



## Effect of Think-Pair Share on Geometric Knowledge of Primary School Pupils in Mathematics

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### Abstract

This study focused on think-pair share; a cooperative learning strategy for the development of geometric knowledge of primary school pupils in mathematics. It was guided by two research questions and two hypotheses. The pretest, posttest quasi experimental research design involving two groups was used for the study. The population of the study comprised of all the primary five (5) pupils of 2022/2023 academic session in Umuahia Education Zone of Abia state. The education zone has 201 primary schools with 4,447 primary five (5) pupils. The only Two (2) primary schools with class teachers in primary five (5) that have mathematics background at NCE and Degree levels from Umuahia Educational Zone of Abia State were purposively sampled for the research. Simple random sampling technique was used in determining which school becomes the experimental and control group, 68 pupils participated as a sample for the study (30 males and 38 females). A Geometric Achievement Test (GAT) was used for data collection. Research questions were answered using mean and standard deviation while the hypotheses were tested using Analysis of covariance at 0.05 alpha level, with the aid of SPSS version 21. The results showed a significant difference between the academic achievement of the experimental group and control group in favour of the experimental group. It also revealed that there was no significant difference in the academic achievement of male and female pupils taught geometry in the experimental group which implies that the use of the think-pair share method of teaching is independent of gender. Based on the findings recommendations were made such as teachers should employ the use of cooperative method of teaching such as think-pair share in the teaching of geometrical concepts at the primary level of education to enhance pupils' academic achievement. Finally, workshops and seminars on the use of cooperative method of teaching such as think-pair share should be organized by Ministry of Education for in-service primary school mathematics teachers.

**Keywords:** Geometry, Achievement, Think-pair share, primary school

### Introduction

The field of education is the instrument for change and national development that has been used by developed nations of this world in inculcating relevant social behaviours, scientific and technological skills to its citizens. Nigeria like any other developing nation is making a swift move towards technological development. However, any achievement in technological development will be hampered if the potential scientists, engineers and technologists are not fully equipped with sound knowledge of mathematics at the foundational level (primary level of education). Hence for any nation to achieve meaningful technological development there must be need for effective teaching and learning of Mathematics to its citizens especially at primary school level of education which is the foundational level of the educational system. For

this reason, Federal Government of Nigeria in the National Policy on Education (2013), listed Mathematics as one of the core and compulsory subjects to be offered by all basic school pupils in Nigeria. This is because Mathematics is useful in all human activities and is pivotal in the study of other school subjects like Basic Science and Technology, Business Studies as well as Pre-vocational Studies. Omenka, Kyeleve and Tali (2018) in their observation stated that Mathematics is the backbone of scientific development of a nation or a society.

Irrespective of the importance attached to Mathematics by the Federal Government of Nigeria and society at large, it is very unfortunate to note that pupils' performance in National Common Entrance Examination (NCEE) and Primary School Leaving Assessment Test



(PSLAT) in Mathematics in Abia State remains consistently poor. The annual reports of Education Development Centre Abia state on NCEE and PSLAT in Mathematics from 2015 to 2021, showed that the percentage of pupils who passed at pass level and above (Distinction – Pass) was less than 40%; except in the years 2016 and 2017 when achievement was above 50%. It was observed that geometric questions covered more than 40% of the total questions in mathematics and most pupils attempted little or no question in the area of geometry. In a corroboration study, Njoku and Okigbo (2020) in their observation opined that pupils in basic school do not perform well in geometry.

Geometry is a branch of Mathematics that is concerned with the study of properties, relations of point, lines, surface, solid shape, relative arrangement of the parts, position of objects, movement of objects and the space around the objects, which improve learners' spatial imagination (Ntshengedzeni, 2015). Geometry provides knowledge of how to deal with measurements and relationships of lines, angles, surfaces and solids (Olojede, Bolaji & Musa, 2017). Looking at the level of usefulness of geometry to human existence, the poor achievement of pupils in geometry as observed by Education Development Centre Abia state and Njoku and Okigbo (2020) has created major worries for Mathematics educators in Nigeria. A number of factors have been found to have contributed to pupils' poor achievement in mathematics at primary school level of education especially in area of geometry. Some of these factors are lack of well-trained mathematics teachers, the ineffectiveness of teacher on content delivery, poor students' mathematics comprehensive reading skills, students' poor study habits, students' low interest towards mathematics as school subject, and the inability to link the mathematical concept to real life application through the use of concrete instructional materials and other innovative teaching approaches (Obilor, 2020). To sum it all, Gambari (2010) and Adedayo (2010) stressed that most mathematics teachers at primary and secondary schools do not use teaching aids and innovative teaching approaches that are learner-centred during teaching process. The authors continued, in most cases they stick to only conventional method of teaching, thereby doing most of the talking and leaving the students as passive listeners.

Considering the pedagogical problems as stressed by Gambari (2010), Adedayo, (2010) and others, one may observe that, in some of the primary schools in Nigeria today, in spite of the much talked-about modern teaching approaches that are learner-centred, the traditional classroom approach still prevails especially in teaching of mathematics. Classroom teacher still control instructional process in mathematics classes, the content are still delivered to the entire class with little or no contribution from learners and relevance of mathematical contents to learners are still weak (Akanmu, 2017). Reports from researchers have shown that learning and understanding of school subjects especially mathematics at primary and secondary school levels of education have been frustrated by clumsy methods of teaching (Gambari, 2010, Adedayo, (2010), Emaikwu, 2012) and inability of using instructional approaches that actively involve the learner in handling and presenting mathematical concepts in real life situation during teaching learning process, which has led to mass failure in mathematical concepts (especially in the area of geometry) at both primary and secondary school levels (Charlce-Ogan & Amadi, 2017; Durojaiye, 2018).

The National Mathematical Centre, Abuja (NMC) in Obilor et al (2022) in an attempt to revamp teaching and learning of mathematics at primary and secondary school levels of education, successfully researched into some causes of mass failure in mathematics and revealed among other factors, that poor method of teaching approach adopted by teachers during teaching of mathematical concepts is the major factor. The negative impact have created the need for teachers and researchers to start developing activities based instructional approaches which will help the child at primary stage of education develop intellectually. Moreover, today's classrooms especially at primary level of education are more diverse than ever before with diverse of needs widening and becoming quite demanding (Akanmu, 2017). Undoubtedly, for teaching to be effective in such a diverse classroom, a good teaching method and approach must be adopted by teachers. Unfortunately, the inability of classroom teachers at primary level of education to use innovative teaching methods/approaches in teaching different subjects especially in mathematics at primary school (which is the foundational stage of education) have had a negative impact on the side of the learners (Mkpa, 2017).

The fact that today's classrooms are more diverse than ever before underpins the fact that teachers need to employ many innovative teaching methods in order to achieve educational objectives since no single method is best for all learners and for all subject matter content in this 21st century. These characteristics of 21<sup>st</sup> century learners as listed by Eaton (2016) clearly showed the need for teachers to adopt different innovative teaching methods that will actively involve learners in learning process as well as address their diverse learning needs. Where the role of the teacher will be to guide, direct and facilitate learning activities that will enable the learners learn, while learners on the other hand, will interact with their teachers, work with one another as a team and develop individual accountability so as to demonstrate an understanding of concept that is being learnt Adeniji (2014). To achieve this, it is important to give learners an appropriate amount of time to think and make contribution during teaching and learning (especially in topic like geometry in mathematics which pupils find difficult to learn). By doing this, students may ultimately become more involved in discussions and improve the quality of their responses (Quirey, 2015). These approaches expressed by Quirey (2015), Adeniji (2014) among others, are all innovative activity based and learner-centred teaching strategies that are capable of meeting the diverse needs of a 21<sup>st</sup> century learner especially in subjects like mathematics. Adeniji (2014) expressed that teaching Mathematics requires application of effective methods that will bring active learning, but the absence of this will make the pupils not to participate actively in classroom learning process. It is on the attempt to bring innovative approach in learning geometry at primary school level that the researcher ventured into the use of think-pair-share teaching approach and its impact on development of primary school's pupils' knowledge in mathematics.

Think-Pair-Share is a cooperative teaching strategy that was first discovered and developed by Professor Frank Lyman and his colleagues at the University of Maryland in 1981. Since then, it has been adopted by many writers in the field of cooperative method of teaching and learning. According to Abdurrahman (2015), think-Pair-Share strategy is a cooperative method of teaching that involves presenting students with a question or task, giving them specified time to think individually, sharing and discussing their thoughts with a partner, and then having the pairs

share with the entire class. By using this strategy, students are encouraged to participate in discussions, as well as to have their ideas moulded and developed through shared thoughts. According to Lyman in Abdurrahman (2015), think-pair-share is a strategy designed to provide students to think on a given topic by enabling them to formulate individual ideas and share the ideas with another student. This teaching method promotes classroom participation by encouraging a high degree of student response, rather than using a basic recitation method in which a teacher poses a question and one student offers a response (Simon, 2013).

Think-pair-share is a cooperative learning strategy designed to give learners; time for thinking, time for sharing with a partner, and time to share among larger group of learners. The use of think-pair-share strategy unites the social and cognitive aspects of learning, which promotes the development of thinking and construction of knowledge. It is designed to provide students with "food for thought" on a given topics enabling them to formulate individual ideas and share these ideas with another student (Esther & Abubakar, 2019). It is a learning strategy developed by Lyman and associates to encourage student classroom participation, rather than using a basic recitation method as seen in our various primary schools these days. Think-Pair-Share may encourage a high degree of pupil response and can help keep learners on task thereby giving pupils room to improve their level of understanding concepts they learn through share thoughts. The use of Think-pair-share cooperative method of teaching strategy designed to improve geometric ability of learners in mathematics might have gender based implication which is worth exploring.

Specifically, the study:

- i. determined the effect of using think-pair share teaching method on academic achievement of pupils in mathematics;
- ii. determined the differential effect of using think-pair share teaching method on academic achievement of male and female pupils in mathematics;

### Hypotheses

The following null hypotheses ( $H_0$ ) were tested at 0.05 level of significant in the study:

- H<sub>01</sub>:** There is no significant difference between the mean achievement scores of pupils taught geometry using think-pair



share teaching method and those taught without using Problem Teaching Method  
**H<sub>02</sub>:** There is no significant difference between the mean achievement scores of male and female pupils taught geometry using think-pair share teaching method.

## Methodology

This study adopted quasi-experimental research design because it is not possible or practical to control all the key factors in the study, so it becomes necessary to implement a quasi-experimental research design for this study. Specifically, the design was pretest-posttest non-equivalent control group design. Intact classes were used instead of randomly composed samples. The use of intact classes was to ensure no alteration of regular class period since primary school authorities in Abia State do not allow their lesson periods to be altered.

The population of the study comprised of all the primary five (5) pupils of 2022/2023 academic session in Umuahia Education Zone. The education zone has 201 primary schools with 4,447 primary five (5) pupils (Abia State Universal Basic Education Board, 2022/2023 academic record). The sample size for this study consisted of 68 pupils. This comprised 30 male and 38 female primary five (5) pupils selected from two schools that were selected through purposive sampling technique in Umuahia Education Zone. The schools were randomly assigned into experimental and control groups. The researchers developed one instrument called Geometric Achievement Test (GAT) which consisted of 40 items adopted from past question papers in NCEE and FSLC examinations based on plane shape geometry covered during the study. The items of the Geometric Achievement Tests (GAT) were put together with a Table of Specifications to ensure they were content valid.

## Results

**Table 1a: The mean achievement scores of pupil taught geometry using think-pair share teaching method and those lecture method.**

| Variables          | N  | Pre-Test Mean | SD of Pre-Test | Post-Test Mean | SD of Post-Test |
|--------------------|----|---------------|----------------|----------------|-----------------|
| Experimental Group | 32 | 37.17         | 4.1            | 69.53          | 14.73           |
| Control Group      | 36 | 37.91         | 16.52          | 52.78          | 14.92           |

Table 1a above shows the mean achievement scores of pupils who were taught geometry using think-pair share

The Kuder-Richardson (KR- 20) formula was used to ascertain the reliability of the GAT. The value of 'r' was found to be 0.83.

## Experimental Procedure

The researchers within the first week obtained permission from the sampled schools. They briefed the research assistants (who were the regular mathematics teachers in the schools) on the activities to be carried during the research. They administered the research instrument to both experimental and control groups as pre-test in their respective schools. The pre-tests were scored and kept under the custody of the researchers. In the subsequent four weeks, pupils in think-pair share experimental group received instruction on plane shape geometry according to activities in lesson plan designed for their group, while students in control group received instruction on plane shape geometry using conventional method of teaching lesson plan. The treatment experimental and control groups received strictly followed the steps in the lesson plan made available to the research assistants by the researchers for each of the groups. On the sixth week, the instruments were re-administered to both experimental and control groups as post-test. The post-test of the groups were scored by the researchers. The score from pre-test and post-test were used in determining the academic achievement of students in geometry.

Data collected from the pretest and posttest using GAT were recorded for the two groups. Also, their scores were arranged into male and female, since the study had concern for gender effect. Data collected were analyzed with respect to the research hypotheses formulated for the study. Descriptive statistics of mean, standard deviation and Inferential statistics of ANCOVA were used to test all the hypotheses at significant level of 0.05.

method (Experimental group) and those taught without using think-pair share method (Control group). From table 1.1, it could be seen that the





pupils in experimental group had a pre-test mean achievement score of 37.17, while in post-test mean achievement score the pupils scored 69.53. For the pupils in control group, it was observed

that they had a pre-test mean achievement score of 37.91, while in their posttest mean achievement score they scored 52.78.

**Table 1b Analysis of covariance on the mean achievement scores of pupils taught geometry using think-pair shareteaching method and those taught without using think-pair shareteaching method**

| Source          | Sum of Squares        | Df | Mean Square | F       | Sig. | Partial Eta Squared | Decision Rule |
|-----------------|-----------------------|----|-------------|---------|------|---------------------|---------------|
| Corrected Model | 1274.699 <sup>a</sup> | 2  | 637.350     | 116.738 | .000 | .724                |               |
| Intercept       | 2929.661              | 1  | 2929.661    | 536.602 | .000 | .858                |               |
| PRETEST         | 250.640               | 1  | 250.640     | 45.908  | .000 | .340                |               |
| Groups          | 895.286               | 1  | 895.286     | 163.982 | .000 | .648                | S             |
| Error           | 485.909               | 65 | 7.476       |         |      |                     |               |
| Total           | 33470.000             | 68 |             |         |      |                     |               |
| Corrected Total | 1760.609              | 67 |             |         |      |                     |               |

a. R Squared = .724 (Adjusted R Squared = .718)

Table 1b shows that the F-ratio is 163.982 with 1 degree of freedom. However, since the associated alpha level of .000 is less than the p-value of 0.05 ( $p > 0.05$ ), the null hypothesis which states that there is no significant difference in the mean achievement

scores of pupils taught geometry using think-pair share in experimental group and control group is rejected. This implies that there is a significant difference in the mean achievement scores of pupils taught geometry using think-pair share in experimental group and control group.

**Table 2a: The mean achievement scores of male and female pupils taught geometry using think-pair shareteaching method.**

| Gender     | N  | Pre-Test Mean Scores | SD of Pre-Test | Post-Test Mean Scores | SD of Post-Test |
|------------|----|----------------------|----------------|-----------------------|-----------------|
| Male       | 15 | 37.73                | 9.44           | 84.79                 | 10.70           |
| Female     | 17 | 36.59                | 8.64           | 84.23                 | 10.08           |
| Difference |    | 1.14                 |                | 0.56                  |                 |

Table 2a showed the pre-test and posttest mean achievement scores of male and female pupils who were taught geometry using think-pair share teaching method. From Table 1.2, it could be seen that the male pupils scored a pre-test mean achievement score of 37.73, while in the

posttest they scored a mean achievement score of 84.79.

On the other hand, it was observed in table 2 that the female pupils scored a pre-test mean achievement score of 36.59, whereas their posttest mean achievement score was 84.23.



**Table 2b Analysis of covariance on the mean achievement scores of male and female pupils taught geometry using think-pair share teaching method.**

| Source          | Sum of Squares       | Df | Mean Square | F       | Sig. | Partial Eta Squared | Decision Rule |
|-----------------|----------------------|----|-------------|---------|------|---------------------|---------------|
| Corrected Model | 380.496 <sup>a</sup> | 2  | 190.248     | 12.269  | .000 | .216                |               |
| Intercept       | 2527.324             | 1  | 2527.324    | 162.981 | .000 | .647                |               |
| PRETEST         | 374.523              | 1  | 374.523     | 24.152  | .000 | .213                |               |
| GENDER          | 1.082                | 1  | 1.082       | .070    | .792 | .001                | NS            |
| Error           | 6745.545             | 29 | 15.507      |         |      |                     |               |
| Total           | 33470.000            | 32 |             |         |      |                     |               |
| Corrected Total | 1760.609             | 31 |             |         |      |                     |               |

a. R Squared = .216 (Adjusted R Squared = .199)

Data in table 2b shows that the F-ratio is 0.070 with 1 degree of freedom and 0.792 significant level. Since the associated alpha level 0.792 is greater than the p-value of 0.05 ( $p > 0.05$ ), the null hypothesis that there is no significant difference in mean achievement scores of male and female pupils taught geometry using think-pair share in experimental group is accepted. This implies that there is no significant difference in the mean achievement scores of male and female pupils taught geometry using think-pair share in experimental group.

### Discussion of the findings

The results in the test of hypotheses have shown that pupils who were taught geometry using think-pair share method performed significantly better than those taught without using think-pair share method. This study is in tandem with Abdurrahman (2015) who posited that think-pair share method is more positive in enhancing and facilitating student's achievement in learning. Simon, (2013) in his study, effect of the think-pair share approach on academic achievement of students in mathematics at the secondary level' also found that the students taught with the think-pair share approach showed much better achievement compared to the control group which was taught by the expository strategy. This implies that getting learners involved through the use of instructional approach that get pupils actively involved during

learning of geometrical concepts encourages learners to actively participate in teaching and learning of mathematics.

The outcome of the findings is instructive to teachers, administrators and government. It implies that teaching methods like think-pair share method among others should be employed by teachers, government, and school administrators during teaching of mathematical concepts to improve level of understanding mathematical concepts by pupils especially in area of geometry. This will in turn reduce poor achievement in mathematics especially at primary school level of education.

The results also showed that there was no significant difference in achievement of male and female pupils taught geometry using think-pair share method. This implies that both male and female pupils taught mathematics using think-pair share method performed relatively well thereby indicating that gender has no influence on pupils' achievement in geometry when they are given equal exposure to learning experience. This finding is in line with Ozofo (1993), Ogbonna 2007 and Etsu & Ahmad (2018) who indicated that there was no significant difference between the achievement of male and female students in mathematics.



## Conclusion and Recommendation

Having seen the effects of using think-pair share method (especially at primary school level of education) in improving pupils' academic achievement, which is also an indicator of improvement in knowledge in mathematics especially in the area of geometry, researchers and mathematics teachers will be motivated to try out other teaching methods that will actively engage pupils and student during learning of mathematical concepts to find out their effectiveness in teaching and learning of other mathematical concepts at secondary and tertiary levels.

Based on the result of the findings of this study, the following recommendations were made:

1. Mathematics teachers should intensively employ the use of think-pair share method that will actively involve pupils and students during teaching learning process which will provide opportunity for them to interact with one another to enhance their understanding and achievement in mathematics.
2. Federal/ State Government and school proprietors should ensure that mathematics teachers use instructional approaches such as think-pair share method that will actively involve learners and give them participatory opportunity during teaching and learning of mathematical concepts.
3. Workshops/Seminars should be organized by Government at state and federal levels and by other relevant professional agencies (MAN, STAN etc) for Mathematics educators, in-service mathematics teachers, and students/pupils to enable them learn how to use think-pair share method aided approach to enhance the teaching and learning of Mathematics in schools at all levels.

## References

- Abdurrahman, H. U. (2015). Using Think-Pair-Share Strategy to Improve Students' Speaking Ability at Stain Ternate. *Journal of Education and Practice*, 6(10), 65-70
- Adedayo, W. K. (2010). Teacher Qualification and Specialization in Primary Education. *Mathematical Association of Nigeria Workshop Manual for Prima*, 2010.
- Adeniji, K.A. (2014). Motivational teaching strategies towards improving learning of mathematics at primary and secondary school levels. *ABACUS: The Journal of the Mathematical Association of Nigeria*, 39(1), 344-354.
- Akanmu, M.A. (2017). Guided Discovery Learning Strategy and senior school student performance in Mathematics in Ejigbo, *Nigeria Journal of Education and Practice* Department of Science Education, Faculty of Education University of Ilorin.
- Charles-Ogan, G. I. & Amadi, J. C. (2017). Teaching mathematics using problem solving method: a tool for achieving global competitiveness and national development. *Nigerian Journal Of Curriculum Studies*, 24 (3): 127-135
- Durojaiye, D. S. (2018). Materials for Teaching Mathematics at Secondary and Primary Schools: Mathematics Laboratory and Kits. *Retraining Workshop for Heads of Mathematics & Lecturers of Mathematics in Colleges of Education*. National Mathematical Centre, Abuja.
- Eaton, E. S. (2016) Literacy, Language and Leadership: 21 Characteristics of 21st Century Learners. <http://wp.me/pNAh3-14d>. Accessed on 11/1/2017k
- Emaikwu, S. O (2012). Assessing the relative effectiveness of three teaching methods in the measurement of student achievement in mathematics: *Journal of Emerging Trends in Educational Research and Policy Studies (JETERAPS)* 3(4): 479-486.
- Esther A. A. and Abubakar A, B (2019) Effects of Jigsaw and Think-Pair-Share Methods on Students' Academic Performance in Accounting in Colleges of Education in North-East Nigeria. *International Journal of Innovative Social & Science Education Research* 7(2):119-132.
- Gambari, A. I. (2010). Effects of instructional models on the performance of junior secondary school students in geometry, Nigeria. *JOSTMED*.
- Jacob, T. A, Decl, C. Bolaji, Y. K., Kajuru, M. M. & Musa, K. B. (2017). Effect of concrete manipulative approach on attitude, retention and performance in geometry among junior secondary school students in Benue State. *IOSR Journal of Research & Method in Education*, 7(6), 80-175.
- Mkpa, A. M., (2017). Pedagogical Imperatives for Teacher Effectiveness in the Nigerian Educational System. 30<sup>th</sup> Inaugural Lecture Presented in Abia State University, Uturu.

- Federal Republic of Nigeria (2013). *National policy on Education*. Lagos: FME/NERDC.
- Njoku, C & Okigbo, E, C (2020). Development of GeoTAN Instructional Software Package for teaching geometry in senior secondary school. *UNIZIK Journal of STM Education*, 3(2), 13 – 24.
- National Mathematical Centre, Abuja. (2009). Mathematics Improvement project. Retrieved from [www.nmc.org/Mathematics\\_improvement\\_programme.html](http://www.nmc.org/Mathematics_improvement_programme.html), on 26th January, 2018.
- Ntshengedzeni, R. M (2015). *Enhancement of learners' performance in geometry at secondary schools in Vhembe District of Limpopo Province*. Unpublished doctoral dissertation, University of Venda. Venda,
- Obilor, W.E (2020). Effects of Geoboard on Academic Achievement and Interest of Primary School Pupils in Mathematics. An Unpublished M.Ed. Thesis Submitted to Department of Science education, Michael Okpara University of Agriculture, Umudike.
- Omenka, J.E., Kyeleve, J .I & Tali, D. J. (2018). Effect Of Collaborative Learning Approach On Upper Basic Two Students' Achievement And Interest In Geometry In Plateau State. *Abacus (Mathematics Education Series)* Pg. 347-359, Vol. 43, No 1, Aug. 2018.
- Olojede, A. I., Bolaji, C. & Musa, M (2017). Effects of information communication technology on senior secondary school students' geometry retention and performance in Bauchi State. *International Journal of Mathematics Trends and Technology (IJMTT)* 48(3), 186-196.
- Quirey G. (2015), "Determining the Effects of Jigsaw versus Think-Pair-Share on Student Participation in an Inclusive Classroom" (2015). Student Research Submissions. 184.  
[https://scholar.umw.edu/student\\_research/184](https://scholar.umw.edu/student_research/184)
- Simon, C.A (2013). *Strategies guide series differentiating instruction*, Urbana Illinois: NCTE publisher. Sinnes (2016)