Critical Appraisal of Female Students' Attitude to Mathematics and Their Career Aspiration in Science and Technology in Nigeria

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Abstract- The aim of this study was to assess the attitude and perception of female students towards Mathematics and determine the relationship of attitude to mathematics and career aspiration of female students. Four hundred and twenty five (425) SSII and SSIII students participated in the research. Questionnaire was used for data collection and the data collected was subjected to statistical analyses in SPSS using frequency, percentage, Pearson correlation and bivariate t test. A very weak positive correlation between female career aspiration and female students' attitude to mathematics was observed (r = 0.004, p > 0.01). The results also revealed significant difference in the female attitude to mathematics and female career aspiration (t = 52.572, df = 424, p < 0.01). The aspiration of female students into Science and Technology was very low.

Index Terms- Female, Attitudes, Mathematics, Career aspiration

I. Introduction

Attitude is a psychological tendency that is expressed by evaluating a particular entity with some degree of favor or disfavor (Eagly and Chaiken, 1998). Attitude can also be viewed as a mental redisposition to act that is expressed by evaluating a particular entity with some degree of favor or disfavor Scholl (2007). Science, Technology, Engineering and Mathematics (STEM) play a critical role in the national growth and economy. Any nation that wants to achieve its developmental objectives must give emphasis to science, technology, engineering and mathematics. Mathematics and mathematics skills are considered essential and a prerequisite to the success in STEM education.

Gender is a social construct. It is defined as the socio-cultural differences between males and females respectively. Butler (1990). It is a sociocultural construct, a category that sorts and organizes social relationships between human male and female. Scott (1986). The national bureau of statistics gave the estimated population of Nigeria close to two hundred million people, that is, 193,392,517 (NBS, 2016). Of this figure, 98,630,184 were males and 94,762,333 were females. In Kebbi state, the total population was estimated as 4,440,050 people. 2,264,425 were males while 2,175,625 were females. It can be observed from the figures that half of the Nigeria's population and indeed Kebbi state were females. It can be argued therefore, that no meaningful development can be achieved without the contribution of females, in other words, it is a great necessity for females to contribute to the development of Nigeria and Kebbi state in particular. It is a necessity in the sense that female education is an efficient asset that a country can invest for sustainable development. Female education affects economic productivity positively, it also improves the mother's knowledge and use of healthcare practices thereby reducing mortality rates (Hartnett and Heneveld, 1994). The length of educational pursuit helps in reducing early marriage and reduces fertility rates through proper use of family planning which can eventually helps in reducing poverty (Herz et al 1991).

Researchers have written a lot of literatures on the disparity among males and females in the study of science, technology and mathematics. Evidence shows that girls' self-efficacy and attitudes related to STEM are strongly influenced by their immediate family environment, especially parents, but also the wider social context. Parents' own beliefs, attitudes and expectations are themselves influenced by gender stereotypes, which can cause differential treatment of girls and boys in care, play and learning experiences. Mothers, more than fathers, appear to have a greater influence on their daughters' education and career choices, possibly due to their role model function. Parents with higher socio-economic status and higher educational qualifications tend to have more positive attitudes towards STEM education for girls than parents with lower socio-economic status and education, of immigrant status and ethnic minority background or single parents. Media representations of women and the status of gender equality in society also has an important influence, as it influences the expectations and status of women, including in STEM careers. UNESCO (2017)

Etukudo (2002) revealed a significant gender difference in performance in mathematics. He however opined that such gender difference can be removed when computer assisted instruction is used. Markus (2014) revealed a low enrolment of females in science and technology when compared to the males. She identified the factors leading to the low enrolment of females in science, technology and mathematics to include the attitude of the society towards the role of females as child bearing and housekeeping among other factors. Female participation in educational pursuits has been a topic of concern to the society and the government in Nigeria. Despite huge resources committed to encourage females to participate in education, the progress recorded so far needs more effort especially in the Northern part of the country. Domestic issues and

responsibilities, culture of marginalization, gender stereotyping of knowledge and skills were found to be the barriers to effective participation of females in science, technology and mathematics (Iwu and Azoro, 2017). This agrees with the findings of Maryam and Patience (2017) that home, school and society are the factors influencing female participation in science and technology in Nigeria. They observed that females are saddled with lot of domestic chores, gender intimidation, gender stereotyping, paucity of role models as contributing factors bedeviling female participation in science and technology. Baran (2016) revealed that the lower participation of female in physics is not because of their abilities, but their interests. Moreover, it can be concluded that female students have a potential for physics just as male students do but environmental conditions cause them to generate negative perceptions concerning the fields of science.

However, some researches reveal that female show more positive attitude towards mathematics at higher level than their male counterpart (Iji et al, 2017). The research established a statistically significant difference in the impact of cloud services on students' attitude towards mathematics education between male and female mathematics education students in public universities. It further revealed that female students tend to better perceive their ability to study mathematics education than male students. Similar research also revealed that female students are more responsible to technological innovation in mathematics education as related to attitude towards mathematics than their male counterparts (Wong and Hanafi, 2007), Sanders (2006). Isa and Balarabe (2009) observed a significant difference in the performance of males and females in science and technology. Research has shown that the negative effects of societal affluence on attitudes toward mathematics are not limited to girls, however. Boys too show a significantly weaker orientation toward mathematics and related fields in post materialist contexts. Both girls and boys view mathematics more negatively in these societies. Charles et al (2014).

Sunday and Adebowale (2013) observed that, textbook as an instructional guide, can affect the learner's attitude towards mathematics. Their findings revealed that there is positive multiple correlation of the textbook features and students' attitude towards mathematics where 2.8% of variation of students' attitude to mathematics is based on the features of textbook used. A research finding have shown that although females had less positive attitude towards mathematics, they aspired to mathematics related careers in equal numbers as males Jensen (1997). The finding raised the possibility that gender could moderate relationship between attitudes and career aspirations.

II. Female Participation in Science, Technology and Mathematics in Kebbi State.

Available statistics have shown that the percentage pass of female students in Mathematics in ordinary level exams has been higher than performance of males.

Table 1: Kebbi State Distribution of National Examinations Council (Senior Secondary Certificate) Examination Result by Year and Sex

Year	Credit Pass in Mathematics	Total Number of candidates Sat	Percentage Pass in Mathematics
	Male Female	Male Female	Male Female
2012	4,125 1,363	16,515 5,899	24.98 23.11
2013	8,115 3,056	18,162 6,689	44.68 45.69
2014	8,561 3,318	19,421 7,389	44.08 44.90
2015	15,232 5,538	20,396 7,985	74.68 69.36
2016	13,188 6,111	19,416 8,198	67.92 74.54

Source: National Examination Council (NECO)

Despite the yearly improvement in the percentage pass of the female students in Kebbi State, there is low enrolment into the degree awarding institutions when compared to their male counterpart. According to the national bureau for statistics, the 2013 to 2015 average percentage enrolment in Kebbi state was 78.8% and 21.2% for males and females respectively. Also, the average percentage female participation in science at graduate level was as low as 18.2% compared to the males 81.8%. (NBS, 2017)

III. Objectives of the Study

This study intended to;

1. Examine the perception of mathematics by female students,
2. Examine the attitude of female students towards mathematics,
3. Examine the career choice of the female students for the future,
4. Assess the relationship between female students' attitude to mathematics and female students' career aspiration.

IV. Background of the Study

Despite the growing population of females in Kebbi state, it can be observed from the foregoing that there is low enrolment of females in the tertiary institutions in Kebbi state. Consequently, their participation in science and related courses is poor. The study therefore, seeks to examine the attitude of females towards mathematics as a tool for science and technology.

V. Research Questions

1. What is the perception of female students to mathematics?
2. What is the attitude of female students to mathematics?
3. Is there any significant relationship between female career choice and female students' attitude to mathematics?
4. Is there any significant difference between female attitude to mathematics and female career aspiration?

VI. Research Hypotheses

(i). There is no relationship between attitude of female students to mathematics and their career aspiration.

(ii). There is no significant difference between female students' attitude to mathematics and female students' career aspiration.

VII. Methodology

The population of the study was the entire senior secondary II and III female students in Argungu, Arewa, Augie and Dandi local government areas of Kebbi State Nigeria. A stratified random sampling was used to select a sample of four hundred and twenty five (425) female students. Each local government was considered as a stratum. The sample size was calculated based on proportional allocation as follows: Argungu 125, Arewa 100, Augie 110, Dandi 90. Questionnaire was used for the collection of data. The questionnaire has a reliability coefficient of 0.87 and validated by three experts in test, measurement and evaluation.. The questionnaire was divided into four sections. Section A contained the list of five mathematics modules. The respondents were required to rank the modules as 1 to 5 based on preference.

The modules are: Arithmetic, Trigonometry and geometry, Algebra, Statistics and probability, and Structure.

The most preferred is ranked 1 and the least preferred is ranked 5. Section B contained seven mathematical activities to be ranked in order of preference as in section A. These activities include Word problems, Approximations, Geometrical constructions etc. Section C consisted of 16 items on attitude to mathematics. Eight items were positive attitude to mathematics and eight were negative. It had a Linkert type scale (Agree, disagree and undecided). Each agreed response to positive attitude was scored 3 and disagreed was scored 1. The undecided response was regarded as neutral and scored 2. The scores were reversed in the negative attitude items. That is, agreed was scored 1 and disagreed was scored 3. The items in this section are:

(i). Mathematics is interesting,
(ii). I like to study Mathematics in future
(iii). Mathematics is simple
(iv). I like Mathematics
(v). School Mathematics have real life applications
(vi). I want to make sense of what I learn in Mathematics
(vii). I think I can cope with harder Mathematics courses
(viii). Women can do just as well as men in mathematics
(ix). Mathematics is not relevant to my future career,
(x). Mathematics is more important to males than females
(xi). I learn Mathematics well without really understanding it
(xii). I will avoid Mathematics once I leave school
(xiii). I cannot pass Mathematics examination
(xiv). Mathematics is very demanding
(xv). One must be very intelligent to learn Mathematics
(xvi) Males are naturally better in Mathematics than females

Section D consisted of five items containing the aspired fields of study after the completion of secondary school. The fields were; Medicine and health related fields, Science and technology, Arts, humanities and social sciences, Education and philosophy, if the student does not intend to go further, she selects Termination of education upon completion of secondary school.

VIII. Results and Discussion

Table 2: Mathematics Modules Based on Female Students' Preference.

Module	1st		2nd		3rd		4th		5th	
	Freq.	%	Freq.	%	Freq.	%	Freq.	%	Freq.	%
Arithmetic	88	20.7	100	23.5	75	17.6	81	19.1	81	19.1
Trigonometry and geometry	65	15.3	85	20	77	18.1	96	22.6	102	24.0
Algebra	98	23.1	85	20	83	19.5	90	21.2	69	16.2
Statistics and probability	83	19.5	88	20.7	88	20.7	85	20	81	19.1
Structure	94	22.1	90	21.2	83	19.5	79	18.6	79	18.6

Table 3: Female Students' Preferred Mathematics Activity

Activity	1st		2nd		3rd		4th		5th		6th		7th		8th	
	f	%	*f*	%	*f*	%	*f*	%	*f*	%	*f*	%	*f*	%	*f*	%
Working with equations and formulae	77	18.0	52	12.2	62	14.6	62	14.6	44	10.4	42	9.9	44	10.4	42	9.9
Geometrical	27	6.3	50	11.8	60	14.1	65	15.3	50	11.8	60	14.1	46	10.8	67	15.8

constructions																
Collecting/analyzing data	46	10.8	31	7.3	46	10.8	67	15.8	62	14.6	56	13.2	73	17.2	44	10.3
Proving theorems	20	4.6	44	10.4	42	9.9	79	18.6	67	15.8	73	17.2	46	10.8	54	12.7
Word problems	25	5.9	65	15.3	62	14.6	44	10.4	52	12.2	58	13.6	54	12.7	65	15.3
Approximation/reading tables	63	14.8	44	10.4	62	14.6	42	9.9	58	13.6	48	11.3	54	12.7	54	12.7
Interpreting graphs and charts	44	10.3	65	15.3	50	11.8	45	10.6	65	15.3	44	10.3	50	11.8	62	14.6
Sorting, grouping and Venn diagrams	55	12.9	50	11.8	73	17.2	48	11.3	46	10.8	39	9.2	62	14.6	52	12.2

Table 4: Female students' career aspiration

Aspired field of study after school	Number of students	Percentage
Science and technology	85	20.0
Medicine and health related fields	91	21.4
Education and Philosophy	48	11.3
Arts, humanities and social sciences	96	22.6
Terminate my education after school	105	24.7

A bivariate correlation test was conducted to calculate the Pearson correlation coefficient between female career aspiration and female attitude to mathematics. The results obtained indicated a weak positive correlation between female career aspiration and attitude to mathematics (r = 0.004, p > 0.01). Also, a paired samples produced the mean scores of female attitude to mathematics (mean = 34.07, SD = 12.13) and female career aspiration (mean = 2.89, SD = 1.49). The test revealed a significant difference in the female attitude to mathematics and female career aspiration (t = 52.572, df = 424, p < 0.01, r = 0.004).

Table 2 gives the list of five modules of ordinary level mathematics for the respondents to rank in order of preference. 98 respondents (23.1%) ranked algebra first which is the highest in that column. This indicates that algebra is preferred most. 65 respondents (15.3%) ranked trigonometry and geometry first, which is the lowest in that column. 102 respondents (24.0%) ranked trigonometry and geometry last or fifth position which is the highest in the extreme end or last column. This showed that trigonometry and geometry is the module that is least preferred by the female students. Arithmetic and statistics/probability are the second least preferred by female students with 81(19.1%) respondents each. Structure is the second module preferred most by the female students with `94 (22.1%) respondents.

Table 3 gives eight mathematical activities to rank based on preference. Working with equations and formulae was ranked most preferred by the female students with 77 respondents or 18.0% followed by approximation/reading tables with 63 or 14.8% of the respondents. At the extreme end, geometrical construction and word problems had highest score in the last position or least preferred with 67 (15.8%) and 65 (15.3%) respectively. Only 20 female students (4.6%) ranked proving theorems first. It can be observed from tables 2 and 3 that trigonometry and geometry as the least preferred among the modules.

Table 4 contains the aspired educational fields the female students hope to study after the completion of the secondary school. 85 of the female students or 20% showed interest in studying science and technology. 91 or 21.4% of the respondents wanted to study medicine or related fields. 105 (24.7%) do not intend to continue their education after secondary school. This group of students may have probably wanted to get married at that level.

An SPSS analysis of the data obtained indicated a very weak positive correlation between female career aspiration and female students' attitude to mathematics (r = 0.004, p > 0.01). Analyzing the mean scores, we obtained (t = 52.572, df = 424, p < 0.01). Therefore, we reject the null hypothesis and conclude that there is a significant difference in the female attitude to mathematics and female career aspiration. This is in agreement with findings of Razali et al (2018) and Yerdelen et al (2016) that reported significant relationship between students attitude and developing science, technology, engineering and mathematics career.

IX. Conclusion

This paper provided an insight into the female students attitude to mathematics as it relates to their career aspiration. It can be concluded from the results that the career aspiration of the female students have a very little impact on the attitude to mathematics. However, there is a significant difference in the career aspiration of the female students and their attitude to mathematics. It is that a good number of the female students are not willing to go further in their studies. The probable reason may be due to cultural and traditional restrictions of females to child bearing and housekeeping role. UNESCO (2017) reported that, despite gains in access to education by the females, socio-economic, cultural and other obstacles still prevent female learners from completing or benefiting fully from good quality education of their choice in many settings. These barriers increase in adolescence, when gender roles for girls become more entrenched and gender discrimination more pronounced. Barriers include household and care responsibilities, early

marriages and pregnancies, cultural norms that prioritise boys' education. This is very worrisome despite unrelenting efforts by the government to encourage the participation of females in science and technology. The research also revealed that there is need for mathematics teachers to give special attention to those modules that are less preferred by the students and devise suitable methods of teaching that will encourage the students improve in such areas. The government should do more to encourage female participation in science and technology.

REFERENCES

[1] Baran M (2016). Gender differences in high school students' interests in physics. Asia-Pacific Forum on Science Learning and Teaching 7(1)

[2] Butler J (1990). Gender Trouble: Feminism and the Subversion of Identity. New York, NY: Routledge.

[3] Charles M, Harr B, Cech E, Hendley A, (2014). Who likes math where? Gender differences in eighth-graders' attitudes around the world. International Studies in Sociology of Education 24(1): 85–112

[4] Eagly AH, and Chaiken S, (1993). *The psychology of Attitudes*, Orlando, FL Harcourt Brace Jovanovich College Publishers.

[5] Etukudo M, (2002). Mathematics Education for sustainable development in Nigeria. Implication for scientific literacy.

[6] Hartnett T, and Heneveld W (1994). Statistical Indicators of Female Participation in Education in Sub- Saharan Africa, Technical Department, Africa Region, World Bank, Washington D.C.

[7] Herz B, Subbarao, Habib M, and Raney L, (1991). Letting Girls Learn: Promising Approaches in Primary and Secondary Education. World Bank Discussion Paper No 113, Washington D.C.

[8] Iji CO, Abah JA, Anyer JW (2017). Impact of Cloud Services on Students' Attitude towards Mathematics in Public Universities in Benue State. International Journal of Research in Education and Science 3(1): 223-244

[9] Isah H and Balarabe RM (2009). Analysis of the Participation and Performance of Males and Females in Nigerian Science and Technology Programs: A Case Study of Ten Years National Diploma in Nuhu Bamalli Polytechnic Zaria. Educational Research and Review 4(9):588-595

[10] Iwu RU and Azoro RV (2017). A Study on the Barriers to Participation of Females in Science, Mathematics and Technology Education in Imo State the Way Forward. Educational Research and Reviews. 832-838

[11] Markus L (2014). Strategies for Bridging Gender Gap in Science, Technology and Mathematics (STM) Education for National Development. Journal of Educational and Social Research 4(7):61-66.

[12] Maryam NC and Patience CA (2017). Investigating Factors Influencing Girls' Participation in Science and Technology Education in Nigeria. IOSR Journal of Research & Methods in Education (IOSR-JRME) 7(3):50-54.

[13] National Bureau for Statistics Nigeria (2016) Social Statistics Report.

[14] National Bureau for Statistics Nigeria (2017) Statistical Report on Women and Men in Nigeria.

[15] National Examination Council (NECO) in National Bureau for Statistics Nigeria (2017) Statistical Report on Women and Men in Nigeria. 55-64

[16] Razali F, Talib O, Kalthom U, Manaf A, Hassan SA, (2018). Students Attitude towards Science, Technology, Engineering and Mathematics in Developing Career Aspiration. International Journal of Academic Research in Business and Social Sciences 8(5):963-976.

[17] Sanders J (2006). Gender and Technology in Education: A Research Review, in Skelton, C., Francis, B. & Smulyan, L. (Eds). *Handbook of Gender in Education*. London, UK: Sage Publications. 1-50

[18] Scholl S (2007). A Study of Gender Attitude to Mathematics, Cognitive Style and Achievement in Mathematics. Experiments in Education 35:6-13.

[19] Scott J (1986). Gender useful category of historical analysis. American Historical Review. 91.

[20] Sunday AS and Adebowale AI (2013). Mathematics Textbook Attributes as Predictor of Students' Attitude to Mathematics. European Scientific Journal 9(9):159-170.

[21] UNESCO (2017). Cracking the code: Girls' and women's education in science, technology, engineering and mathematics (STEM). http://creativecommons.org/licenses/by-sa/3.0/igo/ *Accessed* October 20th 2018

[22] Wong SL and Hanafi A (2007). Gender Differences in Attitude towards Information Technology among Malaysian Student Teachers: A Case Study at Universiti Putra Malaysia. Journal of Educational Technology & Society 10(2) 1176-3647

[23] Yerdelen S, Kahraman N, Tas, Y (2016). Low Socioeconomic Status Students' STEM Career Interest in Relation to Gender, Grade Level, and STEM Attitude. Journal of Turkish Science Education 13:59-74

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