EFFECT OF INSIDE-OUTSIDE CIRCLE INSTRUCTIONAL STRATEGY ON PRIMARY SCHOOL PUPILS' ACADEMIC ACHIEVEMENT IN MATHEMATICS IN KWARA STATE

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Abstract
This study investigated the effect of inside-outside circle instructional strategy on pupils' academic achievement in mathematics in Ilorin West Local Government Area of Kwara State. Pretest post-test control group quasi-experimental research design was adopted. A total of 74 pupils from two public primary schools were involved in the study. One validated and reliably tested research instrument titled 'Mathematics Achievement Test' (MAT) was used. The reliability index of MAT (r = 0.74) was determined using test retest method. Three hypotheses were formulated and tested with Analysis of Covariance (ANCOVA). The findings of the study revealed that treatment had significant effect on pupils' academic achievement in mathematics ($F_{(1; 69)} = 248.743$, $P < 0.05$). However, gender ($F_{(1; 69)} = 1.325$; $P > 0.05$) did not have significant effect on pupils' academic achievement in mathematics. And finally, the interaction of treatment and gender did not have any significant effect on pupils' academic performance ($F_{(1; 69)} = .603$; $P > 0.05$). Based on the findings, it was concluded that inside-outside circle instructional strategy can improve academic achievement of pupils in mathematics. Based on the conclusion, it was recommended that teachers should be trained on inside-outside circle instructional strategy and also be encouraged to use it.

Keywords: Inside-outside circle, instructional strategy, pupils, academic achievement, Mathematics

Introduction

A nation's mathematics education is comparable to a young human organism's protein because mathematics is the foundation for scientific and technological development in a nation. Mathematics is regarded by society as the cornerstone of scientific and technological knowledge, which is critical to the nation's socioeconomic progress. Mathematics has a critical role in science and technology, as it is required by everyone and in all aspects of human activity (Abubakar & Eze, 2010; Abubakar & Uboh, 2010). The importance of mathematics as a core subject in the Basic school curriculum cannot be overstated. Mathematics is the second core subject in the lower, middle, and upper basic classes, according to section two (2) of the National Policy of Education (FRN, 2014). As a result, it is safe to say that mathematics is offered to all students, from basic one to basic nine. Mathematics

is a required subject in Nigerian elementary and secondary schools, and it is taught every day or at least four times a week in all schools. Mathematics is also a prerequisite for several degree programs, including education, medicine, architecture, and engineering. Despite the important role Mathematics plays in the society, performance of pupils in the subject, at national examinations, has not been encouraging (Erunke, 2020).

Mathematics has always been one of the most important subjects in primary school (Awofala & Awolola, 2011). The importance of mathematics in school curricula stems from the subject's contributions to scientific and technological advancement. Because of the rapid advancement of technology, it is noticed that the demand for mathematical skills is increasing. The language of science and technology is commonly recognized as Mathematics. Norris (2012) made a similar point when he claimed that, although science is the bedrock that gives the springboard for the creation of technology, Mathematics is the door and key to the sciences. Tobies and Helmut (2012) argued that without mathematics, there is no science, without science, there is no modern technology, and without modern technology, there is no modern civilization. To put it another way, Mathematics is the forerunner and queen of science and technology, as well as the most important single factor in modern society growth. As a result, Mathematics education is critical to the development of a nation. On a more positive side, in today's society, when science and technology have become an intrinsic part of global culture, a basic understanding of Mathematics is a sine qua non for citizens' efficacy. Apparently, the importance of mathematics in the development of any society's industrialization and technological advancement cannot be overstated.

However, a closer look at primary school mathematics teaching has become a subject of significant concern for educators and academics in recent years, particularly at the basic education level. The subject has been identified as the most despised subject in school, with students' performance at all levels of education deteriorating year after year (NAUBEP, 2009). In the year 2019, the academic performance of pupils, in Ilorin West Local Government Area of Kwara State, who sat for the Kwara State common entrance examination, was not encouraging. Out of the 13,062 pupils who registered for the common entrance examination in the local government area, only 4,781 (36.6%) pupils had 50 marks and above in Mathematics. 8,281 (63.4%) pupils had less than 50 marks in mathematics. According to the former Registrar and Chief Executive of National Examinations Council (NECO) Godswill Obioma, while presenting the results to the Minister of

Education, Mallam Adamu Adamu, he noted that a number of 70,580 candidates sat for the examination nationwide, out of which only 34.6 percent (24,416) of the candidates had pass mark in all the examinable subjects including mathematics (Erunke, 2020).

This terrible learning scenario related with mathematics should not be permitted to persist, given its prestige and relevance in numerous aspects of our national life. This is a cause for concern because if the trend continues, it will jeopardize national growth. Today, technology lies at the heart of every societal growth, and mathematics has long been considered as the foundation of both technology and science (Awofala, 2008; Rasheed, 2008).

It has been reported (Atandi, Gisore, & Ntabo, 2019; Isa, Mammam, Badar & Bala, 2020) that improvement in the academic performance of pupils is dependent on method of teaching. That is why the poor academic performance of pupils in mathematics has partly attributed to the method of teaching often used by some teachers. Some researchers and scholars (Yaduvanshi, & Singh, 2018; Kingdom-Aaron, Etokeren & Okwelle, 2019) have recommended the use of teaching strategies that tolerate pupils' participation in teaching-learning situation. One of such teaching strategies is inside-outside circle which is a variable of interest in this study.

Inside-outside circle is a cooperative learning strategy that requires students to work in groups (Mutmainah, 2017). Pupils create two concentric circles and rotate around the room, answering or discussing the teacher's questions with fresh partners (Gayle & Lin, 2005). The teacher asks a specific issue or problem from the pupils using the inside-outside circle technique. The teacher's job is to guide and facilitate dialogues. The class is divided into two equal groups by the teacher. One of the groups creates the inner circle, while the other forms the outside circle. The students in the inner circle face the students in the outer circle (Robert, Katie, & Julia, 2012). The teacher asks the kids a specific question. Students are given some time to consider their options. After that, each student in the inner circle is given opportunity to discuss the question with his or her outside circle companion, and vice versa. The students go one step to their left in the outside circle on the teacher's signal and have another quick talk with their new partner. The teacher allows pupils enough time to jot down new thoughts and facts in their notebooks.

A number of studies (Hadi, 2012; Mochammad & Armeria, 2016; Rahmania, 2017; Mutmainah, 2017; Rana, Rusul & Abbas, 2020) have been conducted on inside-outside circle on

students' learning outcomes but none of these studies attempted to examine the effect of inside-outside circle instructional strategy on the academic achievement of pupils in Mathematics.

Another variable of interest is gender. Gender is defined as the set of qualities that define femininity and masculinity and distinguishes them. These traits may include biological sex of been a male or female (Kevin, 2017). A number of studies (Nnamani & Oyibe, 2016; Pirmohamed, Debowska & Boduszek, 2017; Lori, Michelle, Glenda & Brian, 2019) have been conducted on the effect of gender on the academic achievement of students in different subject areas but the studies reported conflicting findings. Hence, this justifies the inclusion of the gender in this study. The general purpose of the study was to examine the effect of inside-outside circle instructional strategy on the academic achievement of pupils in mathematics. Specifically, the study aimed to investigate the significant effect of treatment on the academic achievement of pupils in mathematics, significant effect of gender on the academic achievement of pupils in mathematics, significant interaction effect of treatment and gender on the academic achievement of pupils in mathematics.

Statement of the Problem

The poor performance of pupils in Mathematics particularly in the recent years has not been encouraging. This poor performance of pupils has been partly attributed to the pedagogical methods adopted by teachers. Claims have been made that the methods used by some teachers do not embrace active participation of pupils in the classroom(Yusuf, Guga & Ibrahim, 2016; Olutola, Ayodeji, & Abdusalam, 2017). And one of the methods which embrace active participation of pupils in the classroom is inside-outside circle instructional strategy. Studies on inside-outside circle instructional strategy have been conducted but deserved research attention has not been given to the investigation of the effect of inside-outside circle instructional strategy on the academic achievement of pupils in mathematics particularly at the primary school level. Also, this kind of study has not been conducted in the Ilorin West Local Area of Kwara State where this study was carried out.

Research Hypotheses

Ho_1: There is no significant effect of treatment on the academic achievement of pupils in mathematics.

Ho_2: There is no significant effect of gender on the academic achievementof pupils in mathematics.

Ho_3: There is no significant interaction effect of treatment and gender on the academic achievement of pupils in mathematics.

Methodology

The study adopted a pretest posttest control group quasi-experimental research design with a factorial design of 2x2. The target population was all primary four (4) pupils in Ilorin West Local Government Area of Kwara State. Simple random sampling technique was used to select two (2) public primary schools. One of the two schools was experimental group (30 pupils) while the other was the control group (44 pupils). Primary four pupils in each of the selected schools were involved in the study. The research instrument used in the study was researchers' designed achievement test titled 'Mathematics Achievement Test (MAT)'. The MAT were drawn from the mathematics scheme of work for primary four, and it consisted of 20 multiple choice questions. The drafted questions for the MAT, inside-outside Circle Instructional Guide (ICIG), and Conventional Instructional Guide (CIG) were given to lecturers in the Department of Early Childhood and Primary Education, Kwara State University who validated the instrument. To establish the reliability of the MAT, test retest method was used. The test was administered twice, with an interval of two weeks, to 25 pupils in primary four who were not part of the study. Data from the two administrations were correlated using Pearson Product Moment Correlation (PPMC) and the reliability coefficient was established at 0.74. The study lasted for 6 weeks and data collected were analyzed using Analysis of Covariance (ANCOVA).

Results

Research Hypothesis One

There is no significant main effect of treatment on the academic achievement of pupils in mathematics

Table 1: Summary of Analysis of Covariance (ANCOVA) showing the effect of treatment in pupils' academic achievement in mathematics

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	881.601[a]	4	220.400	65.297	.000
Intercept	5.777	1	5.777	1.711	.195
Pretest	.858	1	.858	.254	.616
Treatment	839.594	1	839.594	248.743	.000
Gender	4.471	1	4.471	1.325	.254
Treatment * Gender	2.035	1	2.035	.603	.440
Error	232.899	69	3.375		
Total	10901.000	74			
Corrected Total	1114.500	73			

Table 1 shows the effect of treatment on pupils' academic achievement in mathematics. There was significant effect of treatment on pupils' academic achievement in mathematics ($F_{(1; 69)} = 248.743$, $P < 0.05$). The null hypothesis is therefore rejected in the light of the result since the significant value (.000) is less than 0.05. This implies that treatment had significant effect on pupils' academic achievement in mathematics. The source of the significant difference is presented in table 2 below.

Table 2: Summary of Bonferroni's Poc Hoc Pairwise Comparison of the scores between the two groups

Treatment	Mean Difference	Experimental	Control Group
Inside-Outside Circle	15.60	*	
Conventional Method	8.67		*

Table 2 revealed that the significant effect revealed by table 1 is as a result the significant difference between inside-outside circle instructional strategy and conventional method. Inside-outside circle instructional strategy refers to experimental group, while conventional method is known as control group. This implies that those exposed to inside-outside circle instructional strategy (15.60) performed significantly better than those exposed to conventional method (8.67).

Research Hypothesis Two

There is no significant effect of gender on pupils' academic achievement in mathematics.

Table 1 also revealed the effect of gender on pupils' academic achievement in mathematics. There was no significant effect of gender on pupils' academic achievement in mathematics ($F_{(1; 69)}$=1.325; P > 0.05). The hypothesis is therefore not rejected in the light of the result since the significant value (0.254) is greater than 0.05. This implies that gender had no significant effect on pupils' academic achievement in mathematics.

Research Hypothesis Three

There is no significant interaction effect of treatment and gender on pupils' academic achievement in mathematics.

Table 2 also revealed the interaction effect of treatment and gender on pupils' academic achievement in mathematics. There was no significant interaction effect of treatment and gender on pupils'achievement in mathematics ($F_{(1; 69)}$ = .603; P > 0.05). The hypothesis is therefore not rejected in the light of the result since the significant value (0.440) is greater than 0.05. This implies that interaction of treatment and gender had no significant effect on pupils' academic achievement in mathematics.

Discussion of Findings

The findings of the study revealed that there was significant main effect of treatment on pupils' academic achievement in mathematics. This implies that pupils taught mathematics using inside-outside circle instructional strategy performed significantly better than their counterparts taught with conventional method. The reason for the result may be attributed to the fact the pupils were active in classroom instruction as they had opportunities to interact with different partners. This finding is in tandem with the finding of Mutmainah (2017) who conducted a study on the use of inside outside circle technique to improve students' writing on recount text. And the finding of the study revealed that there was significant effect of inside-outside circle technique on students' recount text. The finding of this study also corroborated the finding of Rahmania (2017) who discovered that there was significant effect of treatment on academic achievement of learners. The students' academic achievement in experimental group was higher than that of control group.

Another finding of the study revealed that gender had no significant effect on pupils' academic achievement in mathematics. This implies that being a male or female did not account for difference in the academic achievement of pupils in mathematics. This finding corroborated with the finding of Ahmed (2017) which discovered that there was no significant main effect of gender on the academic performance of pupils in Mathematics in Moro Local Government Area of Kwara State. Similarly, the finding supported the finding of Rafiu (2018) which unfolded that gender had no significant effect on the academic performance of pupils in numeracy in Ilorin West Local Government Area of Kwara State.

The findings of the study further revealed that there was no significant interaction effect of treatment and gender on pupils' academic achievement in mathematics.This implies that the treatment was effective and it was not gender-biased. This finding occurred because the learners, regardless of their gender, had opportunity to interact with different partners. This finding supported the finding of Oyinlola (2022) who discovered that the interaction of treatment and gender had no significant effect on academic achievement in English language. Yusuf (2019), also reported that there was no significant interaction effect of treatment and gender on the academic achievement of pupils.

Conclusion

Based on the findings of the study, it can be concluded that inside-outside circle instructional strategy can bring out improvement in the academic achievement of pupils in mathematics regardless of gender.

Recommendations

Based on the above conclusion, the following recommendations were made:

- Teachers should adopt the use of inside-outside circle instructional strategy in teaching mathematics.
- Seminars, workshops and conferences should be organized for teachers on how to use inside-outside circle instructional strategy.
- Inside-outside circle instructional strategy should be incorporated in teacher training programme courses.
- Inside-outside circle instructional strategy should be included in mathematics curriculum.

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