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**EFFECT OF INQUIRY-BASED TEACHING STRATEGY ON JUNIOR
SECONDARY SCHOOL STUDENTS` PERFORMANCE IN MATHEMATICS IN
ODOGBOLU LOCAL GOVERNMENT AREA OF OGUN STATE**

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Abstract

The study investigated the effect of inquiry-based teaching strategy on junior secondary school students` performance in mathematics in Odogbolu Local Government Area of Ogun State. The study employed a pre-test, post-test, and non-random control group quasi-experimental research design. 100 (52 male and 48 female) junior secondary school students were the sample for the study, and three hypotheses were posted. A 20-item Mathematics Performance Test (MPT) was used to gather data. Data collected were analyzed using descriptive statistics such as mean, and standard deviation while inferential analysis of Analysis of Covariance (ANCOVA) at 0.05 level of significance. The results revealed that there was a significant effect of inquiry-based teaching strategy on students` academic performance in mathematics, no significant main effect of gender, and also no two-way interaction effect on the students` scores in mathematics. Based on these findings, the study recommended among others that there was a need for mathematics teachers to approach the teaching of mathematics with more innovative approaches such as Inquiry-Based Strategy to develop students` performance in the subject.

Keywords: *Inquiry-based teaching strategy, Junior secondary school, Performance in mathematics, Ogun State*

Introduction

Mathematics as a subject has its influence on all aspects of human life and the social, economic, scientific, and technological aspects of a nation are centered on it. According to the Federal Republic of Nigeria

in the National Policy on Education (FRN, 2014), mathematics education should, among other subjects, provide a solid foundation for everyday living as well as stimulate and encourage creativity. Considering the importance of mathematics, it was made a compulsory subject from primary school to the secondary level and a prerequisite to gain admission to any Nigerian Tertiary institution.

Regrettably, despite the importance and usefulness of mathematics as a key subject in achieving any national scientific and technological aspiration, the majority of Nigerian students generally dread the subject. Most of them consider mathematics difficult, complex and abstract. Many students find it difficult to see the applicability of the subject to their daily activities and the world around them and wonder why they are bothered by such a subject. Thus, the teaching and learning of mathematics have been problematic in the school (Lassa, 2012). Tella (2007) cited in Badru (2017), attributed the students' negative attitude towards mathematics to the too-dumb and bad teaching of mathematics going on in our classrooms.

Oyedeji (2000) submitted that one of the problems with mathematics education in Nigeria is the poor teaching of the subject. He stated that this poor teaching method has made many students dislike the subject, find simple mathematics concepts difficult, and are frustrated by mathematics lessons. Research has shown that in many Nigerian schools, active children's participation is rarely encountered in the classroom. According to Ezeugo and Agwagah (2001), Hassan (2000), and Amoo and Rahman (2004), cited in Badru (2017), much of mathematics today still follows the traditional pattern. This traditional pattern of teaching has been identified as one major factor responsible for the poor performance of students in mathematics. This assertion was corroborated by Adeagbo (2001) and Alio (2001), who reported in Badru (2017) that the approaches used by mathematics teachers have not allowed the students to develop their intuition, imagination, and creative abilities.

To overcome various identified challenges, the teaching of mathematics requires innovations and the use of professional skills and competencies for effective and reliable results (Badru, 2017). Thus, mathematics teachers need a new paradigm. This new paradigm needs to emphasize learners as human beings who have the potential to learn and develop. Through the new paradigm in the classroom, students will

be active in learning, discussing, conveying ideas, accepting other ideas, and finding the appropriate solution to any problems they encounter with high confidence. To improve the quality of education, particularly to enhance students' mastery of mathematics, there is a need to find methods and techniques to make learning more meaningful and improve students' achievement. In light of this, the study focused on the effect of inquiry-based teaching strategies on students' performance in mathematics.

Inquiry-based learning is defined as an approach to teaching and learning that places students' questions, ideas and observations at the centre of the learning experience (Friesen and Scott, 2013). The inquiry approach is more focused on using learning content as a means to develop information-processing and problem-solving skills. The system is more student-centred, with the teacher as a facilitator of learning. There is more emphasis on "how we come to know" and less on "what we know." Students are more involved in the construction of knowledge through active involvement. The more interested and engaged students are in a subject or project, the easier it will be for them to construct in-depth knowledge of it. Learning becomes almost effortless when something fascinates students and reflects their interests and goals. Inquiry-based learning is defined as an approach to teaching and learning that places students' questions, ideas, and observations at the centre of the learning experience (Friesen and Scott, 2013).

Gender is one of the other factors mentioned in the literature that has a significant effect on students' academic performances, especially in science subjects. Gender is the range of physical, biological, mental and behavioral characteristics of and differentiating between the feminine and masculine (female and male) population Adigun *et al.*(2015). The importance of examining performance by gender is based primarily on the socio-cultural differences between girls and boys. Some vocations and professions have been regarded as men's (engineering, arts and crafts, agriculture, etc.), while others are women's (catering, typing, nursing, etc.). Parents assign tasks like car washing, grass cutting, bulb fixing, climbing ladders to fix or remove things, etc. to the boys.

On the other hand, chores like dishwashing, cooking, cleaning, sweeping, and so on are assigned to the girls. In a nutshell, what is

regarded as complex and difficult tasks are assigned to boys, whereas girls are expected to handle relatively easy and less demanding tasks. As a result of this way of thinking, the larger society has tended to see girls as weaker sexes. Consequently, an average Nigerian girl goes to school with these fixed stereotypes. Because of the belief that students' gender may have an impact on their performance, this study, therefore, investigates the effect of inquiry-based teaching strategies on students' achievement in mathematics in the Odogbolu Local Government Area of Ogun State

Statement of the Problem

The persistent students' failure in mathematics in certificate examinations such as WAEC and NECO over the years has made mathematics educators show concern about how to improve the teaching and learning of the subject. Previous researchers have identified the problems of teaching and learning mathematics, particularly at the junior secondary school level, as well as the difficulties teachers face in the selection of teaching and learning strategies in other subjects. Little has been done in the area of mathematics, particularly at the junior secondary school level.

Thus, the need for this study was designed to investigate the effect of inquiry-based teaching strategies on students' achievement in mathematics in the Odogbolu Local Government Area of Ogun State.

Hypotheses

The following hypotheses were formulated and tested at a 0.05 level of significance:

Ho1: There is no significant main effect of treatment on students' achievement in mathematics.

Ho2: There is no significant main effect of gender on students' achievement in mathematics. ::

Ho3: There is no significant two-way interaction effect of treatment and gender on students' achievement in mathematics.

Methodology

This study adopted a quasi-experimental design. Specifically, the study had a non-equivalent control group design. The design is presented diagrammatically, as shown below.

N O1 X O2
N O1 O2

Where O1 means before treatment

O2 means after treatment

X means treatment

A sample of 100 JSS Two students, made up of 52 males and 48 females, participated in the study. A purposeful sampling technique was employed to sample two (2) co-educational schools from the Odogbolu local government area of Ogun State. Out of the two schools selected, one was randomly assigned to the experimental group, and the other was assigned to the control group. In each school, an intact class was drawn through a simple random sampling technique. The experimental group was taught using the inquiry-based method, while the control group was taught with the use of the conventional method.

The instrument used for data collection was the Mathematics Performance Test (MPT). The MPT consisted of two sections: section A sought demographic data of the respondents which included the name of schools, Age, Gender, etc. Section B was made up of a list of four multiple-choice items. An initial pool of forty (40) questions was drawn to cover JSS II mathematics topics taught in the school. The items were from past questions of the Junior School Certificate Examination that corresponded with the topics covered by the researcher. To determine the content and face validity of the instrument, the test items were given to two other experts in the field of study to ensure that the questions were error-free and measured what they were supposed to measure before final administration. Their suggestions were used to correct the test items, which were then trial-tested on JSS II students from Omu - Ajose Comprehensive High School, Omu - Ijebu, this is because the school was not part of the study but shared the same characteristics with the selected schools. From the responses collected, discriminating and difficulty indices were calculated and used to remove items adjudged inadequate, resulting in 20 items. Split-half coefficients were calculated, and a reliability coefficient of 0.79 was realized.

Data Analysis

Data analysis in this study involved the use of both descriptive and inferential statistics. Mean and standard deviation scores are the descriptive statistics used to show estimates of the pre-test and post-test scores in achievement in mathematics according to the different levels of independence and moderator variables (instructional strategies and gender). The three hypotheses formulated were tested using the Univariate Analysis of Covariance (ANCOVA), with pre-test scores serving as covariates at a 0.05 level of significance.

Experiment

The Inquiry-Based: The teaching strategy was used to teach the participants in the experimental group, while the conventional approach (the chalk and talk strategy) was used in the control group. Mathematics teachers were used as research assistants in experiments. At the onset of the experiment, a pre-test was administered to both the experimental and control groups. The experiment was carried out during normal school hours using the school timetable. At the end of the experiment, which lasted for four weeks, a post-test was administered to the students in both the experimental and control groups. The results collected are used to answer the tested hypotheses.

Results

Table 1: Summary of Analysis of Covariance of Students' Performance in Mathematics According to Treatment and Gender

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	815.707a	4	203.927	30.915	.000
Intercept	962.746	1	962.746	145.951	.000
Pre-Test	47.951	1	47.951	7.269	.008
Treatment	736.628	1	736.628	111.672	.000*
Gender	.028	1	.028	.004	.948
Gender x Treatment	9.511	1	9.511	1.442	.233
Error	626.653	95	6.596		
Total	19452.000	100			
Corrected Total	1442.360	99			

* Indicate significant F at .05 level R Squared = .566 (Adjusted R Squared = .547)

Table 1 presents the summary of the Analysis of Covariance (ANCOVA) test on the effect of treatment and gender on the students' achievement scores in mathematics. Table 1 showed the outcome of the main and interaction effects of the two levels of instructional strategy (Inquiry-Based Method (IBM) and Conventional Method (CMT) used in the study) and two levels of gender (male and female) on students' achievement in mathematics. The result showed a significant main effect of treatment ($F(1, 95) = 111.672, P < 0.05$). This implies that there was a significant difference in the mean post-test achievement scores of the students after exposure to the two levels of instructional strategy. As a result, the null hypothesis was rejected.

The results of the main effect of gender in table 1 showed a non-significant main effect of gender on the students' performance scores ($F(1, 95) = .004, P > 0.05$). This outcome implies that there was no significant difference between the scores obtained by the male and female participants in the performance test in mathematics. The non-significant outcome obtained after the post-test for the main effect of gender further confirmed the finding.

The results of the 2-way interaction effect of instructional model and gender in table 1 show no significant interaction effect of the instructional model and gender on the students' performance scores in mathematics ($F(1, 95) = 1.442, P > 0.05$). This outcome implied that the students' mean post-test performance scores after exposure to the two treatments (IBM and CMT) do not vary significantly between male and female students. This means there is no significant difference in the mean post-test performance scores of the male and female participants exposed to the two learning strategies (Inquiry-Based Method (IBM) and Conventional Method of Teaching (CMT)) before and after treatment.

Discussion of Findings

The findings showed a significant effect of inquiry instructional strategies on students' performance in mathematics. A plausible reason for this outcome might be that students found the use of the inquiry method interesting, and the active involvement and participation of the learners could have helped. Active engagement helped the students to construct knowledge and organize information into meaningful schema (Mayre, 2003), as cited in Adebajo (2018). The significant difference

observed was corroborated by the finding of Sage (2015) on the importance of the teacher in the teaching-learning process. According to Bamford (2013), the most important determinant of teaching and learning quality is the vital role played by passionate and committed teachers.

Furthermore, as explained by Alebiosu (2012) and cited in Adebajo, teachers who used the strategy were able to fulfil the responsibility of inspiring, challenging, and stimulating students' enthusiasm for learning. Even though the emphasis is shifting towards learner-centred instructional strategies, the role of the teacher in learning is still incontrovertible. The results of this study are consistent with earlier studies by Riordan and Noyce (2001), which showed that students in schools using inquiry-based programmes as their primary mathematics curriculum performed significantly better than students taught using the traditional approach. The effectiveness of the inquiry-based teaching approach was tested using a paired sample t-test. A p-value of 0.015 was recorded, which indicated that the inquiry-based teaching approach was effective. Also, Ferguson (2010), compared an inquiry-based curriculum with a traditional curriculum and found comparable results. In their study, it was found that students taught through an inquiry-based approach scored higher than the group taught through the traditional method, which indicated a very good understanding of the inquiry instructions by the students compared to their traditional group counterparts.

Hypothesis 2 in respect of the effect of gender on the students' performance in mathematics showed no significant main effect of gender on the students' performance scores in mathematics. This may be because all the strategies appealed to both male and female students. The common notion that male students are better academically or perform better than their female counterparts in some fields, such as mathematics, has been challenged by the findings in this study. It is therefore assumed that gender stereotyping could not have significantly affected the experimental processes involved in this study, thus resulting in no significant main effect of gender on the students' performance scores in mathematics. The finding was in support of earlier findings by Erinosh (2008), Olurinola (2015), Afuwape and Oludipe (2008) and Adebajo (2018), who reported that there was no significant difference in learning outcomes concerning gender.

The 2-way interaction effect in table 1 showed no significant interaction effect of the inquiry-based strategy and gender on the students' performance scores in mathematics. This implied that there was no significant difference in the mean post-test achievement scores of the male and female participants exposed to the two learning strategies (Inquiry Base Strategy (IBS) and Conventional Method of Teaching (CMT)) before and after treatment. The effect of the inquiry-based strategy on improving students' performance in mathematics is the same for male and female students who took part in the study. The reason might also be due to the equal treatment and equal opportunities given to both sexes during the treatment. This finding agreed with Bello and Aliyu (2012), who reported that there were no gender differences in the learning strategies and attitudes of students in electrical and electronic technology education.

Conclusion

The research has shown that many students struggled with some mathematics concepts, as seen in the pre-test. This low conceptual understanding, according to the students, was due to the traditional methods used in teaching mathematics since the methods do not encourage creativity and critical thinking in the class. The subject of mathematics is not static, so the method of teaching should also be dynamic. The teachers of mathematics must be conversant with the trends of events in the dissemination of knowledge to the learners to bring about a desirable change.

Recommendations

Given the results of the study, the following recommendations are made:

- There is a need for mathematics teachers to approach the teaching of mathematics with more innovative approaches such as Inquiry-Based Strategy to develop students' interest in the subject.
- Mathematics teachers should design a diverse range of teaching, learning and assessment approaches that recognize and support the needs of students both as individuals and as members of a learning community

- Seminars, workshops, and conferences should be organized more frequently for mathematics teachers, to update their knowledge on the use of students-centered learning strategies as demonstrated by the present study.

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