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Effect of Peer Influence on the Girl-Child Interest in Science, Technology, Engineering and Mathematics (STEM) Subjects in Imo State, Nigeria

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Abstract

The enthusiasm, confidence, and success of women and men differ significantly in the fields of science, technology, engineering, and mathematics (STEM). Several factors at individual, environmental and policy levels such as teaching methods, lack of female role models with very little evidence on the link between peer influence and interest of females students in STEM. Multi-stage sampling was deployed to select seventy- four (74) schools from nine (9) local government areas in the three senatorial districts of Imo state, Nigeria. Five thousand one hundred and eighty (5180) students from SSS two and three participated in this survey along with three hundred and seventy teachers (370). Six research questions and five hypotheses were tested at $p<0.05$ level of significance. Pearson product moment correlation, one-way ANOVA and multiple statistical tests was used to test hypotheses. Findings from this study reveal that peer influence is central to building and sustaining the Girl-Child interest in STEM. A group of learners collaborating to find a solution to a challenge, finish a task, or produce an end result is known as peer learning (Johnston, 2009) [3]. Research has shown that peer learning: promotes students learning and academic achievement; increases student retention of subject matter; helps students develop social and communication skills; improve students self- esteem, enhances student satisfaction with their learning experience and stimulates and motivates interest in the STEM related task or topic.

Keywords: Interest, Girl-Child, Students, STEM, Peer Influence, Learning, Extracurricular

Introduction

Historically, there has been a gender gap related to interest, confidence and achievement in Science, Technology, Engineering and Mathematics (STEM) subjects and careers in many countries including Nigeria (British Council, 2012; UNESCO, 2012, 2015; Ekine, 2013; Okeke, 2019) [1, 9, 2, 7]. Enrollment into West African Examination Council (WAEC) and National Examination (NECO) and Nigerian university for Science and Technology subjects and courses is clearly male dominated leaving female to choose from other fields of study (British Council, 2012) [1]. The few females who break the norm to pursue careers in the field of STEM face many obstacles and often fail to fulfill their dreams of practicing or working in STEM related fields. Girls and boys start developing views regarding their skills in elementary school. This can be strengthened as they progress through support from family, teach and peer in their schools. According to studies (Ekine, 2013 [2]; Ballane, 2019; UNGEI, 2016 [10]), boys and girls share a similar desire to perform well in school. However, girls appear to have lower levels of confidence in their abilities. The discrepancy between the two sexes in self-assurance, however, widens in high school when males show higher levels of self-assurance and girls express greater degrees of nervousness and lower levels of confidence in their aptitude for scientific and mathematical subjects. According to studies by Khasawneh, Gosling, and Williams in 2021, Arsad, Zaidi, and Mahmood in 2015, and Rozgnonjuk, Kumar, Mikkor, Orav-Pauural, and Tahk in 2020, students' degree of concern about their capacity to succeed rises as they perceive math lessons to be more challenging. According to research (Khasawneh, Gosling & Williams 2021 [4]; Arsad, Zaidi, & Mahmood 2015; Rozgnonjuk, Kumar, Mikkor, Orav-Pauural, & Tahk, 2020), it is damaging to one's capacity to continue studying mathematics if they lack confidence in their skills. The biggest predictor of whether a female will choose to enroll in a STEM degree program in college, according to research, is the student's self-confidence level in high school (Khasawneh, Gosling, & Williams 2021 [4]; Arsad, Zaidi, & Mahmood, 2015). With fewer females currently engaged in STEM related occupations such as mathematics, computer science, engineering, information and communication technology, STEM professions including the academia, are male dominated. This implies that most science and mathematics teachers in secondary schools and universities in Nigeria are males subconsciously alluding to STEM as the sole reserve of men. The Girl-Child in secondary school girls who lack female role models, mentors and participate in fewer extracurricular activities (science club). Hence, they are socialized into existing gender stereotypes related to STEM subjects, disciplines and occupations. This implies that they appear to be uninterested and lacking confidence in STEM subjects and careers. Available data from the Nigerian University System Statistical Digest indicate a 43 percent undergraduate enrollment rate for females in Nigerian universities compared to 57 percent for males, with lower postgraduate enrollment rate of 36 percent for females compared to 74 percent for males (NUSSD, 2017). Generally, there is a low enrolment of girls in science in secondary schools in Nigeria as reflected by the Gender Parity Index for Biology (0.83), Physics (0.73) and Chemistry (0.73) (Ekine, 2013) [2].

The perception and attitude of science teachers affects the interest and achievement of girls in STEM subjects. Studies have shown that teachers are more attentive to boys and offer them more opportunities for hands-on practical work while the girls are almost ignored or not given as much attention as the boys (UNESCO 2012; Ndirika, & Agommouh 2017) [9, 6]. This situation is compounded by poor funding for education by government of Nigeria resulting in underemployment of science teachers and lacks of provision of needed equipment for scientific discovery in many secondary schools especially those in the rural areas. The low female participation in STEM related professions in Nigeria and inadequate attention to motivate interest and confidence implies that female secondary students who do not have female role models and mentors to aspire towards. As a result, female students find it challenging to understand science and become indifferent, studying about science rather than actually learning it (Umoh, Akpan, & Udongwo, 2013) [8]. There is little existing evidence linking peer influence and girls' interest, achievement, and retention in STEM. Peers play a significant role in influencing the decisions and choices each other make including girls interesting in STEM. This paper examines the relationship between peer influence and female student's interest in science, technology, engineering and mathematics among senior secondary schools in Imo state. The information herein will guide the review of educational policy and practice to close the current gender gap in STEM education in Nigeria

Materials and Methods

Study Area and Design

Imo is located in south- eastern Nigeria on longitude 5 29' N and Latitude 7 2'E. It was created in 1976 with Twenty-seven (27) local government areas and three senatorial districts of Imo East, Imo North and Imo West. The inhabitants of Imo state are predominantly involved in farming, trading, civil service and fishing. The study is descriptive and employed triangulation to increase the credibility and validity of data. A combination of qualitative (In-depth-Interviews and focus group discussions) and quantitative (survey) methods were used in eliciting data from respondents. The study also examined school records to determine student- teacher ratio and the state of their science laboratories in each of selected schools were assessed. Students in senior secondary school one science and the art classes were excluded from this study.

Study Population and Sampling

The study population comprised of senior secondary school two and three students (SS 2 & 3) in Imo. Multi-stage sampling was used to select schools/ respondents who were interviewed. Sampling methods include: i) Stratification of the state into three senatorial districts; ii) Selection of nine local government areas representing a third in each senatorial district; iii) Selection of seventy-four private and public, single and mix secondary schools; iv) Lastly, purposive selection of five thousand one hundred and eighty students in SS 2 and SS 3 classes who participated in the survey.

Data Collection and Analyses

Data for this study was derived using the survey and focus group discussions (FGD) methods. FGDs were taped, translated and their content was examined in accordance with the study's questions. Descriptive statistical method involving the use of frequency counts, percentages and mean, mode and median as well as inferential statistics were used to analyze the data. Pearson product moment correlation, one-way ANOVA and multiple regression statistical test was used to test hypotheses. Statistical significance was set at a p-value of 0.05 and the confidence level at 95%. The Statistical Package for the Social Science (SPSS) was used to evaluate the questionnaire's information.

Results

The traits of the individual sample used for the study is shown in Table 1. A large number of them 52.8 percent who participated in the survey were males compared to 47.2 percent females. This is consistent with literature which shows that more males take STEM subjects and pursue STEM related courses and careers. However, private secondary schools were found to have more females in science classes compared to public secondary schools in Imo state where males were significantly more. The average age of respondents is sixteen years, and their ages range from twelve to twenty years. Most (80.1%) are fifteen to seventeen years old followed at a clear distance by those aged 18 years and above (13.6). The median age of the respondents is 16 years. From the table we glean that marginally more SSS 3 (50.2 percent) students participated in the study than SSS 2 students (49.8%) showing that they are passionate in studying STEM courses.

Table 1: Characteristics of Respondents

	Variables	N (%)
Sex	Female	2446 (47.2%)
	Male	2734 (52.8%)
Age	12-14	328 (6.3%)
	15-17	4151 (80.1%)
	18 and above	701 (13.6%)
Class	SSS2	2581 (48.8%)
	SSS3	2599 (50.2%)

Table 2 shows that peers have significant influence on the choices they make, particularly decisions related to their academic interest and achievement. A large number of the selected sample (61 percent) claimed that their peers influenced their decision to major in science. Eighty one percent of the students who participated in the study revealed that they support each other to learn after school. Majority of them (85.5 percent) also revealed that they challenge each other on who will score the highest and get the best result. Likewise, most of the respondents (78.7 percent) revealed that they get helpful feedback from each other.

	Variable	N (%)
My friends influence my choice of science subjects	Strongly disagree	1182 (22.8%)
	Disagree	559 (10.8%)
	Agree	1380 (26.6%)
	Strongly disagree	1781 (34.4%)
	Missing	278 (5.4)
We support each other to learn after school	Strongly disagree	426 (8.2%)
	Disagree	335 (6.5%)
	Agree	1897 (36.6)
	Strongly disagree	2314 (44.7%)
	Missing	208 (4.0%)
My friends and I challenge ourselves on who will score the highest and get the best result	Strongly disagree	294 (5.7%)
	Disagree	243 (4.7%)
	Agree	1698 (32.8%)
	Strongly disagree	2728 (52.7%)
	Missing	217 (4.1%)
I get helpful feedback from my friends which motivates me	Strongly disagree	468 (9.0%)
	Disagree	382 (7.4%)
	Agree	1559 (30.1%)
	Strongly disagree	2520 (48.6%)
	Missing	251 (4.8%)

From ANOVA, it is evident that 3161(64.5%) of the respondents admitted that their friends influenced their choice of science subjects while 1741(35.5%) of the respondents did not agreed to this statement. Similarly, 4211 (84.7%) of the respondents agreed that they support each other after school while 761 (15.3%) of them contrasted the information. Also, 4426 (89.2%) of the respondents agreed that often challenge themselves on who would score the highest during their exams while 537 (10.8%) of the respondents disagreed to the statement. Finally, 4079 (82.7%) of the respondents agreed that they get helpful feedback from their friends which motivates them to do better while the remaining 850 (17.3%) disagreed with the views. In summary, it is evident that majority of the respondents (Mean 3.13 and standard deviation .968) admitted that peer influence plays a significant role in female students' interest in STEM subject choices.

Discussion

Peer learning (PL) approach should be encouraged to build and sustain the Girl-Child interest in STEM. Peer learning is a method of learning and instruction whereby teams of learners collaborate to solve an issue, finish a task, or produce an outcome (Johnston 2009) [3]. It includes peer tutoring, small and large groups for class discussions, participation in science club activities and online discussion and feedback. Research has shown that peer learning:

- Promotes students learning and academic achievement. With peer learning, students get the opportunity to support their peers' learning through tutoring and feedback. They can also speak freely, expressing their fears and ask questions with less pressure as experienced in class room settings. Peer learning has been shown to improve students' academic performance as students often compete for who will have the overall highest scores in their subjects.
- Increases student retention of subject matter: Understanding and retention has been shown to improve when peer learning approaches are used. This is because students have their unique ways of explaining the topic or subject matter to aid understanding by their peers. Students have developed different strategies to help retention such as use of songs and rhymes.
- Peer learning helps students develop oral communication and social skills: Peer learning encourages greater communication among students and enhances their social skills. Students also build their social skills such as leadership, collaboration, empathy, listening, conflict resolution strategies etc. as they interact with their peers. These skills are critical in social and organizational settings.
- Promote students self –esteem: Improved knowledge and academic performance gained through peer learning has proved to promote students' self-esteem. Student led discussions gives students the opportunity to ask questions and get feedback from their peers which they may not be able to do when their teacher is leading the discussion. Students also facilitate discussions in groups settings which strengthens their confidence in public speaking.
- Enhances student satisfaction with their learning experience: Peer learning approaches have proved to raise the satisfaction levels of students in their abilities and performance.
- It stimulates and motivates interest in the task or topic: Students interest and motivation is increased through peer learning. Students often look forward to learning through their peers during meetings.

Conclusion

As espoused above, peer learning profound benefits for the students and should be applied to teaching of STEM. However, peer learning should be properly planned, organized and implemented to yield maximum benefits. Factors to consider in adopting peer learning include, positive interdependence- where group member depend on each other (swim or sink together); group accountability- each group members effort is needed; face to face interaction- group member support each other to learn and share together; interpersonal small group skills- the teacher needs to regularly restate groups members expectations, assign roles, and giving specific feedback; and lastly, monitoring and intervening- the teacher has to monitor the students' their work and interactions and intervene when necessary to improve teamwork, ensure tasks are completed and help groups with strategies.

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