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RELATIONSHIP BETWEEN VISUAL PERCEPTION OF GEOMETRIC SHAPES AND STUDENTS' ACHIEVEMENT IN JUNIOR SECONDARY SCHOOLS IN MINNA METROPOLIS.

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ABSTRACT

This study determined the relationship between Perception of Geometric shapes and Achievement of Junior Secondary in Minna Metropolis. The subjects for the study were 370 (Boys = 186; Girl = 184) from 11 purposively sampled schools. Two instruments were used for the study. Three research hypotheses were formulated and tested. The study revealed that significant relationship exists between visual perception of Geometric shapes, and achievement. And there was significant difference between the mean scores of male and females in the test of Geometric achievement and no significant gender difference in the test of visual perception of Geometric shapes at $\alpha = 0.05$. Recommendations made were directly mainly to teachers of Mathematics to teach geometry by extending students' knowledge beyond the four corners of the classroom.

Introduction

One of the goals of teaching and learning of Mathematics is to help students develop positive attitude and appreciation which will increase their initiative, curiosity, confidence and interest in learning every branch of mathematics. For the obvious reason stated above, mathematics teachers' effort must be aimed at developing both the cognitive and affective abilities of students to enable them think, remember and apply appropriately the mathematics taught / learned. One of the ways to achieve this is to develop in the student the basic mathematics skills.

According to Adetula (1989) skill is what learners should be able to do, which are characterised in terms of proficiency (accuracy) and efficiency (speed). Developing these skills may take place through the use of two or more of the senses (sense of touch, smell, hearing, taste and sight) specifically, ability to visualize and understand the world around them (visual perceptual ability). Visual perception skills enable the students to develop their ability to think, to learn and to remember. This makes students become socially and emotionally balanced

particularly in mathematics classroom. Mariam (1973) said, the enjoyment of art, of nature, and of the world around us, depends on the refinement of our perception skills while visual perception is primarily the medium through which human beings encounter their environment and 80% of our perceptions are visual. Furthermore, Mariam (1973) reported that the quality of the experiences that provide the child with direct contact with his environment not only improves his perceptual ability but also is a first step in training cognitive functions such as classification, seriation, categorization etc which is the goal of studying mathematics in general and Geometry in particular.

However, Geometry, a special branch of mathematics which can be studied through observation, description, construction of shapes, locations of point in one, two or three dimensional space has been identified as one of the difficult aspects of mathematics where students' performance has not significantly improved. (Inekwe, 1991; Fajemidagba 1992 and Iransaro 1988). Nevertheless, Geometry in the hand of a skilful mathematics teacher in junior secondary school becomes not only a valuable area of study but a fascinating one.

In a related literature, Carol et al (1999) reported that there were markedly low achievement partterns in geometry both in national and international assessment over the past decade. Nevertheless, there was significant growth in 8th grade students' achievement in number operations and measurement between 1990 and 1992 with no significant growth in geometry achievement. For this, Carol et al (1992) opined that since instruction is assumed to have an impact on the students' learning, one way to enhance achievement in geometry is for the mathematics teacher to improve his instructional practice. Similarly, Warren and English (1995) said, the study of geometry helps children to operate in their physical world. Geometric experiences help children to represent and make sense of their world, assist in the understanding of Arithmetic and problem solving competence, however this ability in students have been acknowledged by many Educators as a major issue. Thorton et al in Warren and English (1995) reported that there is an intimate relationship between many aspects of mathematics learning and ability to conceptualise plane shapes. How one acquires and applies Geometric concept and skills is of paramount concern to all educators.

In the same vein, Warren and English (1995) said ability to recognise plane shape from the environment seems to be influenced by factors the most important being the visual perceptual ability. Visual perception is the ability to form the image of an object when the object is either present or not. Furthermore, Warren and English (1995) opined that, the way a child visualizes a shape is one

of the most important factors affecting the development of spatial ability and yet many experience difficulty with this process.

Prototype phenomena and geometrical rigidity are other perceptual limitations experienced by the students. Prototype Limitation is the inability of the students to visualise a novel shape when present in a variety of contexts and orientation. Example is when an equilateral triangle is presented as a super example for the triangle concept while, geometrical rigidity is the students inability to see a diagram in a different way. Example is one might not perceive the side function of a line segment in a right triangle because it serves also as the height of the triangle.

However, gleaning from the mathematically rich environment, there is no doubt that there exists the natural model which generally characterizes learner's learning process. In this model, learners are not aware of their mental operation and procedures. Secondly, are the improvised models, which reflect the intuitive process involved in the subject matter and suitable for use by the learner at a certain developmental stage. Geometrical representations and concrete models of this kind have indeed been introduced in classes by inspired teachers and mathematics educators, yet they have been extensively studied from a theoretical point of view. For example Obioma (1991) opined that generally when school mathematics tasks in 3 - Dimensional shapes are presented with the aid of related concrete models interest of the learners in Mathematics are increased significantly in positive direction. Thus to obtain higher gain in school mathematics achievement, the related mathematics task should be presented with concrete models that permit the application of mathematics experiences.

In another investigation by Inekwe (1999), significant relationship was found to exist between students' ability to perceive geometrical concepts from the environment and their performance in geometrical reasoning. Related to that, Fajemidagba (1992) suggested that more attention should be given to the study of geometry while teachers should learn more geometry to improve upon its teaching in schools. Adetula's (1989) study reported that, in geometry students perform better in basic geometric concepts than in either knowledge of basic properties or relationships among geometric objects.

However, this paper attempts to investigate the relationship between visual perception of Geometric shape and achievement of Junior Secondary School Students in Minna Metropolis.

Statement of the problem.

Classroom experience and the researchers in addition to available literature do indicate students' general distaste for geometry. Despite the rich

geometric environment surrounding the learner, poor achievement in geometry may not be divorced from students' inability to visualize geometric shapes and figures. Besides the few studies on students' geometric understanding emphasized by Mensah (1982), Iransoro (1988) and Inekwe (1999), visual perception in particular has found little attention in reserch of Mathematics Education, while few studies in the relationship between visual perception of geometric concepts are available.

Hence the need for this investigation to empirically ascertain if visual perceptive ability of individuals do affect or influence in any way their achievement in geometry.

Hypotheses.

The following hypotheses are formulated for the study:

Ho1: There is no significant relationship between (JSSIII) students' scores in the test of Visual perception of geometric shapes and their scores in Geometric Achievement in Minna metropolis.

Ho2: There is no significant difference in the mean scores of male and female (JSSIII) Students in Minna Metropolis in the test of visual perception of Geometric shapes from the Environment.

Ho3 There is no significant difference in the mean scores of male and female (JSSIII) students in Minna Metropolis in the test of Geometric Achievement.

Purpose of the Study.

The purpose of the study is to:

1. Investigate the difficulties experienced by Junior Secondary School students in the Learning of Geometric shapes with emphasis on the relationship between Visual perception of geometry and acheivement in geometry.
2. Report the performance of Junior Secondary School students in the test of Visual perception of geometric shapes and achievement.

Significance of the study.

This study will contribute to the development of knowledge in the following ways:

1. Provide research based information on students' ability to visually perceive geometric shapes.
2. Enable teachers to provide remedial assistance to students to enhance their visual ability on geometry of the immediate surroundings.

3. Reduce teachers' attitude of skipping the geometry aspect of mathematics curriculum by enhancing their instructional practice.
4. The curriculum planners and evaluators will benefit from this study as it serves as a resource material in shifting curriculum emphasis from mere solving of geometric problems to its visualization.

Methodology

Research design used for the study is correlational.

Population.

The population for this study consists of all Junior Secondary III students from the 13 state owned secondary schools in Minna Metropolis totalling 3961 (Niger State Ministry of Education, Statistics section, 2000). 11 (Eleven) schools were purposively chosen out of 13 (Thirteen) while a random sampling technique was used to select a total sample of 370 students used for the study.

Table 1: Distribution of sample by Sex and School Type.

SCHOOL TYPE	M	F	TOTAL.
Boys only	64	0	64
Girls only	0	64	64
Mixed	122	120	242
Total	186	184	370

Instrument

Two instruments were used for the study namely- the Geometric perception from the environment Test, (GPE) adopted from Inekwe (1999) and Test of Geometric Achievement (TGA), constructed by the researchers.

Validity and Reliability of instrument

By the use of test-retest technique each instument was administered and re-administered after two weeks interval. The first scores were correlated with the second to obtain the reliability coefficient of 0.60 (GPE) and 0.67 (TGA) respectively.

Three mathematics lecturers, one from A.B.U. Zaria, two from Federal College of Education Minna and three secondary school teachers face-validated the instruments.

Administration

The tests were personally administered by one of the researchers with the assistance of mathematics teachers in the sampled schools. The two tests constituted a power test which lasted for 3 hours with 30 minutes break in between (i.e 1½ hours each).

Analysis of Data.

The data collected was analysed using the following statistical techniques, namely the mean, Standard Deviation, Pearson Products Moment Correlation and T-test, in order to statistically test the three stated null hypothesis. First, a descriptive statistics of the data is shown in table (2.0).

Table 2.0 Mean, Standard Deviation for all Respondents and Gender.

	VARIABLE	N	MEAN (X)	S.D
All Respondents	GPE	370	13.50	5.82
	TGA		20.37	5.41
Male	GPE	186	13.50	6.48
	TGA		19.58	5.72
Female	GPE	184	13.23	5.08
	TGA		21.17	4.97

Key: GPE - Geometric Perception from the Environment

TGA—Test of Geometric Achievement

Table 2.0 shows a higher mean (20.37) and lower standard deviation (5.41) in TGA, with relatively lower mean (13.50) and higher standard (5.82) in GPE. These indicate that generally students performed better in TGA than GPE. This is also reflected in the gender performances. However, lower (SD) in both tests recorded by females than males is an indication that females' scores are more closely related than those of the males.

Hypothesis 1

There is no significant relationship between students' scores in the test of Visual perception of Geometric shapes from the Environment and their scores in the test of Geometric Achievement.

Pearson Product Moment Correlation coefficient was used to test hypothesis 1.

Table 3.0: Means Standard Deviation and Pearson Moment Correlation Coefficient for all Respondents

VARIABLES	N	MEAN (X)	S.D.	Rcal	r crit	df	p
GPE	370	13.50	5.82				
TGA	370	20.37	5.41	0.506*	0.098	368	0.05

*Significant α =0.05

Table 3.0 shows that there is significant relationship between the visual perception of geometric shapes and achievement at α =0.05

Hypothesis 2

There is no significant difference between the Mean of scores of male and female Junior Secondary School students in Minna Metropolis in the test of visual perception of Geometric shapes from the environment.

Hypothesis 3

There is no significant difference between the Mean scores of Male and Female Junior Secondary Students in Minna metropolis in the test of geometric achievement.

T-test was used to analyse hypothesis 2 and 3.

Table 4.0: Mean Standard Deviation and T-value of Male and Female Students

		MALE	FEMALE	D.F	Tcal	Tcrit	P
E	MEAN	13.23	13.77	368	-0.88Ns	1.96	0.05
	S.D.	6.48	5.08				
A	MEAN	19.58	21.17	368	-2.87	1.96	0.05
	S.D.	5.72	4.97				

*significant at α =0.05

NS not Significant at α =0.05

Table 4.0 indicates that significant difference does not exist between the scores of the male and female students in the test of visual perception of geometric hapes (GPE) while significant difference exists in the mean scores of male and female students in the test of Geometric Achievement (TGA).

Discussion and Conclusion.

The result of this study shows that significant relationship exists between visual perception of geometric shapes and achievement thus, visual perception ability influences Junior Secondary School students' achievement in geometry. This agrees with earlier works of Warren and English (1992), Inekwe (1999) that ability to understand and appreciate geometry is largely determined by students' ability to visualise the shapes from immediate environment. The implication of this to mathematics teachers and students is that, mathematics teachers should pay adequate and appropriate attention to the instructional skills and practices that involve exposing students to learning Geometry from their immediate environment, since such practices can sharpen students' affective domain and eventually enhance their cognitive abilities. The researchers' articulation here is that the environment outside the four walls of the classroom is richer with geometric resources, which makes more room for students' geometric imagination, reflection and perception. On the other hand where it is not feasible to take students outside the classroom, it is possible for the teacher to improvise geometric shapes from that environment and bring to the class. Similarly, the study revealed no significant difference existing between the male and female students' scores in the test of Geometric perception from the environment [GPE]. The implication here is that gender does not in any way affect visual perception ability This finding to the researchers' view would have been contrary to expectation if more mature female students of the senior secondary schools were used as the tests of this study; since from psychological point of view they have more things to think about and may concentrate less in perceiving geometry than the junior female students who have less to think about in life. However, the significant difference observed in the test of achievement in geometry may be explained by the inconclusive claim of no difference in the academic performance of Male and Female subjects, Onyewadume (1998).

Recommendations

In view of this study's findings, the following recommendations were made. The mathematics teachers should teach the geometry aspects of the Junior

Secondary school Mathematic beyond the four corners of the classroom since visual perception reduces students' distaste and memorization strategy and enhances their understanding of geometry. Agencies, such as the government, parents and professional associations should help in raising the level of geometrical awareness from the immediate surroundings and environment.

Secondly, it is hereby recommended that teachers of Mathematics should do their best in bringing the geometric environment into the classroom through a conscious and meticulous process of improvisation. For example the concept of circle can be perceived by improvising rings, wires; spheres can be perceived from oranges, footballs, calabashes; cubes, cuboids, parallelograms from empty packets of chalk, omo; cylinders from milk cans bournvita tins and tree trunks. These can generate interest and excitement among these junior students thus enhancing geometric perception for future geometric achievement.

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