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Effect of Reversed Jigsaw Instructional Strategy on Pupils Academic Achievement in Mathematics

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ABSTRACT

The study examined the effect of reversed jigsaw instructional strategy on pupils' academic achievement in Mathematics. The study adopted a quasi-experimental research design. Two public primary schools were randomly selected to participate in the study. One validated and reliably tested research instrument titled 'Mathematics Achievement Test' (MAT) was used. The reliability index of MAT was determined using Pearson Product Moment Correlation (PPMC). Two research hypotheses were formulated and tested at a standard level of significance with an Analysis of Covariance (ANCOVA). The findings of the study revealed that treatment had a significant effect on pupils' academic achievement in mathematics. However, the interaction of treatment and gender did not have any significant effect on pupils' academic achievement. Based on the findings, it was concluded that reversed jigsaw instructional strategy can improve the academic achievement of pupils. Based on the conclusion, it was recommended that teachers should be trained in the use of the strategy.

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1. INTRODUCTION

The acquisition of mathematical knowledge is crucial for scientific and technological progress and is a key factor in a nation's socioeconomic growth. In the same way that protein is essential for the development of a young human, mathematics education is essential for the advancement of society. Abubakar and Uboh (2010) stated that mathematics plays a vital role in science and technology, and is integral to human activities. In Nigeria, Mathematics is a mandatory subject at the primary and secondary levels and is a prerequisite for degree programs such as education, medicine, architecture, and engineering.

Moreover, mathematics provides a valuable tool for understanding various subjects and languages and forms the foundation for many scientific disciplines. It is an essential component of human reasoning and logic and plays a crucial role in our efforts to comprehend the world and ourselves (Jameel & Ali, 2016). However, despite its importance, the performance of students in Mathematics at national exams in Nigeria has been lackluster (Makondo & Makondo, 2020).

Educators and scholars have raised concerns about the state of primary school Mathematics education, particularly at the basic education level. Despite its significance, Mathematics remains an unpopular subject in schools, and students' grades have shown a consistent decline year after year. The issue is further highlighted by the poor results of external examinations, such as the Kwara State Common entrance examination in 2019, where only 36.6% of the 13,062 pupils who registered in the Ilorin West Local Government Area had 50 marks or higher in Mathematics, while 63.4% scored less than 50 marks. These concerns were echoed by Godswill Obioma, former Registrar and Chief Executive of the National Examinations Council (NECO), who reported that only 34.6% (24,416) of the 70,580 candidates nationwide passed all examinable subjects, including Mathematics.

The state of Mathematics education is currently a source of concern given its crucial role in various areas of national life. If the trend persists, it may pose a threat to national development. Mathematics serves as the foundation for technology and science, which are critical drivers of societal progress. Mathematics and technology are essential in every profession today, as almost all fields have become automated. Additionally, Mathematics fosters computational skills that are vital for solving everyday problems and is a fundamental subject for further education in all higher institutions across diverse fields of study.

Several developed nations' economies are driven by science and technology, and Nigeria's goal to become one of the top 20 economies globally by 2020 emphasizes the significance of "science, technological, and vocational education". Mathematics education is pivotal to a country's economic success as mathematical approaches are prevalent in almost every aspect of human endeavor. Hence, Nigeria demands excellent mathematical performance from students at all levels of education to advance scientifically and technologically. Therefore, there is a need for collaborative efforts to enhance student's academic proficiency in mathematics, starting from the primary school level to establish a strong foundation for future studies.

Several scholars (Isa *et al*., 2020) have examined the relationship between teaching methods and pupils' academic performance. They reported that the method of teaching impacts pupils' academic performance. Researchers such as Osokoya (2013); Oni (2014); and Kabutu *et al*. (2015) observed that poor instructional strategies employed in the teaching of the subjects by teachers contribute to students' under-achievement. However, Kingdom-Aaron *et al*. (2019); Molla & Muche (2018); Yaduvanshi & Singh (2018) argued for child-centered learning strategies that promote pupils' active involvement in the teaching-learning

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process. These strategies shift the focus from the teacher to the learners, allowing them to solve problems, ask questions, discuss, explain, debate, and brainstorm in class. Such strategies view learners as active participants and enable them to bring their knowledge, experiences, and ideas to the table and part of such strategies is Reversed Jigsaw Instructional Strategy.

The Reverse Jigsaw teaching strategy is a cooperative learning technique that has gained popularity in recent years. It is a variation of the jigsaw technique, which is a well-established method of promoting collaboration and engagement among students (Aronson, 2002). In the Reverse Jigsaw technique, students become experts in a particular area and teach it to the rest of the class, taking the approach of the jigsaw technique one step further (Maitra & Staisloff, 2017).

This strategy is effective across all grade levels and content areas, promoting student-centered learning and increasing student motivation (Ma & Chen, 2018). By allowing students to take ownership of their learning and become experts in a specific topic, the Reverse Jigsaw technique promotes deep learning and knowledge retention.

The procedure of the Reverse Jigsaw teaching strategy involves several steps. First, the teacher divides the class into groups of four to six students. Next, each group is assigned a topic related to the lesson or unit. Each student within the group is then assigned a subtopic related to the group's main topic. Students research their subtopic and become experts on it. They gather information and develop a presentation to teach their subtopic to the rest of their group members (Ma & Chen, 2018). Once students have become experts on their subtopics, they return to their original group and teach their subtopics to their group members. The group then discusses each subtopic and works collaboratively to make connections between them. Finally, the whole class comes together, and each group presents its main topic and subtopics to the class (Maitra & Staisloff, 2017).

Many studies (Maitra & Staisloff, 2017; Agu & Samuel, 2018; Ma & Chen, 2018; Amani *et al*., 2019; Mayorga *et al*., 2020; Samuel & Sambo, 2019) have been conducted on the effect of reversed jigsaw instructional strategy but none of these studies was carried out to examine the effect of reverse jigsaw instructional strategy on the academic achievement of primary school pupils in mathematics, particularly in Ilorin West Local Government Area of Kwara State where the study was carried out.

Gender, which encompasses the set of qualities that differentiate femininity and masculinity, including biological sex is a variable of interest in this study. Several studies (Nnamani & Oyibe, 2016; Pirmohamed, *et al*., 2017) have investigated the impact of gender on academic achievement across various subjects, but have yielded conflicting results, justifying the inclusion of gender as a variable in this study.

Similarly, school type is also considered a moderator variable. Public schools are established and funded by the government and are not influenced by private interest groups or organizations, while private schools are controlled by individuals or groups of people (Babatunde, 2019). Previous research (Aransi, 2018; Kumwenda *et al*., 2018; Awodun & Oyeniyi, 2018) on the effect of school type on academic achievement has produced inconsistent and contradictory findings, warranting the need to include school-type as a moderator variable in this study.

The use of the teacher-centered method of teaching, which is often used by teachers, has been confirmed to be responsible for the poor performance of pupils in internal and external examinations in primary mathematics. The use of instructional strategies that encourage the active participation of pupils in teaching and learning activities has been suggested by

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researchers. Part of such a strategy is Reversed Jigsaw Instructional Strategy. Several studies have been conducted on Reversed Jigsaw Instructional Strategy.

Some studies have also been conducted on the effect of Reversed Jigsaw Instructional Strategy on learners' academic achievement in different school subjects other than mathematics. Furthermore, empirical studies have been carried out on the Reversed Jigsaw Instructional Strategy on students' achievement at secondary and tertiary levels of education but none of these studies was carried out to examine the effect of Reversed Jigsaw Instructional Strategy on pupils' academic achievement in primary mathematics. Hence, it is against this background that this study investigated the Reversed Jigsaw Instructional Strategy on primary school pupils' mathematics achievement in Ilorin, Kwara State. Research Hypotheses are

(i) Ho1: There is no significant effect of treatment on the academic achievement of pupils in Mathematics.

(ii) Ho2: There is no significant interaction effect of treatment and gender on the academic achievement of pupils in Mathematics.

2. METHODS

The study adopted a quasi-experimental research design with a factorial design of 2X2. A simple random sampling technique was used to select two (2) public primary schools in the Ilorin West Local Government Area of Kwara State. Primary four pupils in each of the selected schools were involved in the study. One of the two schools was the experimental group while the other was the control group.

The research instrument used in the study was the researchers' designed achievement test titled 'Mathematics Achievement Test (MAT)'. The MAT was drawn from the mathematics scheme of work for primary six, and it consisted of twenty-five (25) multiple-choice questions. The drafted questions for the MAT, Reverse Jigsaw Instructional Guide (RJIG), 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, the test-retest method was used.

The test was administered twice, with an interval of two weeks, to 20 pupils in primary six 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 0.77. The study lasted for 6 weeks and data collected were analyzed using Analysis of Covariance (ANCOVA).

3. RESULTS AND DISCUSSION

Table 1 shows that there was a significant effect of treatment on the academic achievement of pupils in Mathematics ($F(1; 88) = 482.222$, $P < 0.05$). The null hypothesis is therefore rejected in light of the result since the significant value (0.000) is less than 0.05. This implies that treatment had a significant effect on the academic achievement of pupils in Mathematics. The source of the significant difference is presented in **Table 2**.

Table 2 revealed that the significant effect revealed by **Table 1** is a result of the significant difference between the Reverse Jigsaw Instructional Strategy and the conventional method. Reverse Jigsaw Instructional Strategy refers to the experimental group, while the conventional method is known as a control group. This implies that those exposed to Reverse Jigsaw Instructional Strategy (74.02) performed significantly better than those exposed to the conventional method (52.24).

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Table 1 shows that there was no significant interaction effect of treatment and gender on the academic achievement of pupils in Mathematics (F (1; 88) = 1.122, P > 0.05). The null hypothesis is therefore not rejected in light of the result since the significant value (1.827) is greater than 0.05.

Table 1. Summary of analysis of covariance (ANCOVA) showing the effect of treatment on the academic achievement of pupils in mathematics.

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	10814.556[a]	4	2703.639	127.328	0.000
Intercept	0.085	1	0.085	0.004	0.950
Pretest	13.689	1	13.689	0.645	0.424
Treatment	10239.348	1	10239.348	482.222	0.000
Treatment * Gender	38.787	1	38.787	1.827	0.180
Error	1868.562	88	21.234		
Total	361058.000	93			
Corrected Total	12683.118	92			

Table 2. Summary of bonferroni's poc hoc pairwise comparison of the scores between the two groups.

Treatment	Mean	Experimental	Control Group
Reverse Jigsaw	74.02	*	
Conventional Method	52.24		*

The findings of the study revealed that there was a significant main effect of treatment on pupils' academic achievement in mathematics. This implies that pupils taught mathematics using Reverse Jigsaw 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 other pupils.

This finding is in tandem with the finding which unfolded that there were significant differences in the achievement of students taught using Reversed Jigsaw instructional strategies and the conventional (lecture) method. The finding further showed that reversed jigsaw was more effective than the lecture method. Furthermore, the finding of the study aligned with the finding of Amani *et al*., (2019) who reported that students taught with the use of Reversed jigsaw performed better than their counterparts taught with the convention method. On the other hand, however, the research report of Mayorga *et al*., 2020) uncovered that reversed jigsaw was not effective in knowledge acquisition.

Another finding of the study showed that there was no significant interaction effect of treatment and gender on the academic achievement of pupils in Mathematics. This finding was in tandem with the research report of Obafemi *et al*., (2023) which unfolded that there was no significant interaction effect of treatment and gender on pupils' academic achievement in mathematics in Kwara State. Similarly, Obafemi (2022) reported that there was no significant interaction effect of treatment and gender on pupils' academic achievement in social studies.

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4. CONCLUSION

Based on the findings of the study, it can be concluded that reversed jigsaw instructional strategy improves the academic achievement of pupils in mathematics regardless of gender. Based on the conclusion, the study recommended that primary school teachers should adopt the use of reversed jigsaw instructional strategy in teaching mathematics; Seminars, workshops, and conferences should be organized for teachers on how to use reversed jigsaw instructional strategy.

5. AUTHORS' NOTE

The authors declare that there is no conflict of interest regarding the publication of this article. The authors confirmed that the paper was free of plagiarism.

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