EFFECTS OF GENDER AND AGE ON THE MATHEMATICS ACHIEVEMENT OF SECONDARY SCHOOL STUDENTS IN MINNA METROPOLIS, NIGER STATE

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Abstract
This study investigated the influence of gender and age on the mathematics achievement of secondary school students in Minna metropolis, Niger State. An ex-post-facto research design was adopted for the study. A total of 195 students in the intact-classes selected by simple random sampling from five purposively selected schools were used. The instrument used was a 50-item mathematics achievement test (MAT) developed by the researcher which was validated by four experts in the field of mathematics. The reliability coefficient of the instrument was 0.87. Two research questions were formulated and tested for the study. Means, standard deviations and Z-test statistic were used to analyze the data obtained. The findings show that (i) the performance of the male students was better than the performance of the female students (ii) there was no significant difference in the performance of younger and older male students in Minna metropolis. One of the major recommendations was that the girls should be properly encouraged by their parents and teachers from childhood in their respective schools to see mathematics as a simple subject. This can be done by acquitting the girls with objects that are mathematics inclined in order to arouse and sustain their interest in the subject at a tender age.

Introduction
There is indeed no doubt that in any society in the world, men and women, boys and girls, are assigned different roles as dictated by the culture of the people. This, therefore, shows that to a greater extent, the differences in the behaviours of males and females are mainly socially determined rather than biologically or genetically influenced. Archibong (2001) sees gender as rather, being socially oriented and, therefore, dynamic. Thus, this has led many researchers to examine gender differences right from the time measures of intellectual ability were first developed (Ong, 1981; Person and West, 1991; Callahan and Clements, 1984; Nwaneri, 1997; Bordo, 2001; UNESCO, 2003; Reid, 2003; Abiam and Odok, 2006).

Unfortunately, the school which is supposed to be an agent of socialization and reorientation, has not been able to do much in this respect but, rather, has widened the gap that exists in intellectual ability of males and females. According to Archibong (2001), even the school hierarchy and organization, norms and values reflect those aspects of the dominant culture which is masculine. The school which is supposed to be a mini- society imbibes the culture of the larger society and, therefore, relegates female child to the background.

In the same vein, Fafunwa (1990) opined that for too long, the woman has lived in the shadow of her male counterpart and this has over the centuries created a psychological complex in the minds of society which thinks the female gender is made to play a second fiddle. That gender differences seem not to surface until age ten (Callahan and Clements, 1984; Dossey, Mulis, Lindquist and Chambers, 1988) suggests that the decline of female achievement is the result of a strong pattern of socialization rather than to gender differences in innate ability.

Owing to the importance of mathematics, the Federal Ministry of Education, according to the National Policy on Education (FME, 1981) has made it to be one of the core subjects to be offered by every student from the primary to the pre-tertiary levels of education. Mathematics, as the saying goes, is the bedrock upon which scientific knowledge rests and, hence, for a modern existence, amidst the fast rate of technological advancement, a good knowledge of mathematics is inevitable. Since mathematics is a "sine qua non" for the technological development of any nation, researchers have been prompted to examine critically the issue of gender differences in performance of learners in mathematics. According to Callahan and Clements (1984) and Dossey, Mulis, Lindquist and Chambers (1988), girls' mathematics achievement in the elementary grades is equal to boys' but decreases in the middle school. Hanna (1989) found that, in some countries, girls were more successful than boys, while in others the opposite was true. She, therefore, opposed the theories that attempted to explain boys' superiority in mathematics on the basis of biological differences. In the opinion of Meyer and Koehler (1990), it appears reasonable to believe that lesser confidence or greater anxiety on the part of females is an important variable which helps to explain sex-related differences in the study of mathematics.

Since the researcher observed that the results of the studies on gender differences in mathematics are inconclusive and deficient in some important aspects such as cognitive development of the child, the researcher therefore, hoped to address this situation in the study. What then could be said to be responsible for the one-sided tendency of having more men as celebrated mathematicians than women? Could it be that the speculation that as male grow in age, there could be a low performance in mathematics is true? This speculations, if true could put the country's hope of scientific achievement in jeopardy. These situations prompted the researchers to investigate effects of gender and age on the mathematics achievement of secondary schools in Minna, Niger State.

To facilitate the investigation, two research questions were raised:
Is there any significant difference in the mathematics achievement of:
1. Male and female secondary school students in Minna metropolis?
2. Younger and older male secondary school students in Minna metropolis?

Methodology

Sample and Sampling Techniques

The population of the study was made up of twenty five senior secondary schools in Minna metropolis comprising twenty-two co-educational and three single-gender schools.
Five schools were purposively selected based on the types of senior secondary schools in the metropolis for the study; three co-educational and two single-gender schools. In each of the schools, an intact arm of the SS2 classes was selected using simple random sampling. A total number of hundred and ninety five (195) students were used. The table below shows the distribution of male and female students from the selected senior secondary schools.

S/N	Name of School	Type of School	No. of Male	No. of Female	Total
1	Federal Government College, Minna.	Federal Public Co-Educational School.	12	14	26
2	Himma International School, Minna.	Private Co-Educational School.	10	11	21
3	Day Secondary School, Tunga, Minna.	State Public Co-Educational School.	36	28	64

4	Maryam Babangida Girls' Science College, Minna.	State Public Single (Girls) School.	0	32	32
5	Government Secondary School, Minna.	State Public Single (Boys) School.	52	0	52
	Total		110	85	195

Research Instrument

The main research instrument used for the study was a researcher prepared 50 – item mathematics achievement test (MAT). The 50 – test items were multiple – choice items, each having a main stem and five options lettered A-E.

The areas covered in the mathematics achievement test were Algebra, Numbers and Numeration, and Trigonometry. In Algebra, the topics covered were algebraic simplifications, quadratic equations, quadratic graphs, factorization, substitution, and subject of the formula. In Numbers and Numeration, the topics treated were fractions, decimals, percentages and simple interest. In Trigonometry the topics treated were bearings and trigonometric ratios. Seventy (70) items were initially prepared and subjected to face and content validation by four experts; two senior lectures in the department of mathematics, Federal University of Technology, Minna and two chief education officers from two different secondary schools, also in Minna.. The result of the validation was used to select sixty questions, which were used for the pilot test in Hill-Top Secondary School, Minna. Thirty SS2 students were used for the pilot test. For items which were used for the study. The test items were built around four levels of Bloom's Taxonomy of educational objectives of learning as described in Table 2.

Table 2: Blue print reflecting levels of bloom's taxonomy and their corresponding items

S/N	Level of Cognitive Domain	Topic	Number of Items	Total
1	Knowledge	Algebra	9	
		Trigonometry,	6	
		Number and Numeration	3	18
2	Comprehension	Algebra	6	
		Trigonometry	2	
		Number and Numeration	5	13
3	Application	Algebra	7	
		Trigonometry	1	
		Number and Numeration	4	12
4	Evaluation	Algebra	4	
		Trigonometry	1	
		Number and Numeration	2	7
	Sum Total			50

The experts used criteria of ambiguity, clarity and simplicity to determine which items fitted for each level of cognitive domain used. The instrument was tested using Kuder Richardson (K-R 21) formula for reliability and the reliability coefficient yielded was 0.87, indicating a high reliability.

In each of the five purposively selected schools, arrangements were made with the Principals of the schools in collaboration with the Heads of Mathematics Department and the Mathematics teachers in the selected schools for permission and assistance to be allowed to make use of the students and their periods to administer the mathematics achievement test. MAT was administered to the students by the researchers, students answers were graded and the scores obtained were recorded and the data analysed.

Results

The data collected was analyzed using percentages, means, standard deviations and independent Z-test analysis. The significant level adopted for the statistical test was 0.05.

Research Question One

Is there any difference in the mathematics achievements of male and female secondary school students in Minna metropolis?

Table 3: Z-test comparison of mean scores of male and female students in mathematics achievement test

Variable	N	X	S.D	df	Z-Value Calculated	Z-Value Critical	P
Male	110	51.946	26.828	193	7.055*	1.66	0.001
Female	85	28.988	15.302				

*Significant at 0.05 levels

Table 3 shows the result of the Z-test comparison of the mean scores of male and female students in the mathematics achievement test. The result on the table indicates that there is significant difference in the mean scores of males (51.946) and the females (28.988) at 0.05 level of significance (Z_{cal} (7.050) > Z_{crit} (1.66), df=193, $p<0.05$). therefore, this means that there is statistical difference in the performance of male and female students in the mathematics achievement test.

Research Question Two

Is there any significant difference in the mathematics achievements of younger and older male secondary school students in Minna metropolis?

Table 4: Z-test comparison of mean scores of younger male and older male students in the mathematics achievement test

Variable	N	X	S.D	df	Z-Value Calculated	Z-Value Critical	P
Younger Male	38	55.895	26.508	108	1.23^{ns}	1.66	0.264
Older Male	72	49.861	26.945				

ns: Not Significant at 0.05 level

Table 4 shows the result of the Z-test comparison of the mean scores of younger and older male students in the mathematics achievement test. The result on the table indicates that there is no significant difference in the mean scores of younger males (55.895) and the older males (49.861) at 0.05 level of significance (Z_{cal}(1.23) < Z_{crit} (1.66), df=108, $p<0.05$). therefore, this means that there is no statistical significant difference in the performance of younger and older male students in the mathematics achievement test.

Discussion of Results

From the result of Table 3, it was found that boys performed better than the girls in the mathematics achievement test. The finding agreed with the study carried out by Faculty of Education, University of Benin (1987) on technological training in Nigeria, that the female performance is significantly lower than the performance of males in mathematical subjects at the secondary school level. The result is also supported by those studies of Michelmore (1973), Nwagwu (1977), Mills, Ablard (1993) and Leder (1992) that boys proved superior to girls in mathematics. This finding could be attributed to many factors such as strong relationship of socialization to mathematics success or failure rather than to gender differences in innate ability (Callahan and Clements, 1984); greater anxiety on the part of the female students (Meyer and Koehler, 1990), and self-defeatist attitude on the part of the females. From the point of view of the researchers, this means that the women who are engineers, doctors, etc were able to deliberately work against the enumerated factors in order to excel and be where they are today. Girls, therefore should aim at nothing else but outright success in their mathematical pursuits.

Also From the result of Table 4, it was observed that the performance of the younger male students in the MAT did not show any appreciable difference when compared with the older male students. This is to say that the level at which a male student performs in mathematics at a younger age might not likely change when he grows older. This finding is in agreement with that of Olagunju (1996) who found that there was no significant difference in the performance of boys whether they were young or old.

Conclusions

The findings of this study serve as the basis for making the following conclusions; that male students are better than female students in the branches of Mathematics (Algebra, Number and Numeration and Trigonometry) treated in the research in Minna metropolis, age is no barrier to the studying of mathematics within the age range of thirteen (13) and twenty two (22); and that gender has an effect on the performance of students in mathematics.

Recommendations

The following recommendations have been proffered based on the findings of the study:

1. Girls should be properly encouraged by their parents from childhood and teachers in their respective schools to see mathematics as a simple subject. They should also be acquainted with objects that are mathematically inclined for example, triangles, squares, circles, etc, so as to arouse the girls' interest in the subject at a tender age. This would make the girls to grow up with this interest and not depart from it.
2. Schools, in partnership with government, should reward female students who excel in mathematics with scholarship for example, the best female student in mathematics in a session. This would lead to a healthy competition among the female students.

References

Abiam, P. O. & Odok, J. K. (2006). Factors in students' achievement in different branches of secondary school mathematics. *Journal of Education and Technology. 1(1), 161-168.*

Archibong, A. (2001). *Gender sensitivity: onus for motivating girls in science and technology.* 42nd Conference Proceedings of the Science Teachers Association of Nigeria. Pg. 92-94.

Bordo, S. (2001). Selection from flight to objective. In Lederman, M. & Barrtsh, I. (Eds), *The gender and science reader*. London: Routledge.

Callahan, G. & Clements, D. H. (1984). sex differences in rote – counting ability on entry to first grade: Some observations. *Journal of Research in Mathematics Education*, *15, 378-382.*

Dossey, J. A., Mulis, I. V. S., Lindquist, M. M., & Chambers, D. L. (1988). *The mathematics report card: Are we measuring up? Trends and achievement based on the 1986 national assessment*. Princeton: Educational Testing Service.

Fafunwa, A. B. (1990). *Women: Able partners in the development processes. Women and Leadership* – NAWU Conference Proceedings.

FME (1981). *National policy on education (Revised).* Federal Ministry of Education Lagos: NERDC.

Hanna, G. (1989). Mathematics achievement of girls and boys in grade eight: Results from twenty countries. *Educational Studies in Mathematics*. *20, 225-232.*

Leder, G. C. (1992). *Mathematics and gender: Changing perspectives. Handbook of research on mathematics teaching and learning.* Edited by D. A. Grouws. New York, Macmillan: 597-622.

Meyer, M. R. & Koehler, M. S. (1990). Internal influences on gender differences in mathematics. In E. Fennema and G. Leder (eds.)*, Mathematics and gender influences on teachers and students.* New York: Teachers' College Press, pp. 60- 95.

Mills, C. J. & Ablard, K. E. (1993). Gender differences in academically talented young, students' mathematical reasoning: Patterns across age and subskills. *Journal of Educational Psychology. 85 (3), 340-346.*

Nwagwu, P. E. (1977). *Sex differences in mathematics achievement and attitudes in secondary schools (in and around Zaria)*. PGDE Thesis, ABU, Zaria, Unpublished.

Nwaneri, H. (1997). *Gender stereotypes and power equality. Girls Power Initiative. 3 (2), 10.*

Olagunju, S. O. (1996). *Sex, age and performance in mathematics*. Unpublished Thesis ICEE. University of Ibadan.

Ong, W. (1981). *Fighting for life*. Ithaca: Cornell University Press.

Pearson, J. C., & West, R. (1991). An initial investigation of the effects of gender on student questions in the classroom: Developing a descriptive Base. *Communication Education, 40, 20-32.* (EJ 419 819).

Reid, N. (2003). Gender and physics. *International Journal of Science Education, 25 (4), 509-536.*