**THE EFFECT OF INQUIRY-BASED LEARNING ON THE ACADEMIC PERFORMANCE OF SENIOR SECONDARY SCHOOL PUPILS IN GEOGRAPHY IN ONDO STATE, NIGERIA**

**Abstract**

This study examined how the inquiry-based teaching approach affected the academic performance of senior secondary school pupils in Ondo State's Ondo West Local Government region. At the 0.05 threshold of significance, two research questions were posed and postulated. Pre-test, post-test, and control group designs were used in the study. One hundred (100) senior secondary school students—43 male and 57 female—were chosen at random from the total population using a straightforward random selection procedure. The Geometry Achievement Test [GAT] was the tool utilized to collect data for the study. The sample t-test was used to examine the collected data. The study's findings demonstrated that using an inquiry-based teaching approach improved students' academic performance in geometry. Additionally, the study's results showed no discernible change. The study's conclusions also showed that male and female students exposed to the inquiry-based teaching approach did not significantly differ in their academic performance. Therefore, it is advised that math teachers be encouraged to use the inquiry-based teaching approach when teaching geometry.

**Keywords:** academic achievement, inquiry method, secondary school students, geometry, mathematics.

**Introduction**

The contributions that mathematical knowledge has made to the modern world's economic, industrial, and technological advancements are readily apparent. The use of calculus, a branch of mathematics, is crucial to many discoveries, including the creation of satellites and the advancement of supersonic travel. So, it should come as no surprise that many professional and employment prospects require a foundation in mathematics. Mathematics is superior to physical biology and social sciences, according to Awolola (2003), who also claims that there are no unifying factors among the many scientific disciplines. Without mathematics, he said, scientific knowledge is only shallow. The requirement for a system to count and calculate the areas of surfaces and volumes of objects gave rise to mathematics, according to Marut (1999). However, throughout the ages, mathematics has become less concerned with practical issues and more focused on logical and pure intellectual exploration. Science and technology cannot advance without mathematics.

The study of various shapes is the focus of the mathematical field of geometry. The forms could be solid or flat. Any geometric shape in which a straight line connects any two points entirely on the surface is called a plane shape. Shapes that simply have two dimensions—length and breadth—such as squares, rectangles, triangles, parallelograms, and so on, are called plane shapes. Surfaces that might not be fully depicted on a plane surface bind a solid object. They are three-dimensional objects, including cubes, cuboids, cylinders, trapeziums, and others, with dimensions of length, width, and height. Teachers have employed a variety of teaching strategies while instructing geometry, and it is necessary to investigate strategies that will enhance instruction and improve students’ academic achievement in Mathematics.

As the foundation of all science subjects, mathematics requires a method or methods that are both systematic and engaging to both teachers and students. Thus, it suggests that the older teacher-centered approach might not be able to satisfy the demands of the teaching and learning process in the twenty-first century. Nonetheless, the use of an inquiry-based teaching approach is necessary in order to optimize students' meaningful comprehension of mathematical concepts and to provide them the chance to enhance their learning and comprehension of the subject. For teaching mathematics, a variety of approaches have been modified, including cooperative learning, teacher-centered, learner-centered, and concept mapping strategies. Inquiry-based teaching is one of them.

The inquiry teaching technique is a teaching approach in which students, sometimes with little assistance from the teacher, strive to identify and develop solutions to acknowledged problems through a process of thorough investigation (Adjei Yeboah, 2020; Calson, 2003). The foundation of science and math process skills is scientific research and instruction. Teaching pupils mathematical process skills, critical thinking, and scientific reasoning techniques employed by scientists is known as mathematics by inquiry (Pratt & Itackett, 2008). The inquiry teaching approach gives students the chance to learn new values for themselves as well as new facts, guidelines, and approaches to issues (Esan, 1999). Even though this could be incredibly challenging and time-consuming, students will enjoy learning new things. When we use the inquiry or discovery technique to mean learning, this approach works well for all areas of learning. With the inquiry technique, students thoroughly explore particular subjects.

Algbonian and Lyanic (2001) define the inquiry-based technique as a process that gives students the chance to learn new values for themselves as well as new truths, rules, and approaches to problems. The teacher lets the students learn things on their own rather than providing them with information. According to Afolabi (2012), the inquiry approach is democratic, participatory, and learner-centered, and the teacher's job is to instruct or inspire (Akanmu & Fajemidagba, 2023). The effectiveness of the inquiry-based teaching approach has been the subject of numerous studies in the sciences and mathematics. According to research by Popoola (2003), pupils who were taught mathematical ideas through the inquiry technique performed better than those who were taught using the traditional method. Obeka (2010) discovered that, in comparison to all other approaches, inquiry had a considerable impact on students' geography achievement. In a similar vein, study by Seweje (2004), Oloyede (2010), and Igboegwu (2012) shown that inquiry-based learning significantly improves students' performance in chemistry when compared to traditional teaching approaches. Additionally, Nwagbu (2010) and Ibrahim (2009) discovered that inquiry-based teaching techniques improved students' performance. According to Lyang (2001), students must engage in specific mental processes as seeing, categorizing, measuring, predicting, inferring, and hypothesizing in order to properly use the inquiry technique.

As a result, there is a great deal of inquiry in the classroom, and the instructor serves as a motivator, moving from one place to another to help the students navigate challenges. The instructor fulfills the role of a resource person by directing the students' knowledge sources. According to Bantalem and Kassie (2020), inquiry-based learning is essential for the development of scientific, mathematics, and critical-thinking abilities as well as scientific content knowledge. As a socio-cultural category that categorizes and arranges the social ties between men and women, gender has a big impact on education and may work against students' superior arithmetic performance (Akinsola & Igwe, 2002; Johnson, 1984).

**Statement of the Problem**

Math teachers and other pertinent education stakeholders are very concerned about the issue of kids' low math achievement. Geometry is a crucial component of mathematics, and research has shown that pupils struggle with it. Every other subject benefits from and is related to geometry. It aids in describing and comprehending the basic characteristics of the physical universe. Even though geometry is important, students' attitudes and levels of interest in the subject have an impact on how well they perform on internal and external exams. Some education stakeholders see teachers' erratic teaching methods and approaches as the cause of students' low academic performance, lack of interest, and negative attitudes about the topics. When teaching geometry, the majority of teachers choose a traditional approach that doesn't seem to help pupils grasp the different mathematical ideas or hone their critical thinking skills (Stison, 2004). Therefore, in order to improve students' strong academic performance in mathematics, appropriate and suitable teaching methods must be used.

**Purpose of the study**

 This study's primary goal is to find out how senior secondary school pupils' academic performance in geometry is affected by the inquiry-based teaching approach. to determine whether a student's gender affects their geometry performance.

Research Questions

To direct the investigation, the following research questions were posed:
1. How does the inquiry-based teaching approach affect geometry students' academic performance?
2. Will a student's gender affect their academic performance in geometry?
Hypotheses for Research
Ho1: Students who are taught geometry utilizing an inquiry-based approach and those who are taught it conventionally do not significantly differ in their academic performance.

Ho2: The mean achievement scores of male and female students taught geometry utilizing an inquiry-based teaching approach do not differ significantly.

**Methodology**

This study uses a non-randomized pre-test-post-test control group design and is quasi-experimental in nature. The study's dependent variable is geometry achievement scores, while its independent variable is instructional methodologies (traditional method and inquiry-based teaching strategy). The moderating or intervening variable is gender (male and female).

The study's participants were all twenty-six (26) coeducational public secondary schools in Ondo State, Nigeria's Ondo West Local Government Area, and all senior secondary school two (SSII) pupils enrolled in those schools. One thousand four hundred forty-six (1446) senior secondary school two (SSII) pupils made up the population. One hundred (100) SSS II students were chosen from the population to make up the sample. There were forty-six female pupils and fifty-four male students. For the study, two schools were chosen using a straightforward random sample procedure. One complete class was placed in the experimental group, which used an inquiry-based teaching approach, and the other class was placed in the control group, which used a traditional approach. The geometric topic was introduced to the classes.

The achievement assessment tool was created by two math teachers and approved by a math education specialist. The test comprised fifty multiple-choice questions based on the above specified subjects. After pilot testing the instrument, a reliability coefficient of 0.80 was obtained using Kuder-Richardson Formula 20 (KR-20). The treatment groups were first given the Geometry Achievement Test (GAT) as a pretest, and the results were utilized as covariate measures to adjust for potential pre-existing disparities in the groups' overall ability.

**Results**

First research hypothesis: Students who are taught geometry using an inquiry-based approach and those who are taught it conventionally do not significantly differ in their academic performance.

Table 1: Students' independent samples t-test results for geometry instruction utilizing the traditional method and inquiry-based learning

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Variables | N | X | S.D | Df | t-cal | t-tab | Level of Significance | Decision |
| Inquiry strategy | 54 | 72.36 | 58.12 | 98 | 4.31 | 2.18 | 0.05 | Rejected |
| Conventional Method | 46 | 67.64  | 44.29 |  |  |  |  |  |

The academic performance of students taught geometry utilizing the inquiry-based teaching approach differs significantly from that of students taught geometry using the standard method, as Table 1 above demonstrates. This indicates that the way teachers teach mathematics affects students' performance because the t-cal, or 4.31, is higher than the t-tab, or 2.18, with a degree of freedom of 98 at the 0.05 level of significance.

Hypothesis 2: When geometry is taught using an inquiry-based approach, there is no discernible difference in the academic performance of male and female pupils.

Table 2: t-test analysis of post-test results for students, both male and female, exposed to both traditional and inquiry-based teaching methods

|  |  |  |
| --- | --- | --- |
| Group | Male | Female |
|  | N | X | SD | t-value  | p | Sig | N | X | SD | t-value | p | Sig |
| Inquiry strategy | 32 | 67.43 | 8.46 | 3.56 | 2.65 | NS | 22 | 53.45 | 75.45 | 3.43 | 2.73 | NS |
| Conventional Method | 25 | 50.40 | 8.23 | 21 | 48.71 | 67.82 |

P > 0.05 (Result Not significant at 0.05 level), NS = Not Significant.

Table 2 indicates that the males' likelihood of error is larger than 0.05 (P = 2.65>0.05) and the females' (P = 2.73>0.05). Males and their female counterparts in the two groups did not differ considerably, according to the data. This suggests that neither the male nor female peers' improved performance in learning geometry was statistically affected by the treatment. The null hypothesis is thus upheld.

**Discussion**

When comparing the achievement of students taught geometry utilizing an inquiry-based teaching technique to that of their counterparts in the control group, the study's findings revealed a statistically significant difference. According to the study's findings, pupils' performance in mathematics increased when teachers used an inquiry-based approach. Stilson (2004) observed that the inquiry-based teaching approach had a greater impact on students' academic achievement, which was consistent with this. Students' active participation in the teaching and learning process may be the cause of the achievement increase. Also, the results supported the findings of Afolabi & Akinbobola (2009) and Odutuyi (2012), who discovered that treatment had no beneficial impact on students' performance according to gender.

**Conclusion**

The purpose of the study was to ascertain how senior secondary school pupils' academic performance in geometry was affected by an inquiry-based teaching approach. According to the study, pupils who are taught using an inquiry-based approach outperform those who are taught using a traditional approach. The results also showed that students' achievement in geometry was greatly improved when inquiry-based teaching was used in the teaching and learning process. However, when using an inquiry-based teaching style, the study found no discernible difference in the mathematical achievement of male and female pupils. This suggested that, if implemented correctly, there is no gender disparity in the application of inquiry-based teaching methods.

**Recommendations**

The study's conclusions led to the following recommendations being deemed suitable. Based on the results of this investigation, it was suggested that:
1. In the classroom, inquiry-based learning should be implemented realistically. This technique is a good way for teachers to get their students interested in learning mathematics.
2. In order to completely engage kids in learning mathematics through creative methods, the government should help support mathematics teacher education programs.
3. The focus of educators should change from a teacher-centered model to one that emphasizes more activity-based learning, including inquiry-based teaching.

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