Assessing the Influence of Gender Related Factors on Girls' Performance in Mathematics

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Abstract: This study assessed the influence of the gender related factors affecting female students' performance in mathematics in three female public senior secondary schools in Benin Metropolis. The specific objectives of the study were to assess the influence of career choice, domestic responsibilities, peer group and culture on performance in mathematics among some female public senior secondary school students. The correlational survey research design was used for the study. As a guide, four hypotheses were formulated and tested at the 0.05 alpha level of significance. A total of 93 students were selected from the three female public senior secondary schools with a population of 466 students in Benin metropolis through stratified random sampling technique. Two instruments were used, namely; a questionnaire and a mathematics objective test. The questionnaire contains items relating to the factors above and was validated by two colleagues in the Department of Education, Faculty of Arts and Education, Benson Idahosa University, Edo State. The questionnaire was tested for reliability using the test retest method and 0.80 coefficient of reliability was obtained. The test items were drawn from past examination questions of West African Examination Council (WAEC) and National Examination Council (NECO). 50 objective test items were selected and adapted in line with the test blue print drawn from the scheme of work already covered by teachers at the time of this study. The items were administered to a pilot group from the population of study outside the sampled students and the test items were then validated using the method of item analysis. The difficulty indexes between $0.3 - 0.7$ and discrimination indexes between $0.5 - 1.0$, were used as benchmark and 20 items were finally selected. Ninety three (93) copies of the questionnaire with the Mathematics test attached were administered to the respondents by the researchers and class teachers under examination conditions. The data were measured at the ordinal, nominal and interval levels and were analyzed with the Spearman rho and biserial correlation statistics. The findings of the study showed that: the caring for babies or the aged persons was significant ($N = 93$, $r_b = -0.212$, $p \leq 0.042$) and the number of chores the students do in the house was significant ($N = 93$, $r_s = -0.321$, $p = \leq 0.041$). The rest gender related factors were not significant. Thus the coefficient of determination of the larger coefficient, 10.3% of the observed variation in the female students' performance in the mathematics test is explained by domestic responsibility. By extension it means that 89.7% of the observed variation in the female students' performances in the mathematics test is attributable to non gender related factors. Based on the findings, the researchers therefore recommended that while all stakeholders in education sector, workout remedial programme in Mathematics for students in female public secondary schools to compensate for the lost in studying hours due to the time spent on house chores; the main focus however should be on the motivational and infrastructural factors for the learning of mathematics.

Keywords: Influence, Female students, Performance, Mathematics.

INTRODUCTION

The importance of mathematics to science and technology cannot be over emphasized. Over the years a good number of people have expressed the desire of having more professionals in science and technology to fast track national development in Africa. The idea of bridging the gap between boys and girls in the sciences is envisaged will enhance the number of skill manpower personnel in the area of technological development in this part of the world. Thus considerable efforts are being made to motivate female students into science subjects and improve their performance in same particularly mathematics.

The performance of female students in mathematics is still lower than that of their male counterparts in Benin City, Edo State, despite efforts made by the government, good spirited groups and individuals to make female students perform well in mathematics. A pilot survey carried out by the Researchers in two mixed senior secondary schools in Benin Metropolis revealed that the male students in the two schools had higher mean scores in mathematics than their female counterparts. The two schools' records of the promotional examination for senior secondary school II students for instance, indicated that the mean scores of male students were 55.02 and 50.50 while that of the female students were 45.12 and 48.30. In addition, the West African Examination Council (WAEC) results of these two schools further confirmed that on the average, the male students performed better than their female counterparts in mathematics – It was 58 to 53 in favour of the male students.

This revelation prompted the researchers to carry out this study and contribute to the ongoing efforts to assess the influence of the factors responsible for the disparity between boys and girls performance in mathematics. The scope of the paper was on the gender related factors, since the general factors such as school facilities, adequate teachers, attitude of: parents, teachers and students; parents' background such as education, income and occupation that influence performance in examination cannot account for the differences between the performance of male and female students in mathematics. Thus these general factors were not examined in the study. .

To identify gender related factors, this study was guided by the following theories, the Adlerian theory (1991) and the social learning theory of Bandura (1977). According to Adler (1991), human beings possess inherent factors that have effect on their destiny; among the factors identified by the author, is culture. The elements of cultural influence according to the author are predominantly beliefs. He posited that individuals are merely discouraged as a result of their self-defeating inferiority feelings due to cultural beliefs. In most traditional societies there are cultural definitions of roles. In such societies certain professions are associated with the men folk. Under this influence some girls might decide to pay less attention to the subjects linked to those professions such as mathematics, which invariably will affect their performance in the subject. Similarly, most domestic responsibilities according to cultural beliefs belong only to the women folks. This then means that the female students studying hours would be affected which would likely influence their performance in mathematics because the subject requires sufficient time to solve take home problems.

The social learning theory of Bandura (1977) posits that in social situations, people frequently learn quickly from one another through observation, imitation and modeling. It is also called the observational learning theory. Education is always carried out in physical and social settings. Thus this theory implies that female students will likely emulate their female friends who tend to dominate the literary courses and give less attention to the quantitative courses like mathematics. The literary courses require little or moderate knowledge of mathematics and at most a credit pass in the subject at the ordinary level. This fact could influence female students to set a low performance goal for mathematics. Therefore this theory is suggestive that peer group and career choice could influence the performance of female students relative to male students in mathematics.

The above theories thus point to the possibility of a connection between female students poor performance in mathematics and career choice, domestic responsibilities, peer group and culture but only through empirical analysis, could the strength of these factors be assessed. Therefore, the empirical researches related to this

study were reviewed. Omwenga (2014) carried out a study titled: factors contributing to dismal performance in mathematics among secondary school girls in Borabu Division, Nyamira district Kenya. The research used the ex-post factor research design. The population for this study was 714 which comprised of 700 girls, 7 teachers and 7 head teachers out of which a sample of 154 respondents was obtained comprising 140 girls, 7 mathematics teachers and 7 head teachers. The sample for the teachers and head teachers was done purposively while that of the girls was arrived at by random selection. Data was collected by making use of questionnaire and interview. The researcher made use of descriptive statistics using frequencies and percentage to analyze the data. The findings revealed that girl's low level of aspiration, peer group influence, gender stereotype among other factors greatly contributed to the dismal performance in mathematics by secondary school girls in Borabu division. It was recommended; firstly that there was need to enlightened the girls on the importance of mathematics in their day to day lives. Secondly, that school teachers should be encouraged to motivate and guide students regularly because they are the most important agent that can positively influence students' attitudes towards mathematics. Thirdly, that, adequate learning facilities be provided and that emphasis should be on the use of manipulative materials and visual aids, so as to make students participate actively in learning mathematics.

Olango, (2007) investigated factors affecting performance of girls in mathematics in school certificate examination in public secondary schools in Migori District, Nyanza province, Kenya. The study investigated the extent to which career aspirations among other factors affect performance of girls in mathematics in school certificate examination in public secondary schools. The study utilized a sample of 610 students and 54 teachers and the sample was selected through stratified random sampling method. Among the instruments used were students' and teachers' questionnaires and an attitude scale. The hypothesis was tested at 0.05 alpha level of significance using the chi-square. It was found that there was a weak relationship between performance in mathematics and career aspirations. The recommendation made was that: Guidance and counseling department should be strengthened in girls' secondary schools with emphasis on career advice; this will assist girls to demystify mathematics and enable them to recognize subjects that will make them reach their dream careers.

Hamatu, (2015) conducted a similar study on the performance of female students in mathematics and science in selected secondary schools in Lusaka district from 2005 – 2010. This study used a descriptive survey design. Data was obtained from 136 respondents which comprised of 120 female students, 4 head teachers, 2 senior education standard officers and coordinators, 4 secondary school career masters and 6 heads of department. The simple random sampling method was used to select the female students from 4 secondary schools while the other respondents were sampled on purpose. Data was collected using semi-structured questionnaires with open and closed questions, academic record and interview. One of the findings was that a couple of factors were responsible for the low performance of female students in mathematics and sciences. These factors consist of culture and home chores among other factors. It was recommended among other things that the ministry of education should promote policies that will increase the performance of female students in science and mathematics.

The findings above show that cultural factors, career aspiration, peer group and domestic responsibilities, all contribute to the poor performance of female students in mathematics. This reality might be worst in single sex female secondary schools. The absence of male students (among whom, are usually the models in mathematics), might make the situation in single sex female secondary schools critical. The likelihood of a relatively low ownership mentality among public secondary schools' administrators, and the attendant poor supervision may even compound the influence of these factors on the performance of female students in mathematics in female public secondary schools.

Statement of the Problem

There are a couple of female public secondary schools in Benin metropolis, Edo state, Nigeria. The intention of Government is to give these schools specialized attention and protection against the odds that militate against girls' education. How do these gender related factors influence the girls' performance in mathematics in these schools? Currently there are no empirical data in literature to address this question in this locality.

Purpose of the Study

Therefore the purpose of this study was to assess the influence of the gender related factors affecting girls' performance in mathematics among selected students in three female public senior secondary schools in Benin Metropolis, Edo State, Nigeria. Specifically the study sought to find out among the three female public senior secondary schools in Benin Metropolis, Edo State, Nigeria:
  i)   The extent to which career choice influences the female public secondary school students' performance in mathematics.
  ii)   The level of influence of domestic responsibilities on the female public secondary school students' performance in mathematics.
  iii) The degree of influence of peer group on the female public secondary school students' performance in mathematics.
  iv)   The extent to which culture influences the female public secondary school students' performance in mathematics.

Hypotheses

The following null hypotheses were formulated and tested at 0.05 level of significance:
  i)   The choice of career made by the female public secondary students does not significantly influence their performance in mathematics.
  ii)   Domestic responsibilities do not significantly influence the female public secondary students' performance in mathematics.
  iii) Peer group does not significantly influence the female public secondary students' performance in mathematics.
  iv)   Culture does not significantly influence the female public secondary students' performance in mathematics.

Research Method

The research design used in the study was the correlational survey design. The population for the study consisted of four hundred and sixty six (466) students of three female public senior secondary schools form 111 in Benin Metropolis. The researchers made use of stratified random technique in selecting a sample size of ninety three (93) female students which represents twenty percent (20%) of the population of the study. Two instruments namely a questionnaire and a mathematics test developed by the researchers were used for the study.

The questionnaire was titled: "Gender related factors affecting female students' performance in mathematics questionnaire (GRFAFSPMQ)". It was divided into four sections, (A – D), representing the four hypotheses. There were a total of twenty five (25) items in the questionnaire. The questionnaire was used to elicit responses from the sampled students in order to assess the level of their domestic responsibilities; identify: their culture, career choices and the type of peer group they belong to. Section A has the ordinal scale while sections B – D were nominal. To ensure the validity of the questionnaire, the initial draft was presented to two colleagues who made some inputs. Their inputs were effected in the final draft of the instrument. In determining the reliability of the questionnaire, it was administered to thirty (30) students. Data generated were analyzed, using the Spearman rho and the phi Correlation Statistics. This yielded
coefficient of 0.8.

The mathematics test has twenty (20) multiple choice items which were adapted from past questions of West African Examination Council (WAEC) and National Examination Council (NECO) from 2010 – to date. The validation of the mathematics test was as follows: 50 items were selected using the test blue print drawn from the work already covered by teachers at the time of this study, as a guide. The items were administered to a pilot group of fifty (50) students from the population of study who were not part of the sample of the study and their responses were used in performing item analysis. The difficulty indexes between 0.3 – 0.7 and discrimination indexes between 0.5 – 1.0, were used as benchmark and 20 items were finally selected.

Ninety three (93) copies of the questionnaire with the Mathematics test attached were administered to the respondents by the researchers. The school heads in conjunction with their mathematics teachers helped in informing the students about the research work. These students were also informed that their participation was completely voluntary and that the information they give would remain anonymous; the purpose of the study was also clearly explained to the respondents. The process was conducted under the supervision of the researchers and the class teachers. To elicit the real examination attitude among the respondents, the researchers announced that prizes (undisclosed) will be given for good performance in the test. The students were given approximately fifty (50) minutes to complete the questionnaire and answer the mathematics test. The students were closely monitored to guide against malpractice during the process. The questionnaires and mathematics tests were collected as soon as the questionnaires were duly filled and the mathematics test completed by the respondents.

To assess the influence of the level of domestic responsibilities (house chores) on the respondents' performance in the mathematics test, the Spearman rho correlation statistics was used, while the rank biserial correlation statistics was used in assessing the influence of cultural group, career choice, and peer group on the respondents' performance in the mathematics test.

Analysis of Data and Presentation of Results

This section deals with the analysis of data and presentation of results in relation to the hypotheses. These are as follows:

Hypothesis 1: The choice of the career made by the female public senior secondary school students has no significant relationship with their performance in mathematics.
The results are presented in tables 1

Table 1: Showing the Summary of the Biserial Correlation Coefficients between the Career Choice of the Female Public Senior Secondary School Students and their Scores in Mathematics Test.

Career Choices	N	r_b	P-value (2-tailed)	Decision (0.05 Significance Level)
Law	93	-0.066	0.529	Not significant
Medicine	93	-0.016	0.876	Not significant
Engineering	93	0.001	0.989	Not significant
Pharmacy	93	-0.099	0.347	Not significant
Nursing	93	-0.070	0.504	Not significant

The results presented in table 1 shows the correlation coefficients and p-values of the correlation between career choice of the female public secondary school students and their scores in mathematics test. Law, Medicine, Engineering, Pharmacy and Nursing have correlation co-efficients of -0.07, -0.02, 0.001, -0.10, -0.07 respectively with p-values of 0.53, 0.88, 0.99, 0.35, 0.50 respectively. The P-values are not significant, since they are greater than the alpha value (0.05). Therefore, the null hypothesis is not rejected.

Hypothesis 2: Domestic responsibilities do not have significant relationship with the female public senior secondary schools students' performance in mathematics.

The summary of the test of hypothesis is presented in table 2

Table 2: Showing the Summary of Biserial and Spearman rho Correlation coefficients between the Female Public Senior Secondary School Students House Chores and their Scores in Mathematics Test.

Independent Variables	N	r_b/r_s	P-value (2-tailed)	Decision (0.05 Significance Level)
Cooking	93	-0.108	0.301	Not significant
Washing plates	93	-0.111	0.291	Not significant
Washing clothes	93	-0.017	0.875	Not significant
Care of children or aged persons	93	-0.212	0.042	Significant
Selling/Hawking	93	-0.025	0.814	Not significant
Number of house chores to which respondents are committed	93	-0.321	0.041	Significant

The results presented in table 2 shows the correlation coefficients and the p-values of the correlation between the female public senior secondary school students house chores and their score in mathematics test. Cooking, washing plates, washing clothes, care of children or the aged persons, selling/hawking have correlation co-efficients of -1.12, 0.11, 0.02, 0.21, -0.03 respectively and p- values of 0.30, 0.29,0.88,0.04, 0.81 respectively. Testing at alpha level of 0.05, the coefficients of the care of children or the aged persons and the number of house chores to which respondents are committed were significant. Therefore, the null hypothesis is rejected.

Hypothesis 3: Peer group has no significant relationship with the performance of the female public senior secondary schools students in mathematics.

The summary of the test of hypothesis is presented in table 3

Table 3: Showing the Summary of the Biserial Correlation Coefficients between Peer Group and the Performance of the Female Public Senior Secondary Schools Students in Mathematics.

Peer Group	N	r_b	P-value (2-tailed)	Decision (0.05 Significance Level)
Study group	93	0.031	0.766	Not significant
Sports club	93	0.158	0.130	Not significant
Gang/clique	93	-0.016	0.876	Not significant
Church group	93	0.008	0.939	Not significant
Tribal association	93	-0.029	0.785	Not significant
Social organization	93	-0.135	0.197	Not significant
Jets club	93	0.068	0.520	Not significant
Music club	93	-0.055	0.603	Not significant

The results presented in table 3 shows the correlation coefficients and the p-values of the correlation between peer groups and the performance of the female public senior secondary schools students in mathematics. Study group, sports club, gang/clque, church group, tribal association, social organization, jets club, music club have a correlation co-efficients of 0.031, 0.16, -0.02, 0.01, -0.03, 0.07, -0.06 respectively with p- values of

0.77, 0.13, 0.88, 0.94, 0.79, 0.20, 0.52, 0.60 respectively. At alpha level of 0.05, all the coefficients in the above test are not significant. Therefore, the null hypothesis is not rejected.

Hypothesis 4: Culture has no significant relationship with the performance of the female public senior secondary school students in Mathematics.
The summary of the test of hypothesis is presented in table 4

Table 4 Showing the Summary of the Biserial Correlation between the Female Public Senior Secondary School Students' Tribes and their Performance in Mathematics.

Statistics	N	r_b	P-value (2-tailed)	Decision (0.05 Significance Level)
Bini	93	0.056	0.596	Not significant
Esan	93	-0.038	0.715	Not significant
Afemai	93	0.042	0.691	Not significant
Igbo	93	-0.182	0.083	Not significant
Yoruba	93	0.172	0.099	Not significant
Tiv	93	-0.034	0.744	Not significant
Ijaw	93	-0.10	0.926	Not significant
Ibibio	93	0.121	0.249	Not significant

The results presented in table 4 shows the correlation coefficients and the p-values of the correlation between the female public senior secondary school students' tribes and their performance in mathematics. The Bini, Esan, Afemai, Igbo, Yoruba, Tiv, Ijaw, Ibibio tribes have a correlation co-efficients of 0.06, -0.03, 0.04, -0.18, 0.17, -0.03, -0.10, 0.12 respectively with p-values of 0.60, 0.72, 0.69, 0.08, 0.10, 0.74, 0.93, 0.25 respectively. At alpha level of 0.05 all the individual coefficients in the above test are not significant. Therefore, the null hypothesis is not rejected.

Summary of Findings
1) The findings revealed that the choice of Engineering has a low positive coefficient of correlation with the female public senior secondary school students' performance in Mathematics, while there was a low negative coefficient with the choice of Law, Medicine, Pharmacy and Nursing on the performance of the female public senior secondary school students in Mathematics. At 0.05 alpha level of significance, none of the career choice in this study has significant correlation coefficient with the female public senior secondary school students' performance in Mathematics.
2) On domestic responsibilities, the study found out that all the house chores examined, have low negative correlation coefficient with the female public senior secondary school students' performance in the mathematics test. Nevertheless only the coefficients of the care for babies or adults, and the number of house chores to which the respondents are committed were significant: N = 93, r_b = -0.212, p ≤ 0.042; N = 93, r_s = -0.321, p ≤ 0.041.
3) On the influence of peer group on the performance of the female public senior secondary school students' in mathematics, the study showed that study group, gang/clique, tribal association, voluntary organization, jets club and music club have a low negative correlation coefficient with the performance of the female public senior secondary school students in the mathematics test. On the other hand, sports club and church group have low positive correlation coefficient with the female students' performance in the mathematics test. But none of these peer groups has significant correlation coefficient with the students performance in the mathematics test.

4) On the influence of culture on the performance of the female public senior secondary school students in mathematics, the findings showed that Bini, Afemai, Yoruba and Ibibio cultures have low positive correlation coefficient with the students' performance in the mathematics test, while Esan, Igbo, Tiv and Ijaw cultures have low negative correlation coefficient with the performance of the students in the mathematics test. None of these cultures has significant correlation coefficient with the students' performance in the mathematics test.

Discussion of Findings

This study found out that there exist a low positive influence of the choice of Engineering on the performance of the students in Mathematics while the choice of Medicine, Pharmacy, Law and Nursing all have low negative influences on the students' performance in Mathematics, all of which were not significant. In support of these findings, Bandura; Barbarnelu, Caprara and Pastorelu (2001) showed that career choice does not have influence on female students performance in mathematics. These findings imply that the level of career counseling in these schools is most probably very low, otherwise if these students know that Mathematics is the key to Engineering, perhaps they will pay more attention and hence their performance in the subject will be higher.

This study also showed that there is low negative influence of cooking, selling, washing plates, washing clothes and care of children or adults on the female students' performance in Mathematics test. However the care of children or aged persons and the number of house chores of the students were significant. In line with this findings, (Heady, 2003) showed in his study that in developing countries, hours of work which domestic responsibility is part of negatively correlated with mathematics skills and reading. This finding is also supported by Akabayashi and Psacharopoulos (1999). Furthermore another study by Jodi R, Sasila H, Suzanna k., Lesley H. & Nina G. (2013) showed that the number of house chores which students are engaged in, negatively correlated with Mathematics test scores. The time spent on caring for children or aged persons has significant influence on students performance in the Mathematics test because this duty is usually prolonged and reserved only for the girls and thus results in substantial lose in their study hours. Similarly the girls usually work more than the boys in terms of the number of house chores involved. Little wonder then that many female students do well in mathematics because the subject requires enough time for practice.

This study also, showed that the influence of peer group on the performance of the female students in mathematics with respect to sports club and church organization is positive low while study group, gang/clique, tribal association, voluntary organization, jets club and music club all have low negative influence on the performance of the female students' in mathematics. However findings from the study conducted by Mapesa (2013) showed that peer group members who scored 400 – 500marks in KCPE had positive influence on the female student academic performance. Similarly, Bankole & Ogunsakin. (2015) showed that peer group influence is either positive or negative depending on the academic orientation of the members. The indication of these findings is that peer group influence is more from the academic disposition of the members rather than the social objective of the group. Thus it is most likely that academically poor students will be influenced positively by peers who are stronger academically, no matter the objective of the group; so long it is not antisocial. It is also very likely that members of a study group will not gain academically if members are educationally poor.

With respect to the influence of culture on the performance of the female students in the mathematics test, the study found out that Bini, Afemai and Yoruba cultures have low positive influence on the performance of the female students while Esan, Igbo, Tiv, Ijaw and the Ibibio cultures have low negative influence on the female students' performance in mathematics though none of these was significant. However some studies have shown that culture influences students' perception which in turn elicits general negative attitude towards the subject. This attitude according to these studies reduces female students' participation in mathematics study significantly (Gudyanga, Mandizvidza & Gudyanga (2016); Iipinge, (2014); Welsh, (2011).

Similarly a study carried out by some researchers from Norway showed that cultures of modern versus traditional societies exact significant difference on both boys' and girls' performance in Mathematics (Srensena, Iversenb, Froma & Bonesrnningb (2015). So the cultures in the study did not exact significant variation in the female students' performance in the Mathematics test probably because the area of study was only urban which is dominated by modern civilisation.

Conclusion

The research concluded that the domestic responsibility of caring for babies or the old persons which the female students are often saddled with affect their academic progress in mathematics. It is a known fact that the subject of mathematics requires a great deal of practice for learners to internalize the principles they are taught in the classroom. In most Nigerian communities the female students are made to look after the babies because they are the future mothers while the boys are often left alone. The time that is expended by girls in taking care of the babies or aged persons and other house chores they grapple with, cut into their time for home practice in mathematics. However the study showed that only 10.2% of the observed variation in the female students performance in the mathematics test conducted is explained by lost in study hours due to the time spent in caring for babies or aged persons and other house chores which means that 89.8 % of the variation in their performance in the mathematics test could be attributable to non gender related factors in the learning of mathematics..

Recommendation

Based on the findings of the study, it was recommended that while all stakeholders in education sector, workout remedial programme in Mathematics such as holiday lessons for students in female public senior secondary schools to compensate for lost of studying hours due to the time spent on caring for babies or aged persons and other house chores; the main focus however should be on the motivational and infrastructural factors in the learning mathematics.

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