

Effects of Explicit Strategies on Geometry Achievement of Orthopaedics Impaired Students in Senior Secondary Schools, Oyo State

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ABSTRACT: Mathematics teachers in secondary schools sometimes neglect orthopaedic impaired students during the teaching and learning process. This study examined the effect of Explicit Strategies on Orthopaedic Impairment Students Achievement in Geometry in Senior Secondary Schools Oyo State. The study employed pre-test, posttest, control group quasi experimental design. The population consists of all students' with orthopaedic impairment in special schools in Oyo State. Intact class of twenty-five (25) SSII students' were used for the study . Instruments used were Students Mathematics Anxiety Rating Scale (SMARS) ($r=0.85$) Geometry Achievement Test for Students' (GATS) ($KR 20 = 0.97$), Geometry Lesson Plan (GLP) and Geometry Lesson Notes (GLN). Three hypotheses were postulated and tested. Data were analyzed using ANCOVA. The results revealed significant main effect of treatment on students' achievement in geometry with orthopaedic impairment ($F_{(2, 23)} = 12.94$; $p < 0.05$, partial $\eta^2 = 0.65$). There was no significant main effect of gender on students' with orthopaedic impairment achievement in geometry ($F_{(1, 24)} = .026$; $p > .05$, partial $\eta^2 = .002$). Also it was revealed that there was a significant main effect of mathematics anxiety on orthopaedic impairment students' achievement in geometry. ($F_{(1, 24)} = 5.164$; $p < .05$, partial $\eta^2 = .629$). It was concluded that treatment have no effect on gender and anxiety on students' with orthopaedic impairment academic achievement. It was suggested that same-age peer tutoring and guided explicit strategies should be employed to enhance orthopaedics impairment students achievement in geometry.

KEYWORDS: Orthopedic Impairment, Same-Age Peer Tutoring, Guided Explicit Strategy.

1. INTRODUCTION

Mathematics is a subject that study number patterns, measurement and number theories. It form basis for science and technology with many branches such as algebra, geometry, calculus, statistics, real analysis, complex analysis, mathematical modeling and topology (Ayeni, 2012). Olunloyo, (2010). Sees mathematics as a gatekeeper and air bag of intelligence, a pillar on which each discipline and source of enlightenment to human critical thinking lies. As important as mathematics to human development, students' have phobia for the subject and this had led to the mass failure during internal and external examination. The mass failure recorded in mathematics every year among our secondary schools students had become threat and this can affects advancement of science and technology in Nigeria. Our engineering sector was badly affected because most students did not understand basic concept of geometry which form the basis for engineering.

However, geometry as a branch of mathematics analyzed the process of problem solving, how to solve the problems and to construct logical proposition or assumption by which ideas and concepts are conveyed (Malik, 2017). Geometry according to Saidu, (2018) is not limited to science; it also encompasses all fields of study and affects all human endeavour such as agricultural and engineering. He further stated that as a branch of mathematics, geometrical concept enhances students' logical thinking, problem solving skills, conjecturing, deductive reasoning, logical argument and proof. The achievement of engineers in the construction of houses, bridges, roads, railways, seaport and airport is centered on the principles and ideas derived from geometry (Tenty, & Awe, 2015).

Sambo, (2015) opined that geometry enables students to think logically, critically and develop their creativity skills. The concepts of geometry form the basis for science and technology. A nation can only be self-reliant if she makes science and technology a priority. But it was observed that students failed the aspect of geometry as it was shown in 2017, 2018 and 2020 WAEC reports (Pasha, 2015).

Orthopaedic impairment students are students on wheelchair; students on crutches and students with amputated arms or legs. These categories of students have challenges that affect their psychomotor domain which in turn made them unable to hold pen and write extensively in the classroom and during the period of examination; this predicament faced by orthopaedic impairment students discouraged them to grasp the geometrical concepts, numerical facts, and procedures during teaching and learning process (Mangan, 2015). Orthopaedic impairment students failed geometry because of their inadequate concentration during teaching and learning process, they find it difficult to recall, identify and reorganize geometrical concepts in the instruction given during the lesson. Orthopaedic impairment students see geometry as a difficult concept and as a result they abandon mathematics class.

Students' performance can be improved if appropriate teaching strategies were employed. Teaching strategies are very vital in enhancing students' interest and skills in problem solving, it makes instruction meaningful and makes teaching and learning effective (Anibueze, 2017). For instruction to be effective the lesson should be planned ahead of time and have all necessary material and equipment needed for the lesson. Explicit instructional techniques enable teachers to relate approach with concepts which judiciously give the desired learning outcome. Students with orthopaedic impairment can benefit if this teaching strategy can be employed to teach geometry. Explicit instructional techniques have processes that enhance students' comprehension during teaching and learning (Rodriguez, Scheeler, Winn, & Ziegler 2017). Smith, Sáez, & Doabler, (2016) opined that explicit instructional technique enables mathematics teachers to explain the concepts by examples and demonstrate to the learners how problems can be solved. This technique had addressed the needs of orthopaedic impairment students' in United States of America.

Nevertheless, it was observed that male orthopaedic impaired students perform better than female orthopaedic impaired students in mathematics (Ahmad, Shabamaliki, & Alhassan, 2020). The low achievement of orthopaedic impaired students in mathematics is based mainly on discrimination and gender disparity. Furthermore, cognitive or

intelligence determine the achievement on gender. While some believe and concluded that females are intellectually inferior, others said that females and males are equally intellectually capable. The notion that gender differences increase is high in secondary school level favour male students. Boys often score higher in mathematics tests than girls. Male students are good at problem-solving than females.

Moreover, anxiety has been linked with academic achievement of students with orthopaedic impairment. Anxiety is a panic and mental disorganization exhibited by students when solving problems (Isa, 2017). Anxiety is often detrimental and debilitating to academic achievement of students with orthopaedic impairment. Etsu, & Manko (2019) opined that teachers approach to teaching and learning of geometry is found to play a major part in gender disparity. However, the adoption of guided explicit instruction facilitates learning and improve the performance of orthopaedic impaired students in mathematics if well utilized and this will go a long way in reducing mathematics anxiety in them. Teachers' adoption of guided explicit strategy enable teacher's to stabilized his/ her lesson and to make proper evaluation of the students taught. The future of Nigeria is at stake if the failure rate of students in geometry is not reduced or eradicated. The problem confronting orthopaedics impairment students in geometry were solved by same-age peer tutoring and guided explicit teaching strategy in United State of America many years back (Owan & Robert 2019). Since this problem had been solved outside Nigeria however, the study want to examine whether guided explicit teaching strategy can be used to solve the same problem confronting orthopaedics impaired students' in Oyo State.

2. STATEMENT OF THE PROBLEM

The challenges of orthopaedic impaired students contribute to their poor performance during internal and external examinations. Although, several studies revealed that orthopaedic impairment students in other advanced countries learned under conducive environment but reverse is the case in Nigeria. Orthopaedic impaired students were learning under hardship and frustrating condition such as hatred on the part of teachers; discrimination among colleagues and inability to blend with classroom situation. This prompts the researcher to look into the factors that lead to non performance of orthopaedic impairment students in geometry. Before learning can take place, learners must be able to write legibly. Majority of orthopaedic impairment students writing are not legible enough to read, the examiners find it difficult to read what they put down on their examination scripts and this affects their performance in geometry. Also, students on wheelchairs and students using crutches are restricted to some extent that they cannot access in the classroom. Orthopaedic impairment students find it difficult to perform due to stigmatization and the discrimination faced from their colleagues and teachers during the teaching and learning process. More so, mathematics teachers see them as a threat to their teaching profession as a result these students prefer avoiding mathematics class which in turn affects their performance in geometry.

3. HYPOTHESES

The following null hypotheses were postulated and tested at a 0.05 level of significance.

H₀1: There will be no significant main effect of treatment (Guided Explicit and Conventional Strategy) on geometry achievement of orthopaedics impairment students.

H₀2: There will be no significant main effect of gender on orthopaedics impairment students' achievement in geometry.

H₀3: There will be no significant main effect of mathematics anxiety on orthopaedics impairment students' achievement in geometry.

4. SIGNIFICANCE OF THE STUDY

The study is expected to enable mathematics teachers to adopt an appropriate method to teach geometrical concept to on orthopaedics impairment students. This study will also enable teachers work towards the achievements of students with orthopaedic impairment in geometry. It will also enhance teachers' creativity and competencies to design teaching strategies that will enable orthopaedics impairment students to learn mathematics easily.

5. SCOPE OF THE STUDY

This study was limited to the effectiveness of guided explicit (GES) strategies on the achievement of students with orthopaedic impairment in geometry. The study is limited to students with orthopaedic impairment in Senior Secondary School II in Oyo state. Ijokodo High School Sango Ibadan and Durbar Grammar School Oyo was used as a control.

6. METHODOLOGY

The study adopted the pretest, posttest control group quasi-experimental research design. The study employed one experimental groups and one control group; the experimental groups was first exposed pretest using geometry achievement test to ascertain students pre knowledge on concept and after teaching the group with explicit strategy posttest was given, while the control group was exposed to the conventional strategy. The total population for the study was twenty-five senior secondary school students in SSII with orthopaedic impairment in Oyo State. Fifteen respondents with orthopaedic impairment were selected from Ijokodo High School Ibadan as experimental group. And ten (10) students in Durbar Grammar School was selected as control group. The respondents used for the study comprised male and female students with Orthopaedic impairment in the two schools.

The sampling procedure used is purposive sampling techniques because all orthopaedics impairment students in these schools were allowed to participate in the experiment. The instruments that were used to collect data are: Students Mathematics Anxiety Rating Scale (SMARS); Geometry Lesson Plan (GLP); Geometry Lesson Notes (GLN) and Geometry Achievement Test for Students (GATS). The instruments were validated under content, construct, and face validity. The reliability of the Mathematics Anxiety Rating Scale, Cronbach's Alpha was used. The reliability coefficient obtained was $r = 0.85$. To ensure its reliability using Kuder Richardson Formular (KR20).

The reliability coefficient of $r=0.97$ was obtained. The data collected were analysed using inferential statistics of Analysis of Covariance (ANCOVA).

7. RESULTS AND DISCUSSION OF FINDINGS

The results and discussion of findings were presented based on the respondents’ demographic data analysis, hypotheses and discussion of findings.

7.1 Testing of Hypotheses

H₀₁: There will be no significant main effect of treatment (Guided Explicit and Conventional Strategy) on orthopaedic impairment students achievement in geometry.

Table 1: Analysis of Covariance (ANCOVA) showing main effect of treatment on students with orthopaedic impairment achievement in geometry.

Source	Type III Sum of Square	Df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	292.141	10	29.214	5.692	.002	.803
Intercept	115.197	1	115.197	22.443	.000	.616
Pre achievement	94.941	1	94.941	18.497	.001	.569
Treatment	312.796	2	66.398	12.936	.001	.649
Gender	.132	1	.132	.026	.875	.002
Mathematics Anxiety	26.504	1	26.506	5.164	.039	.629
Treatment x Gender	1.182	2	.591	.115	.892	.016
Error	71.859	14	5.133			.000
Total Corrected	24080.000	25				
Total	364.000	24				

R. Squared = .80 (Adjusted R Squared = .66) Denotes significant $p < .05$ (Source: *Fieldwork, 2022*)

Table above revealed that there was a significant main effect of treatment on students’ with orthopaedic impairment achievement in geometry ($F_{(2, 23)} = 12.936$; $p < 0.05$, partial $\eta^2 = 0.649$). The indicated effect size means that 65.0% of the total 66.0% variation observed (Adjusted $R^2 = .66$) in students’ with orthopaedic impairment post-achievement scores in geometry in this ANCOVA model was due to the treatment. Therefore, hypothesis 1 was rejected implying a significant effect of treatment on orthopaedic impairment students achievement in geometry.

H₀₂: There will be no significant main effect of gender on orthopaedics impairment students’ achievement in geometry.

The table also showed that there was no significant main effect of gender on students' with orthopaedic impairment achievement in geometry ($F_{(1, 24)} = .026$; $p > .05$, partial $\eta^2 = .002$). Therefore, hypothesis 2 was upheld. This means that gender had no effect on students' with orthopaedic impairment achievement in geometry.

H₀₃: There will be no significant main effect of mathematics anxiety on orthopaedic impairment students' achievement in geometry.

Table 1 indicated that there was a significant main effect of mathematics anxiety on orthopaedic impairment students' achievement in geometry. ($F_{(1, 24)} = 5.164$; $p < .05$, partial $\eta^2 = .629$). Hence, hypothesis 3 was rejected. This means that mathematics anxiety had effect on students' achievement in geometry. The table also revealed that 62.9% of the variation in students' with orthopaedic impairment post-achievement scores in geometry was caused by main effect of mathematics anxiety.

7.2 Discussion of Findings

The finding of this study revealed the effectiveness of the guided explicit strategy over conventional strategy. It was revealed that students taught by guided explicit Strategy (GES) treatment group 2 had the highest adjusted mean score in their post-achievement in geometry than the Conventional Strategy (CS) control group. This finding agreed with a study who revealed that students taught with explicit strategies acquired problem-solving skills in mathematics (Schwab, 2018). This finding contradicts a study of Campbell. A. (2019) that maintained that there was significant effect of explicit strategy on students' achievement in mathematics. The contradiction might be due to disparity in the socio-cultural environment and an inclusive classroom setting.

Moreover, the result of this finding supported the findings of Sinnes, (2006) that reported that gender difference does not affect students' achievement in learning. The finding is also in agreement with the findings of Scada, Jacobs, Becker & Glimer (2015) that revealed that male students perform better than female students in mathematics.

This finding also revealed that there was a significant main effect of mathematics anxiety on orthopaedic impairment students' achievement in geometry. Students had the highest adjusted mean score in their post-achievement in geometry (30.48) and those with high mathematics anxiety had (29.02). This order is represented Low > High. The result obtained in this study agree with the findings of Ching, (2017) that reported that the level of anxiety exhibited was related to the score obtained in a standardized Mathematics test (the high the anxiety level the less the score obtained. This finding contradicts the observation of Gunderson, Park, Maloney, Beilock, & Levine, (2018) that said there is no significant difference between mathematics Anxiety and Mathematics performance. He further stated that the performance of college students and those three variables (mathematics anxiety, study habits and locus of control) positively correlate with, and significantly predict academic performance.

8. CONCLUSION

This study determined the effects of Guided Explicit Strategy are used by the teacher to teach them. In addition, when Students with Orthopaedic Impairment are exposed to either of these teaching strategies to pass instruction during the teaching and learning process, it will in turn enable them to improve and have remarkable academic achievement in Geometry.

9. RECOMMENDATIONS

The following recommendations are made based on the findings:

- i. To improve Students with Orthopaedic Impairment achievement in Geometry, guided explicit strategies should be adopted by Mathematics teachers.
- ii. Mathematics teachers should ensure that they achieve positive outcome when using either guided explicit strategy or conventional strategy.
- iii. Teacher should ensure that students with orthopaedic impairment are carried along during teaching and learning process irrespective of their sex to improve their performance in Geometry.

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