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An Investigation on Perceived Difficult Areas in Geometry Among Secondary School Student S' in Urue Offong-Oruko Local Government Area of Akwa Ibom State, Nigeria

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Abstract

This study adopted descriptive survey design to investigate perceived difficult area in geometry among secondary school students' in Urue Offong-Oruko Local Government Area of Akwa Ibom State, Nigeria.. It was guided by two research questions and two null hypotheses. A sample of there hundred (300) out of population of one thousand two hundred and thirty two (1232) SS2 students was selected from 5 public secondary schools using the simple random sampling technique and proportionate sample techniques. One instrument titled Perceived Difficult Geometry Concepts in Mathematics (PDCCM) was used for data collection. The reliability of the questionnaire established using Cronbach Alpha gives, 87. The hypothesis one was tested using population t-test while hypothesis two was tested using independent t-test both at .05 level of significance. The findings of the study revealed that the degree of geometry concepts perceived difficult by the secondary school students is significantly high and there was a significant difference in geometry concepts perceived difficult between male and female secondary school students. It therefore concluded that there is a high degree of geometry concepts perceived difficult which

	male students perceived geometry concepts more difficult than their female counterparts in public secondary schools. Based on the findings of this study, it was recommended amongst others that the identified difficult geometry concepts in mathematics by the students should be taught by using appropriate teachers' method of instruction.

Introduction

Mathematics is the indispensable tool in the study of science, humanities and technology. Thus, for a person to be able to function very well within his immediate environment, the knowledge of rudimentary mathematics is very necessary (Ibok & Unoh, 2019). The importance of mathematics to an individual and society is acknowledged worldwide (Githua, 2013). Geometry is a branch of Mathematics that deals with different figures and their parts. The content of geometry covered at the basic schools is centered around shapes or spatial attributes (Akayuure, Asiedu-Addo,, & Alebna, 2016). Geometry is among the critical subjects in the curriculum of most countries. This is because the world and its structures are composed of geometrical codes that need to be decoded to solve problems. Sudihartinih and Wahyudin (2019) defined Geometry as a branch of Mathematics which deals with the study of shapes or figures and their properties. These branches of mathematics play an important role in primary and secondary school mathematics curriculum in Nigeria. Geometry is applicable to the day to day activities of different fields and relevant employment skills. It curriculum is harshly appreciated in science, art and technology. The developments in mathematics and various progressive knowledge in the study of geometry has made us to understand that geometry deals with curves and surfaces of various dimensions and due to that there has been several branches within geometry; some of which are algebraic geometry, differential geometry, and others Geometry also addresses shapes and their associations among themselves (Amoaddai, Lawer,, & Atteh, 2020)..

In spite of the importance and application of geometry, it has been observed by researchers that lack of poor reasoning skill on geometry, geometry language comprehension, lack of visualizing abilities, teaching method, poor background knowledge, student knowledge on proofs, gender qualities, non-availability of instructional materials among others, contribute to the students perceived difficulty in learning geometry as a mathematics concepts.

Geometry is perceived to be difficult to teach and to learn because it consists of unfamiliar concepts involving complex relations. The highly conceptual nature of geometry concepts makes it particularly difficult for students to understand and learn (Ibok & Unoh, 2019). . Students have problem in comprehending geometric concepts, which is an important aspect of

learning mathematics. Student generally encountered difficulties in learning geometry concepts and performed poorly in secondary school Mathematics concepts. Most of them fail to grasp key concepts in geometry and leave math classes without learning basic terminology. The situation is not improve and the students are not committed to studying of geometry concepts and the they are not encourage to do so. Most time students have problems on the reliance physical appearances of the figures, inability to associate geometric properties with one another, overgeneralization of specific rules, and inability to comprehend geometric concepts exactly. These make them perceived geometry concepts to be difficult (Ozyildirim-Gumus, Zeybek, & Aydin, 2021). Teaching geometry with different activities to investigate the students' perceptions, attitudes and self-efficacies..

Basically, learners' views about a subject refers to learners' perception about the subject. Naidoo and Kapofu (2020) explain perception as one's understanding of our surroundings based on sensual experiences and the processes the mind goes through to understand the environment. The learners' own understanding of a situation is greatly subjective based on individual exposures. Perception toward geometry refers clearly to the mental view a person has in the teaching and learning of geometry, but attitude goes beyond one's mental view. Learners are unequal so they hold different perceptions about geometry and the perceptions they hold can shape their behaviour, understanding in learning geometry (Naidoo & Kapofu, 2020). Geometry perception may not be attributed to learners' present view, but it can also be due to previous experiences observed in learning geometry concepts or mathematics. According to Kivkovich (2015), the difficulties that students experience in geometry are related to understanding mathematical language in geometry and associating it with prior knowledge. Gloria (2015) stated that students perceived geometry as a difficult area in Mathematics because of weak concept mastery, the weak understanding of mathematical skills, and the lack of students' enthusiasm toward the studied. For instance, Ahmad., Azizan, Rahim, Jaya,, Shaipullah, and Siaw, (2017) studied relationship between mathematics perception of students and achievement and found a negative perception of learning mathematics concept among the students which related with their achievement. A study conducted by Maat and Zakaria, (2020) found high degree of perception which affected learners achievement in schools. Olofinlae, and Jimoh, (2019) study to examined the perceived difficult topics in secondary school mathematics by students as well as the mathematics teachers' views of the causes of the identified difficulties in Ikere local Government Area of Ekiti State and found that students identified and perceived some mathematics topics (longitude and latitude, bearing, mensuration) as difficult. Siagian, Singa, and Mulyono. (2019) conducted a study aims to describe the level of students' geometry thinking based on Van Hiele's thinking theory, the level of students' geometric problem solving abilities, and analyzing students' difficulties in solving geometric problems and found high difficulties experienced by the students in solving problem in geometry. Also Purba. Sinaga, Mukhtar and Surya (2017) conducted a study on the analysis of the difficulties of the Mathematical Creative Thinking Process in the Application of Problem Based Learning Model and found high difficulties experienced by the students in solving problem in geometry

Gender differences among students has been identified as one of the factors that has greatly influenced students' perception in learning Mathematics concepts (Ibok**,** .Meremikwu, & Umoh, 2020) Gender was found to have no significant influence on students' perception in learning (Gongden, Gongden and Lohdip, 2011; Charles-Ogan & George, 2015; Etoboro & Fabinu, 2017).. Unarguably, males and females in view of their biological structures are naturally different, this different could attributed to their different perception in learning geometry (Ibok, Thomas, Nyong, 2019). Fabiyi(2017) conducted a study and focused on geometry concepts in mathematics perceived difficult to learn by senior secondary school students in Ekiti State, Nigeria and found ' gender significant influence the students' perception in learning of concepts in geometry in favour of female students. Aboagye and Mante (2021) examined factors Influencing Students' Perceived Difficulties in Studying Geometry: A Case of Konogo-Odumasi, Ghana and found a difference in perceived difficulties in geometry between male-female students of the school understudy. The study conducted by Facciaroni., Gambini, and Mazza (2023) on the difficulties in geometry: A quantitative analysis based on results of mathematics competitions in Italy found a significant difference i between the perception of female and male students in learning of mathematics concepts. Ubi and Odiong (2018) examined geometry Viewed as a Difficult Mathematics and found student gender quality significantly influence the learning of geometry concepts in favour of female students. Jimoh (2010) found that students' gender have no influence on their perception of difficult topics in mathematics curriculum.

Purpose of the study

The main purpose of the study is to investigate perceived difficult area in geometry among secondary school student s' in Urue Offong-Oruko Local Government Area of Akwa Ibom State, Nigeria. Specifically, the study to examine

i) The degree of geometry concepts perceived difficult by the students
ii) The difference in geometry concepts perceived difficult between male and female secondary school students

Research questions

The following questions was raise to guide the study

i) What are the degree of geometry concepts perceived difficult by the secondary school students?
ii) What are the difference in geometry concepts perceived difficult between male and female secondary school students?

Research hypotheses

Base on the investigation, the null hypothesis was formulated and tested for the study.

i) The degree of geometry concepts perceived difficult by the secondary school students is not significantly high
ii) There is no significant difference in geometry concepts perceived difficult between male and female secondary school students.

Research methodology

The study was carry out in Urue Offong-Oruko Local Government Area of Akwa Ibom State, Nigeria. The research design used for this study was the descriptive survey design. The researchers used this design in attempt to understand the kinds of naturally occurring of variables and collect information on the geometry concepts in Mathematics perceived to be difficult. The population for the study consisted of all the 1232(511 males and 721 females) SS2 students in 5 approved public secondary schools in Urue Offong-Oruko Local Government Area of Akwa Ibom State, Nigeria.. The sampling techniques adopted for this study were simple random sampling technique and proportionate sampling technique. . This technique was considered appropriate because every learner of all the five (5) secondary schools had an equal chance of being selected for the study. To select the schools for the study, the researcher using all the five (5) schools in the study areas From the 5 schools, the researchers again adopted the hat and draw method of sampling where "Yes" and "No" were written on pieces of paper and learners were asked to pick. The basket was shaken together with the paper balls and each students was asked to choose without replacement. Those who picked the paper balls with "Yes" tags were given a copy of the questionnaire to fill. A sample of 300(124 males and 176 females) SS2 students were selected representing 24.4% of the entire population of SS2 students in the study area. Proportionate was used to ensure that 24.4 % of the students in each schools were selected for the study.

A researcher developed checklist in form of questionnaire for the perceived difficult geometry concepts in mathematics consist of two different sections, section A contained of respondents personal information, such as gender while section B contained 4 areas each contain four sub-topics in geometry collected from Senior Secondary Mathematics Curriculum from which the students were to identify difficult concept perceived to learn.

The four area considered are plane geometry(angle and line, theorems on triangles, similar triangles, Congruent triangles), circle(polygon, quadrilateral, circle theorem, construction and line), mensuration (Length, area and perimeter of plane figure, surface area of solid figure, volume and solid figure, longitude and latitude) and trigonometry (Pythagoras theorem and sine, cosine and tangent of right angled triangle, angle of elevation and depression, graphs of sine, cosine function).

The four (4) alternative responsive include, very difficult, difficult moderately, difficult and not difficult. The two kinds of validation established for the instrument of the study were face

and content validity. The face and content validity were established by using three (3) experts in Test, Measurement and Evaluation; in the faculty of Education, University of Calabar. The expert certified that the instrument was face and content valid and could be used for the study. Reliability was established through Cronbach alpha reliability of the instrument (questionnaire), a trial testing was done using forty (40) students with Cronbach alpha reliability was conducted and the internal consistency of .87 showed that the research instrument was reliable. The hypotheses formulated to guide the study were appropriately tested using population t-test for hypothesis one and independent t-test for hypothesis two

Presentation of results

The result of the analysis is presented in the table 1 &2. The hypotheses were tested at .05 significance level.

Ho_1: The degree of geometry concepts perceived difficult by the secondary school students is not significantly high.

For the geometry concepts perceived difficult by the secondary school students to be significantly high, the score on each area in geometry concept should be significantly greater than 10.00(2.50 of each item multiply by 4 such topics in identified geometry area) of which is the expected average for each of the identified area in geometry and the overall four area of 40.00. This hypothesis was tested with a test of one sample mean (population t-test). The result is presented in table 1

Table 1: Population t -test analysis of the degree of geometry concepts perceived difficult by the secondary school students (N=300)
Expected mean=10.00

Sub-variables	Observed mean	Mean error	SD	Df	t-value	p-value
Plane geometry	13.7267	0.08311	1.4395	299	44.840*	.000
Circle geometry	13.9367	0.08445	1.4528	299	46.613*	.000
Mensuration	13.9300	0.09165	1.5875	299	42.878*	.000
Trigonometry	14.0133	0.10258	1.7768	299	39.123*	.000
Overall concepts	55.6067	0.24302	4.2092	299	64.220*	.000

*Significant at the .05 level,

The information in table 1 also revealed the computation of t-value of the degree of geometry concepts perceived difficult by the secondary school students , in term of plane geometry (t=44.840; p=.000), circle geometry (t=46.613; p=.000), mensuration (t=42.878; p=.000), trigonometry (t=39,123; p=.000), and overall concepts (t=64.220; p=.000), are all significantly high at the 0.05 level of significance. With this result, the null hypothesis was

rejected. This mean that the degree of geometry concepts perceived difficult by the secondary school students are significantly high

H_{O2}: There is no significant difference in geometry concepts perceived difficult between male and female secondary school students.

The independent variable in this hypothesis is gender while the dependent variable is geometry concepts perceived difficult. In testing this hypothesis, the mean scores of the male response on geometry concepts perceived difficult for the four (4) sub-topic in area and overall mean for the four areas were computed and compared with the mean scores of the female students. The results are presented on table 2.

Table 2: Results of independent t - test analysis of the significant difference in geometry concepts perceived difficult between male and female secondary school students (N=300)

Variables	Group	N	Mean	SD	t-value	p-value
Plane geometry	Male	124	14.5565	1.4102	9.565*	.000
	Female	176	13.1420	1.1451		
	Total	300	13.7267	1.4395		
Circle geometry	Male	124	14.4758	1.5167	5.626*	.002
	Female	176	13.5568	1.2993		
	Total	300	13.9367	1.4528		
Mensuration	Male	124	14.7339	1.3858	8.122*	.000
	Female	176	13.3636	1.4750		
	Total	300	13.9300	1.5875		
Trigonometry	Male	124	14.9516	1.2419	8.554*	.000
	Female	176	13.3523	1.8018		
	Total	300	14.0133	1.7768		
Overall concepts	Male	124	58.7177	2.8386	13.692*	.000
	Female	176	53.4148	3.5942		
	Total	300	55.6067	4.2099		

*Significant at the .05 level, df =298

The result presented on Table 2 shows that male students in secondary schools significant difference in geometry concepts perceived difficult from their female counterparts in term of plane geometry (t=9.565; p=.000), circle geometry(t=5.656; p=.002), mensuration (t=8.122; p=.000), trigonometry (t=8.554; p=.000), and overall geometry concepts

(t=13.692; p=.000) are all significantly at the 0.05 level of significance. With this result, the null hypothesis was rejected . Hence, there is a significant difference in geometry concepts perceived difficult between male and female secondary school students.

Discussion of the findings

The result of the first hypothesis revealed that the degree of geometry concepts perceived difficult by the secondary school students is significantly high. The finding agreed with Ozyildirim-Gumus, Zeybek, and Aydin, (2021) who stated that most time students have problems on the learning geometry concepts which make them perceived geometry concepts to be difficult. The finding agreed with Naidoo and Kapofu (2020) who opined that learners are unequal so they hold different perceptions about geometry and the perceptions they hold affected their understanding in learning geometry. The finding is in line with Ahmad., Azizan, Rahim, Jaya,, Shaipullah, and Siaw, (2017) who found a high negative perception of learning mathematics concept among the students . The finding is in consonance with a study conducted by Maat and Zakaria, (2020) who found high degree of perception which affected learners achievement in schools. The finding agreed with Olofinlae, and Jimoh, (2019) who found that students identified and perceived some mathematics topics difficult. The finding is in line with Siagian, Singa, and Mulyono. (2019) who found high difficulties experienced by the students in solving problem in geometry.

The result of the second hypothesis revealed that there is a significant difference in geometry concepts perceived difficult between male and female secondary school students.
The finding contradicted to the finding of (Gongden, Gongden and Lohdip, 2011; Charles-Ogan & George, 2015; Etoboro & Fabinu, 2017) who found no significant influence of gender on students' perception in learning The finding agreed with Fabiyi(2017) who found ' gender significant influence the students' perception in learning of concepts in geometry. The finding also agreed with Aboagye and Mante (2021) who found a difference in perceived difficulties in geometry between male-female students of the school understudy. The finding supported the conducted conducted by Facciaroni., Gambini, and Mazza, (2023) who found a significant difference i between the perception of female and male students in learning of mathematics concepts. Also the finding agreed with Ubi and Odiong (2018) who found student gender quality significantly influence the learning of geometry concepts .

Conclusion

Based on the results of this study, it was concluded that, the degree of geometry concepts perceived difficult by the secondary school students is significantly high and there is a significant difference in geometry concepts perceived difficult between male and female secondary school students. This implies that male students perceived geometry concepts more difficult than their female counterparts in public secondary schools. However, students perceived geometry concept more difficult in spite of the importance of the concepts in

the school curriculum. In conclusion, the students' gender and perception are essential and importance factors that should be considered in teaching and learning geometry concepts in secondary schools.

Recommendations

Based on these findings, the following recommendations are considered appropriate:

1. The identified difficult geometry concepts in mathematics by the students should be taught by using appropriate teachers' method of instruction.
2. School authorities should allocate sufficient time for mathematics especially geometry concepts that students perceived difficult to learn.
3. Since male and female students differ in their perception of difficult area in geometry concepts in public secondary schools, it is recommended that Mathematics teaching and evaluation strategies should be free of gender bias. This will make males and females to see themselves as equal, capable of competing and collaborating in school activities.

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