EFFECTS OF SCHOOL TYPE ON VISUAL PERCEPTION OF GEOMETRIC SHAPES AND PERFORMANCE OF JUNIOR SECONDARY SCHOOL STUDENTS IN MINNA METROPOLIS.

By

Hassan, A. A.
Department of Science Education
Federal University of Technology, Minna.

Abstract

The study examines the effects of school type on visual perception of geometric shapes and performance in geometry in junior secondary school students. A total of 370(M=186, F=184) were drawn randomly from 13 junior secondary schools in Minna constitute the sample for the study. Two validated instruments were used in the study. The geometric perception from the environment (GPE) and Test of Geometric Achievement (TGA) with reliability for co-efficient of 0.60 and 0.67 respectively, were used to generate data. The scores of GPE and TGA according to school type were analyzed using mean, standard deviation and F-test. Two hypotheses were raised in the study. Findings from the study indicated that significance difference exist in visual perception of geometric shapes and performance in Geometry. Girls in pure Girls school performed better than boys in boy's school and mixed school. Recommendations were made based on the findings.

Introduction:

The need for mathematical knowledge continues to receive attention in today's modern world of science and information technology. This is because of its inherent usage in every aspect of our development. It is a basic requirement for day to day accomplishment of man's social economic and technological needs. Such importance justified its inclusion in the school curricula as subject in primary and secondary school levels of our education system. Adetula (1989) buttressed this point when he stated that Mathematical competence is very vital for meaningful and productive life. However, it is not enough for an individual to have mathematics knowledge but Mathematics power is what is needed to succeed in life.

Mathematical power according to Donna et al (1997) is the ability to feel comfortable in using Mathematics knowledge to solve real-life problems. Despite the importance of Mathematics to man and society at large, research reports continue to indicate that students performance is worsening as years go by Kurumeh (2006), Harbor – Peters and Iji (2005), Fajemidagba (1992) and Adegboye (1991). The decline in students' performance in Mathematics could have far reaching effects on the nation's goal of attaining science Technology and Mathematics (STM) by the year 2020.

Many reasons have been adduced for poor performance of students in Mathematics. These include, the learner, teachers, society, environmental factors and instructional strategies employed by the Teachers. Akinsola (1984) as cited in Hassan (2001). The Chief examiner's report (2005) stressed that students had problems in geometric area of Mathematics and such problems have been traced to lack of visualization and spatial skills. Development of these skills by the learner may take place through the use of two or more combinations of the senses (touch, hear, seeing, etc). According to the available literature, students find it difficult to accurately measure, construct,

draw and even re-arrange objects. These are processed involved in study of geometry. Indeed, Mathematics and spatial skills are related and both are correlate of science Achievement. Awoniyi (2001) stated that differences in spatial ability accounted for variation in educational pursuit and achievement in Mathematics tasks. Visualization skills allow human to discriminate and interpret the visible action, objects and or symbols, that they encounter in their environment similarly, it aids active reconstruction of past visual experience. Hence the presence of visual elements in today's teaching and learning is on the increase as the integration of images and visual presentation in text books, instructional manuals, classroom presentation and computer interface. It was also reported that Aristotle said without image thinking is impossible. Mariam (1993) as cited in Inekwe and Hassan (2006) asserted that, enjoyment of nature and the world around us is a function of our perceptional skills and visual perception is the primary medium through which human beings come in to contact with environment and 80% of our perceptions are visual. Similarly, the quality of the experiences that provide the child with direct contact with his environment not only provide his perception ability but serves as the first signal receive in training cognitive function such as classification, seriation, categorization etc which are the fundamentals in studying mathematics in general and geometry in particular. Geometry, the study of space and spatial relationship is an important and essential branch of Mathematics curriculum at all grades levels. The ability to apply geometric concepts is life skill used in many occupations. The study of geometry provides the learner with a vehicle for enhancing logical reasoning and deductive thinking for modeling abstract problems. For example, men has pondered about the universe and stars contained in it. It was the use of geometry that helped man develop working model of our solars system, ellipse and that path of motion of the planes about the sun.

The study of geometry helps to develop the mind in determining differences especially at early stages of our life as in games where children are made to place different shapes (squares, rectangles, circles etc) in the right positions or slots. These help the toddlers to make deductions that expand their mind and are the first exposure to Mathematics.

However, as important as geometry is to men, society and nation building, students continue to record poor performance in schools. swafford et al (1997), Fajemidgba (1992). Inekwe (1990) WAEC chief examiner's report, 2005; 2000; 1996 and 1995.

According to Benjamin (2006) and Shaaba (1995), Schools found in our societies where the formal learning of Mathematics started are categorized in to three (3) namely; the single school (boys or girls) and mixed schools (boys and girls). The single schools could be boys only while the mixed schools is made up of boys and girls. The rationales for this categorization according to shaba (1995) and Benjamin (2006) cannot be unconnected with the issues of moral decadence, enrollment explosion and proximity to the learner's community. But most importantly, gender issues has assumed an important dimension in recent times as a result of increasing awareness of the moral implications of the dangers inherent in the marginalization of women who form more than half of the world population.

Research on gender and gender related issues are inconclusive, Onyewadume (1998) found gender related difference in academic Mathematics performance. Alfa (2007) reported that most researchers found boys performing better than girls especially in high order knowledge; a few others found girls out performing boys while others established no significant differences especially during early education. Also Benson (1997) reported that the largest differences between boys and girls achievement lie on the affective domain that is attitude.

Statement of the Problem

Gender based studies show that there is inconsistency as to the nature, extent and sources of the differences in the performances of boys and girls in Mathematics. With this inconsistence findings and significant Methodological flaws observed, more empirical researches are needed to investigate the existence of gender differences in the classrooms.

Research reports on gender and visual perception and performance in Geometry seem to be promising direction for improved students performance in geometry. It is against this background that the study was initiated to investigate the effects of school type on visual perception on geometric shapes and performance in geometry.

Hypotheses:

The following hypotheses were formulated and tested at the 0.05 level of significant.

$H0_1$ There is no significant difference in the mean scores of boys schools, girls schools and mixed schools in the test on visual perception of Geometric shapes.

$H0_2$ There is no significant difference in the mean scores of boys' schools, girls' schools and mixed schools in the test on Geometric performance.

Objective of the Study:

The primary objectives of the study were to investigate the effects of school type on visual perception of geometric shapes.

1. Compare the mean performance of boys-girls and mixed schools in visual perception of geometric shapes.
2. Determine the effects of school types on performance in geometry.

Methodology:

Research design used for the study is a survey type.

Sample and Sampling

The population for the study consists of all junior secondary III students in the state owned schools in Minna metropolis. These are 13 schools with an enrollment population of 3961 students. (Niger State Ministry of Education, Statistics Section, 2000).

It is from this population that 370 junior secondary school students were randomly selected for the study. The distribution of sample by sex and school type is shown in table. 1.

Table 1: Distribution of sample by sex and school types.

School Type	Male	Feniale	Total
Boys only	64	0	64
Girls only	0	64	64
Mixed	122	120	242

Instrumentation

Two-instruments, the Geometric perception from the enrolment Test (GPE) adopted from Inekwe, (1995) and Test of Geometric Achievement (TGA) constructed by the researcher were used for the study.

The tests were validated by seasoned mathematics educators. Test of Geometric perception from the enrolment consists of 14 items. It aimed at investigating students ability to perceive geometry from the naturally endowed geometric surroundings. Each items has 3 responses that could be seen from the immediate environment. Each respondent was to identify and name the 3 geometric concepts perceived. While test of Geometric Achievement consists of two sections A and B. Section A contains a table with 5 geometric shapes. (Square, rectangle, parallelogram, Rhombus and Trapezium) of which respondent, were to supply YES or NO in five spaces for geometric properties possessed or otherwise by each of these geometrics shape. While section B consist of 18 items (multiple choice) having 4 options for each item with one correct answer.

The same scoring system used by Inekwe (1995) was adopted in the test of Geometric perception from the environment (GPE). Thus three point were awarded for each item answered correctly up to a maximum of 42 points. Also for the purpose of this study, a '1' was given to each correct response in table of section 'A' on the Test of Geometric Achievement (TGA) up to a Maximum of 25 and a '1' for correct responses is questions on section 'B' up to a Maximum of 18. Therefore, the maximum score in Test of Geometric Achievement (TGA) is (25 + 18)=43. Total score corrected to percentage for the purpose of analysis.

Reliability coefficients of 0.60 and 0.67 were obtained for GPE and TGA respectively using test-retest method after 2 weeks interval.

Data Collection and Analysis

The tests were personally administered to 370 students by the researcher with the assistance of Mathematics Teachers in the sampled schools. The two tests lasted for 3 hours with 30 minutes break in between. The test papers were marked and scored accordingly. The scores of the students were converted to % and used for data analysis.

Results and discussion

The data collected were analyzed using mean, standard deviation and F- Test.

Table 1A. Mean, Standard Deviation on GPE and TGA for school type.

School Type	N	Means (x)	S.D
Boys	64	13.06	6.47
Girls	64	15.23	3.27
Mixed	242	13.15	6.10

The finding from this results indicated that girls schools performed better than both the boy's and mixed school. The boys and mixed schools mean scores were almost the same looking at the table above. This showed that junior secondary school students differed in their visual perception skills and ability of geometric shapes depend on the school types. Boys in pure male and mixed schools performed below the girls in pure girls school while the performance of girls in mixed school was below that of girl in pure girls school. The observed significant performance among the boys and girls shows that girls in an environment on their own perform well academically. The findings agree with those of earlier researchers who posit that gender differences

in performance were neither as marked nor always in favour of boys. Also, that the differential performance observed as a result of gender difference in mathematics is possibly attributable exclusively to the community in which the students stay (Adeleke 2007 and Onyewadume 1998).

Hypotheses

$H0_1$ There is no significance difference in the mean scores of boys school, girls school and mixed schools in the test of visual perception of Geometric shapes.

F-Test was used to test the hypothesis.

Table 2 b Results of F-Test on students visual perception of Geometric shapes by school type.

Source of Variation	Sum of Square (SS)	Df	Ms	Fcal	Fcrit
Between groups within groups	233.92 12272.58	2 367	116.96 38.44	3.50*	3.02
	12506.50	269			

*Significant at x = 0.05

Table 2b reveals the performance of students in visual perception of Geometric shapes according to the school type. The F-test comparison of the mean scores revealed that, there were significant difference in the performance of students in the mean scores n the different schools. On that basis the Null hypothesis is rejected.

$H0_2$ There is no significant difference in the mean scores of boys school; girls school and mixed schools in the test on geometric achievement. F-test was used to analyse $H0_2$

Table 2c: Results of F-test on students Geometric Achievement by school type.

Source of Variation	Sum of Square (SS)	Df	Ms	Fcal	Fcrit
Between groups	622.69	2	311.35	11.21*	3.02
Within groups	10191.58	36.7	27.77		
Total	10814.27	369			

*Significant at x = 0.05

Table 2c reveals the performance of students in the test of Geometric Achievement according to school type. The F-test comparison of mean scores showed that there is significant difference in the mean scores according to school types. With Fcal (11.21)> Fcrit (3.02) at x =0.05 hence $H0_2$ hypothesis is rejected.

Discussion and Conclusion

The result of this study shows that significant difference exist in the students test of visual perception of Geometric shapes and school type and there is a significant difference in Geometric Achievement and school types among the junior secondary school students in Minna Metropolis. This seems to agree with some result findings of Grill and Judith (1994) that separating boys and

girls for Mathematics improves girls' teacher attitudes towards mathematics. The implication of this to Mathematics teacher is that separating boys and girls during geometric instruction improves the girls visual perception ability in Geometry. Furthermore, Lahey (2004) buttressed this by reporting that there are no gender differences in achievement in many schools subjects, but there are some areas in which females excel and some in which males excel and on the average female response better than males in language skill, spatial memory, perceptual speed and motor skills. This implied that there is the need for Mathematics teachers to continue to search for ways to increase girls interest and performance in mathematics and geometry in particular, and this must be given top-most priority in classroom teaching of mathematics. Sadker and sadker (2006) buttressed this and said that, many Educator's believe that students have preferred learning styles and that teaching these preferred styles will increase educational success. By logical extension, it is not all surprising that girls school out performed boys school only or mixed school. The fact that environments and culture might have contributed for this change in girls performance.

Recommendations

1. The importance of this finding lies in the statement that, Mathematics teachers should be careful not to limit girls potential in mathematics by using gender bias practices. Therefore, the teaching of geometry through visualization helps in raising girls interest and attitudes towards mathematics performance.

2. The curriculum planners/developers, text books writers should employ geometry tacks that can encourage/motivate girls to pursue the study of geometry through visualization process.

3. Parents should enrich the girls experience through visualization with tasks that are varied and challenging in geometry which help in the acquisition of visual abilities, such as in domestics work at home.

4. The selection, planning and implementation of geometry lessons by the mathematics teacher should be adequately and appropriately integrated considering the school type and cultural background of the learner.

Conclusion

The intention of this paper has been to investigate the effect of school type on visual perception of geometric shapes. Evidence provided by the result of the study indicate that it is important for the geometry teacher to notice the role school type and gender differences can play in geometry performance of his/her students. The differential performance observed in this study could possibly be explained as a result of classroom environment and cultural background of the learners

References

Adetula, L.O. (1989): Teaching and learning Mathematics at Senior Secondary School level. Nigeria Education Forum 12(1) 197-204

Adegboye, A. O. (1991) Towards an Assessment of Standards in Mathematics Education in Nigeria, Kwara State as a case study. ABACUS. 21(1). 71-91

Adeleke, M. a. (2007). Gender disparity in Mathematics Performance Revisited: can training in Problem solving Bring differences Betweens Boy and Girls? Journal of Essay in Education. 32, 1-7

Awoniyi, O. (2002). Improving Mathematics teaching in Nigerian Secondary Schools. Journal of Education; Assessment of Nigeria. 2(1) 45-47.

Alfa, Y. M . (2007 October). Gender disparity in achievement in Mathematics of Senior Secondary School Students in Bosso Local Government Area. Unpublished B.Tech project. Federal University of Technology, Minna.

Benjamin, A.A (2006 September) An investigation in to Attitude of parents towards Female Education in omale Local Government Areas of Kogi State Unpublished B.Tech Project, Federal University of Technology Minna.

Benson, P. J. (1997). Process in Picturing text. A study of visual/verbal process Solving. Technical Communication quantity, 6(2), 141-160. Retrieved on 30th August, 2007 from website Hlpll www.techjornal.org /back vol/2002/29-1/w 02-walls narch pdf.

Donna E. a. Jarry, L. A; Douglas , K. B and David R. (1997). Teaching Secondary School Mathematics. Theory of how students learn geometry. Retrieved on 30th August, 2007 from http: www.techjournal.org/backvol/2002/29/1/or 02 wells narch ref.

Fejemidagba, O. (1992). The Distribution of Lord I of the Van Hiele Model of geometric thought among JSS students in Nigeria. ABACUS. 22(1), 91-97.

Grill, A. & Judith P. (1994). Shedding some new light on old truth: Students Attitudes to school in terms of year level and Gender. Paper presented at the Annual meeting of the America Educational Research Association, Retrieved on May, 9th from website file://:D:1 math % 20 forum Bibliography %20-%20 Girls.

Inekwe I.O. (1995). Cognitive and Affective factors that affect three Geometric reasoning abilities of Senior Secondary School Students in Kaduna State. Unpublished Ph.D. Ahmadu Bello University, Zaria.

Inekwe I.O. & Hassan, A.A. (2006). Relationship Between visual perception of Geometric shapes and students' Achievement in Junior Secondary School in Minna Metropolis. Sokoto Educational Review 8(2), 130-139.

Kurumeh, M.S. (2006). Effect of Ethono Mathematics Approach on students Achievement in geometry and Mensuration ABACUS.30(1) 35-44.

Lahey, B.B (2004). Psychology: An Introduction. 8th Edition. New York. McGraw Hill Higher Education.

Minium, E. W; king, O.B & Bear, G (1993). Statistical Reasoning in psychology and Education. New York. John Wiley and Sons Inc.

Onyewadume. M. A (1998). Gender in Academic Performance of students in Senior Secondary Mathematics Examination in Edo and Delta State. ABUJER. 30(1), 30-33

Sadker, M.P. & Sadker; D.M. (2000). Teachers, Schools and Society 6th Edition. New York. McGraw Hill Company Inc.

Shaaba, A. M. (1995). Effect of Gender and School type on Student performance in Mathematics. Unpublished B.Tech Undergraduate Mathematics Education Project. Federal University of Technology, Minna.

West African Examination Council (2005; 2000; 1996 and 1995);). Chief Examiners Report.

West,) G (1997). In the mind's eye. Ambross, NY: Promotes Books, Retrieved on May 9th. From website file//D: math %20 from Bibliography %20 -% Girls % attitude 20% towards % 20 math.