not face the same difficulty they face in class and hence rely on them for extra tutorials to get a better understanding of whatever their lecturers have taught them. This finding supports Bosak *et al.* (2018) when they indicated that, albeit there is a change in gender stereotypical behaviors in Ghana as in recent times, both males and females move beyond the sociocultural gender construction of males or females expected to be in certain trades, careers and gender roles. However, when it comes to higher education, the gender stereotypical behavior of the females avoiding certain programs of study is still evident due to the fact that the females perceive certain programs in the tertiary to be masculine and difficult and as such they do not have enough interest pursuing those programs.

Gender imbalances

The analysis of the data also points to the fact that, the female students pursuing the selected STEM programs at the University of Education, Winneba perceive that, the programs they are studying is challenging to them due to the kind of physiological process they have to go through as females. The below data excerpts indicates the following;

"The programs is already a difficult one and so you cannot afford to miss a class. You have to always be attentive in class while the teacher is teaching. But we are faced with some challenges as women. We go through our menstrual cycle every month and when that time comes, hardly can we focus on our studies. Sometimes, we even miss some classes. Even when you are in class, the course is difficult, how much more when you miss some classes".

(Interview, Esi)

"As you can see, I have a four month baby with me in class. I gave birth almost when the first semester was about ending. I couldn't quit the programs because I want to study and get a degree in maths so my mum has to come to campus to support me. Sometimes, as the teacher is teaching, I have to leave the class to breastfeed the baby or else she will cry and disturb the class. ….this affects my performance but I am trying my best to catchup. Mostly, when we do group studies with the guys in our class, that's when we get a better understanding of whatever our lecturers teach us".

(Interview, Akosua)

The analysis of the above interview excerpts show that, the female students pursuing the selected STEM programs in the University of Education, Winneba are faced with gender imbalances related challenges that makes their studies arduous. The analysis indicates that, these female students have to contend with the pains that comes with their menstrual cycle while also focusing on their classes which they believe makes their learning difficult. The data analysis shows that, due to the physiological challenges they face as females, sometimes they even miss classes.

The data analysis also indicates that, the female students pursuing the selected STEM programs perceive the programs to be a challenging one as some of them have to sometimes combine both practical gender needs such as reproduction and nurturing of babies with strategic gender needs of seeking higher education and skill

development so as to get better job opportunities and develop their future career. The analysis shows that, the students believe, they would not have faced the challenges they face in pursuing the STEM programs if they were only seeking higher education, hence fulfilling their strategic gender needs.

Lack of Role Models

The analysis of the data derived from the interviews with study participants point to the fact that, the female students pursuing the selected STEM programs at the University of Education, Winneba perceive that, the STEM programs they are currently pursuing are difficult and not interesting to them because there are few female faculty staffs they can identify with as their role models. The analysis shows that, this perception has a huge toll on how these female students even learn in the STEM classes. The data excerpts below indicates the following;

"…this course is very difficult. Just look around you will see the number of lecturers who are females. We only have two women who teach us this course. The course is dominated by men. From our lecturers to even the majority of students in class. All are males".

(Interview, Akosua)

"The motivation for us to learn this course to the highest level is not there because there are few women here. You will need to study mathematics to the highest level before you can be a lecturer. The fact that, we have few women teaching in this programs should tell you the programs is difficult. For me, after this first degree, I will just end it. Maybe I will do a different programs for the masters. That's if I want to do post-graduate".

(Interview, Adwoa)

From the analysis of the above data excerpts, the study revealed that, the female students pursuing the selected STEM programs lack female role models who will serve as motivation for the female students' in pursuit of their STEM degrees and perhaps a post graduate studies in STEM programs. The lack of these female lecturers in the STEM programs affect the perception of the female students pursuing these programs as they perceive the programs to be difficult hence the reason for the few female lecturers in the programs. The study revealed that, the females in these STEM programs will not want to pursue a post graduate degrees in these programs even if they want to study for their post graduate degrees. This finding is acknowledged by Atuahene (2014) when he averred that, the lack of women to pursue certain programs of study in the Ghanaian universities does not motivate female students to pursue those programs when they want to pursue university education.

CONCLUSION

The purpose of this study was to examine the perception of female students pursuing STEM programs in the University of Education, Winneba. The study concludes that, there are female students in the selected STEM programs. However, the females in the STEM programs are hugely outnumbered by the male students in these programs and as such, the perception of the female students are shaped by this phenomenon. Although the University of Education, Winneba and all public universities in Ghana have instituted an affirmative action that focuses on gender mainstreaming and promoting the educational welfare of females in higher institutions, it seems more needs to be done in dealing with the gap that exist between males and females who pursue STEM programs. Significantly, universities, particularly public universities in Ghana, should implement gender policies that will allow universities to engage and promote a lot of female faculty in STEM programs since that can boost the enthusiasm of young females pursuing STEM programs.

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