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EFFECT OF GEOBOARD ON PUPIL'S PERFORMANCE IN AREAS OF PLANE SHAPES AMONG PRIMARY 5 PUPILS IN IJUMU LOCAL GOVERNMENT AREA

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Abstract
This study investigated the effects of Geoboard on primary school pupils' performance in Areas of Plane shapes. The study adopted quasi-experimental design. The population of the study were all the primary school pupils in Ijumu local government of Kogi state. The sample was 1400 pupils which were selected to participate in the study. Geometry Performance Test was the instruments used for data collection. The findings of the study reveals that primary school pupils taught areas of shapes using geoboard performed significantly better than their counterparts taught using the conventional methods. Hence it was recommended that mathematics teachers should use Geoboard when teaching Areas of plane shapes to enhance their performance in Mathematics.
Keywords: Geoboard, Pupils, Performance, Areas and Plane shapes

Introduction

Education is the process of transferring knowledge ideas norms skills from one individual to another (i.e. from the teacher to the pupils or students). Education is the process of teaching and learning a concept. It is also a process of receiving or giving systematic instruction especially at a school or university. According to TP Nunn "education is the complete development of the individuality of the child so that he can make an original contribution to human like according to the best of his capacity. Education is defined as the aggregate of all the processes by which a person develops abilities, attitudes, and other forms of behavior or practical values (Sunday, etal 2014). Mathematics is the science and study of quality structure space and change. Mathematics is the science of numbers and shapes and what they mean. Mathematics is a subject of numbers, shapes data measurements and also logical activities. According to Oxford dictionary mathematics are established truth by rigorous deduction from appropriately choosing axioms and definitions, Mathematics is a study of patterns and relationships between numbers and shapes. Mathematics is also the use of numbers and symbols as metaphors for understanding even the incomprehensibly abstract.

According to Bacon, "Mathematics is the gateway and key to all science". Mathematics is the science of numeracy cutting across several human activities all over the world. Thus, there is nothing human beings do that mathematics is not part of it. The conception, period of conception, date of delivery and other numerical records are all products of mathematics. Children are naturally curios about the subject mathematics, and come to school with a view of knowing much about mathematics and its other concepts which geometry is a part (Sunday, et al., 2017). C.F. Gauss also called mathematics the queen of all science and arithmetic is the queen of all Mathematics. According to Kant "Mathematics is the indispensable instruments of all physical resource". Mathematical activities include perceiving, describing, classifying and explaining patterns everywhere in number, data and space and even in patterns themselves. Mathematics is also a language used to communicate patterns. According to Albert Einstein "pure mathematics is in its way the poetry of logical ideas. Richard Courant also saw that Mathematics as an expression of the human mind reflects the active will the contemplative reason and the desire for aesthetic perfection. Its basic elements are logic and intuition, analysis and construction, generality and individuality.

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Despite the advantages of mathematics, students often face challenges in comprehending mathematical concepts, particularly in relation to plane shapes. This could be attributed to instructional materials or teaching methods employed by educators. Instructional materials also known as teaching/learning materials are any collection of materials including animate or inanimate object and human or non-human resources that a teacher may use in teaching and learning situation to help achieve desired learning objectives. Examples of instructional materials include abacus, charts, calculators, microphones, slides, geoboard (Achimugu, Njoku & Sunday, 2023). A geoboard is a mathematical manipulative used primarily in geometry education. It consists of a flat board typically made of wood or plastic, with a grid of regularly spaced pegs or nails arranged in rows and columns. Rubber bands or elastic bands are stretched around the pegs to create geometric shapes, lines, and angles. Geoboards are commonly used in classrooms to help students visualize and explore various geometric concepts, such as perimeter, area, angles, and symmetry. By stretching rubber bands around the pegs, students can create polygons, triangles, quadrilaterals, and other geometric shapes, allowing them to experiment with different configurations and properties others (Akanmu, Sunday & Ayinla, 2016).

Additionally, geoboards can be used to illustrate concepts related to fractions, symmetry, transformations (such as translations, rotations, and reflections), and even basic principles of algebra and coordinate geometry. They provide a hands-on, interactive way for students to engage with geometric ideas and develop spatial reasoning skills. Overall, geoboards are versatile and effective tools for teaching and learning geometry, providing students with a tangible way to explore geometric concepts and develop a deeper understanding of mathematical relationships. In Ijumu local government area, integrating geoboards into the teaching and learning of areas of plane shapes among primary 5 pupils can yield numerous benefits. Firstly, geoboards offer a hands-on learning experience, allowing students to physically manipulate rubber bands or pegs to construct various geometric shapes. This tactile engagement facilitates better comprehension and retention of area concepts as students actively participate in the learning process. Additionally, geoboards provide a visual representation of shapes, aiding in the conceptualization of abstract mathematical ideas. By observing how changing dimensions alter the area of a shape, students develop a deeper understanding of geometric principles (Samuel and Sunday, 2024).

Moreover, the interactive nature of geoboards promotes engagement and motivation among primary 5 pupils. The opportunity to explore and experiment with different shapes fosters curiosity and a sense of ownership over their learning. As students collaborate on group activities using geoboards, they engage in peer learning and discussion, further enhancing their understanding of area concepts. This collaborative approach not only strengthens their mathematical skills but also nurtures teamwork and communication abilities. Furthermore, geoboards encourage problem-solving skills as students analyze the relationship between shape and area. Through trial and error, students discover patterns and strategies for determining the area of plane shapes, fostering critical thinking and analytical reasoning. Teachers can customize geoboard activities to accommodate diverse learning needs, ensuring that every student can actively participate and succeed in the learning process. By integrating geoboards into the curriculum, educators in Ijumu local government area can create a dynamic and effective learning environment that empowers primary 5 pupils to develop a solid foundation in geometry and mathematical reasoning.

Statement of the Problem

Despite the importance of geometry education, the teaching and learning of areas of plane shapes encounter significant challenges. Pupils often to grasp abstract geometric concepts related to plane shapes leading to a limited understanding of the topic. The conventional method of teaching may fail to engage students effectively resulting to a lack of interest and motivation to learn geometry, Educators also face challenges in adapting their teaching method to address the diverse learning needs of the pupils particularly in the realm of geometry. In recognition of these challenges, the study seeks to investigate the effect of geoboard on pupil's performance in areas of plane shapes among primary 5 pupils.

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Research Questions

1. What is the mean difference in the performance scores between pupils who are taught areas of plane shapes using geoboard and those who are taught using traditional method
2. What is the difference between the mean performance score of male and female pupils taught areas of plane shapes using geoboard and those taught using traditional method.

Null Hypothesis

1. There is no significant difference in the mean performance scores between pupils who are taught areas of plane shapes using geoboard and those taught using traditional method.
2. There is no Significant difference between mean performance score of male and female pupils taught areas of plane shapes using geoboard and those taught using traditional method.

Methodology

The research design that was used for this study is the quasi-experimental research design. The investigation utilized a quasi-experimental research model characterized by pretest and post-test evaluations, encompassing an experimental group alongside a control group. This research design aimed to enable a thorough examination of the impact of the intervention by comparing outcomes between the experimental and control groups before and after the treatment application. The population for this study were primary school pupils in Ijumu Local government area, where mathematics is being taught. A total of 1400 respondents was selected from the population figure, consisting of 830 male pupils and 570 female pupils offering mathematics in Ijumu Local government area. The average age of the pupils are 9 years to 12 years. According to the Krejcie and Morgan (1970) Sampling table, the sample of the study consists of three hundred and two (302) pupils randomly selected in the area of study. The sample size were divided into two groups, which consisted of 151 pupils in the experimental group and 151 pupils in the control group. The study gathered information from the Geometry Performance Test (GPT) to gauge students' grasp of geometry before and after using the geoboard application (Thomas, etal 2026). This assessment involved 20 multiple-choice questions, each with four answer options.

The students marked the correct answer for each question. In total, the test was scored out of 40 marks, with each question worth 2 marks. Two schools that are not among the sampled schools was used to assess the reliability of the instrument, were assessed for reliability using the test-retest procedure and Kuder-Richardson 20 approach. Using the Pearson's product moment correlation procedure, it yielded a reliability coefficient of 0.70. Data for this study were collected through the pretest and posttest, where the pretest was first administered to assess the baseline knowledge of geometry among all participants, and after a defined period of using geoboard application, a post test was administered to measure the learning outcomes and the results were compared with the control group. Analyzing the initial and final assessment results of the experimental and control groups, this study aimed to evaluate how the geoboard application impacts the understanding of plane geometry. The research also looked into the significance of group variations through suitable statistical methods, such as T-tests.

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Results

Research Question 1: What is the mean difference in the performance scores between pupils who are taught areas of plane shapes using geoboard and those who are taught using traditional method?

Figure 1: Mean Difference in the Performance Scores between Pupils who were Taught Areas of Planse Shapes Using Geoboard and Those Who Were Taught Using Traditional Method.

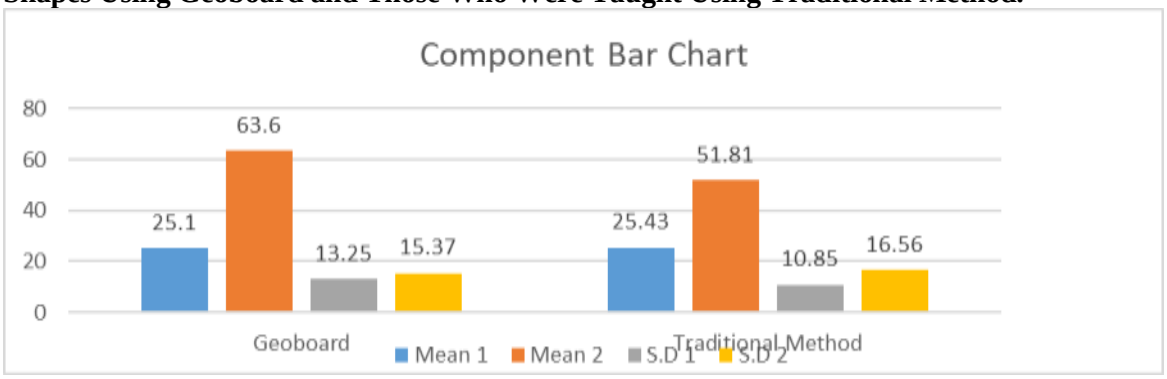

Figure 1 shows the pretest and posttest mean performance scores of students taught Areas of Plane Shapes Using Geoboard were 25.10 and 63.60 while the gain in mean score was 38.50. Their counterpart taught using the traditional method had 25.43, 51.81 and 26.38 as pre-test, post-test and gain in mean scores respectively. This shows a 12.12 difference in gain in mean scores between the two groups in favor of the students taught Areas of Plane Shapes Using Geoboard. The result also shows a remarkable difference in mean gain scores between students taught Areas of Plane Shapes Using Geoboard than their counterparts in traditional method group.

Research question 2: What is the difference between the academic performance score of male and female pupils taught areas of plane shapes using geoboard and those taught using traditional method?

Figure 2: Difference Between the Academic Performance Score of Male and Female Pupils Taught Areas of Plane Shapes Using Geoboard and Those Taught Using Traditional Method.

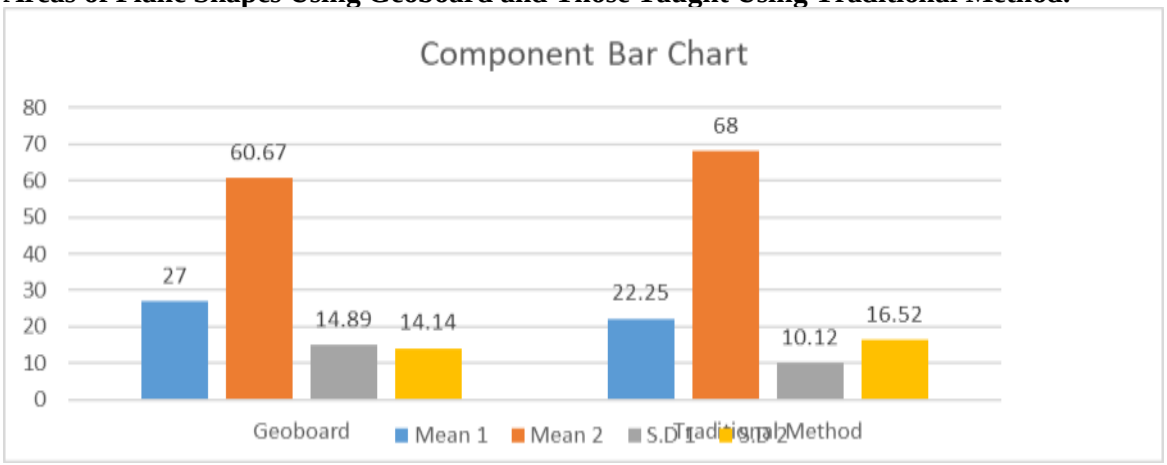

Chart 4.2 reveals that the pretest and posttest mean performance scores of male students (27.00 and 60.67) and their female counterpart (22.25 and 68.00) taught Areas of Plane Shapes Using Geoboard. The gain in mean score for male students was 33.67 while that of the female counterpart was 45.75. This indicates a mean difference of 12.08 in favor of the female students. Hence, the female enjoys the use of Geoboard to teach Areas of Plane Shapes than the male.

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Hypothesis 1

Ho1: There is no Significant Difference in Performance Scores between Pupils who are Taught Areas of Plane Shapes Using Geoboard and Those Taught Using Traditional Method.

Table 1: Difference in Performance Scores between Pupils who are Taught Areas of Plane Shapes Using Geoboard and Those Taught Using Traditional Method.

Variable	Teaching method	N	Mean	Std. dev.	Std. Err	Df	t-calculated	t-critical	Sig (p)
Performance Scores	Geoboard	151	63.60	15.37	2.43				
	Traditional Method	151	51.81	16.56	2.56	300	3.241	2.000	0.002

Calculated t > 2.000, calculated p < 0.05

Table 1 results of the independent t-test statistics showed that there is a significant difference between the mean performance scores of students taught Areas of Plane Shapes Using Geoboard and those taught using traditional method. This is due to the fact that the calculated p value of 0.002 is lower than the 0.05 alpha level of significance while the t-calculated value of 3.241 is higher than the t-critical value of 2.000, at df 300. Their calculated mean performance scores were 63.60 and 51.81 respectively. Consequently the null hypothesis which states that there is no significant difference in performance scores between pupils who are taught areas of plane shapes using geoboard and those taught using traditional method, is hereby rejected.

Hypothesis 2

H_O2: There is no Significant difference between academic performance score of male and female pupils taught areas of plane shapes using geoboard and those taught using traditional method

Table 2: Difference Between Academic Performance Score of Male and Female Pupils Taught Areas of Plane Shapes Using Geoboard and Those Taught Using Traditional Method.

Teaching Method	Gender	N	Mean	Std. dev.	Std. Err	Df	t-calculated	t-critical	Sig (p)
Geoboard	Male	151	60.67	14.14	2.89				
	Female	151	68.00	16.52	4.13	300	1.582	2.024	0.122

Calculated t > 2.024, calculated p < 0.05

Table 2, outcome of the independent t-test statistics showed that there is no significant difference in the mean performance scores of male and female students taught Areas of Plane Shapes Using Geoboard. This is due to the fact that the calculated p value of 0.122 is higher than the 0.05 alpha level of significance while the t-calculated value of 1.582 is lower than the t-critical value of 2.024, at df 300. Their calculated mean performances were 60.67 and 68.00 by Male and female students respectively. Consequently, the null hypothesis which sate that there is no significant difference between academic performance score of male and female pupils taught areas of plane shapes using geoboard and those taught using traditional method, is hereby accepted and retained.

Discussion of the Findings

The result in figure .2 sought to know the mean performance scores of the students in both the experimental group and control group shows that the experimental performed a higher mean score than the control group. This finding is in conformity with NCTM (2017) and Sunday et al (2017) which opined that teacher who use geoboard in the classroom to test the assimilation skills of their students, From there analysis it was observed that the pupils taught with geoboard assimilate better than other pupils taught traditionally, there is a statistical significant difference between the mean a scores of the experimental and control groups. Children are naturally curios about the subject mathematics, and come to school with a view of knowing much about mathematics and its other concepts which geometry is a part (Sunday, et al., 2017). C.F. Gauss also called mathematics the

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queen of all science and arithmetic is the queen of all Mathematics. According to Kant "Mathematics is the indispensable instruments of all physical resource". Mathematical activities include perceiving, describing, classifying and explaining patterns everywhere in number, data and space and even in patterns themselves.

From table 1, the results suggest that there is a significant difference in the academic performance of male and female pupils taught using Geoboard, with females performing better in the experimental group. In the control group, where geoboard was not used, there is no significant difference in performance between male and female students. This finding supports the hypothesis that the use of geoboard has a different impact on the performance of male and female students. Possible reasons for this difference could include varying levels of familiarity and comfort with technology, different teaching methods, or other socio-cultural factors influencing learning. Further research could explore these factors in more detail, potentially involving a larger sample size or different educational settings to confirm and expand upon these findings. Additionally, geoboards can be used to illustrate concepts related to fractions, symmetry, transformations (such as translations, rotations, and reflections), and even basic principles of algebra and coordinate geometry. Additionally, geoboards provide a visual representation of shapes, aiding in the conceptualization of abstract mathematical ideas. By observing how changing dimensions alter the area of a shape, students develop a deeper understanding of geometric principles (Samuel and Sunday, 2024).

Conclusion

The study on the effect of using geoboard as a teaching tool on the performance of primary 5 pupils in the area of plane shapes in Ijumu Local Government Area has revealed significant insights. Geoboards, which are manipulative teaching aids, allow students to physically create and visualize geometric shapes, thereby enhancing their understanding of spatial relationships and geometric concepts. The results of the study indicate that pupils who were taught plane shapes using geoboards performed better compared to those who were taught using traditional teaching methods. This suggests that the hands-on, interactive nature of geoboards fosters a deeper understanding of geometric concepts, making learning more engaging and effective. The use of geoboards helped in addressing the challenges that pupils often face in understanding abstract concepts of geometry. By providing a tangible and visual representation of plane shapes, geoboards bridge the gap between theoretical knowledge and practical application, which is crucial in early childhood education. Moreover, the study found that pupils who used geoboards demonstrated improved problem-solving skills and spatial reasoning abilities. These skills are essential not only in mathematics but also in everyday life, indicating that the benefits of using geoboards extend beyond the classroom

Recommendations

1. Integration into Curriculum: Schools in Ijumu Local Government Area should consider integrating geoboards into the mathematics curriculum, particularly in teaching plane shapes. This will provide pupils with a hands-on learning experience that can enhance their understanding of geometric concepts.
2. Teacher Training: Teachers should be trained on how to effectively use geoboards as instructional tools. Professional development programs can be organized to equip teachers with the necessary skills and knowledge to maximize the benefits of using geoboards in the classroom.
3. Further Research: Additional studies should be conducted to explore the impact of geoboards on other areas of mathematics and on different age groups. This will help to establish a broader understanding of the tool's effectiveness and potential applications.

References

Achimugu, L., Zepherinus, C.N. & Sunday, Y. (2023). Impact of SDGs Retraining Workshop Pedagogical Competencies of Primary School Teachers. *IAFOR Journal of Education, 11*(3), 137-159

Akanmu, M.A., Sunday, Y. & Ayila, J. O. (2016). Effects of Laboratory Component of Teaching and Assessment Strategy on Senior School Students' Performance in Mathematics in Abuja. *Ilorin Journal of Education, University of Ilorin, Volume 35, Number 1, 1-12.*

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E-ISSN 2705-2567

Arends, F., Winnaar, L., &Mosimege, M. (2017). Teacher classroom practices and Mathematics performance in South African schools: A reflection on TIMSS 2011. *South African Journal of Education, 37(3), 67-72*

Samuel, S. S. & Sunday, Y. (2024). Influence of School Type and Gender on Students performance in Mathematics in Damaturu Zone, Yobe State. *Journal of Science, Technology and Mathematics Pedagogy.2* (1), 52-63

Sunday, Y**.,** Salami, R., Olorunishola, A. O. & Arivi, S.S. (2023**).** Influence of YouTube Online Device on Undergraduate Students' Achievements in Mathematics Education in North-Central, Nigeria**.** *Journal of Curriculum and Instructions, (13)1, 132-142.*

Sunday, Y., Akanmu, M. A. & Fajemidagba, M. O. (2016). Assessment of the Availability, Knowledge and utilization Of Mathematics laboratory in Abuja Nigeria. *ABACUS: Journal of the Mathematical Association of Nigeria, 41* (1), 158-168.

Sunday, Y**.,** Akanmu, M.A. & Fajemidagba, M. O. (2017). Fostering Entrepreneurship Education: The Impact of Mathematics Laboratory Approach. *Journal of Curriculum and Instruction Volume 10 Number 1, 36-43*

Sunday, Y., Akanmu, M.A. & Fajemidagba, M. O**.** (2014). Effects of Target-Task Mode of Teaching Senior School Students Geometrical Construction in Abuja. *ABACUS: Journal of the Mathematical Association of Nigeria. 39(1), 33-42*

Thomas, U. O. Benson, A.E.A., Ayodele, G.F., Sunday.Y. & Bolarinwa B. (2026). Transmission Dynamics of Dengue-Zika co-infection with Antibody-Dependent Enhancement, Cross Immunity, and Vaccination: Backward Bifurcation Analysis and Data Calibration. *Journal of the Nigerian Society of Physical Sciences, 8*(3), 3405, 1-36