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Effect of round robin instructional approach on development of students' mathematical skills in secondary schools

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Abstract: The study investigated the effect of round robin instructional strategy on development of students' mathematical skills in secondary schools. The study was carried out in secondary schools in Ngor Okpala Local Government Area of Imo State, Nigeria. Three research hypotheses guided the study based on the objectives. The study was a quasi-experimental research type adopting the pre-test, posttest non equivalent control design. The instrument for data collection was a researcher made test titled "Mathematics achievement test MAT". The instrument had reliability coefficient of 0.75 determined using persons product Moment Correlation Coefficient (PPMC). The experiment group was taught using round robin instructional strategy, while the control group was taught using conventional approach. The data generated were analyzed using ANCOVA to test the hypotheses at 0.05 level of significance. The results of the study showed that the round robin instructional strategy increases students' mathematics achievement. No significant difference was found between the achievement scores of male and female students taught mathematics using the round robin instructional strategy. It was recommended that secondary school mathematics teachers should try to use round robin instructional strategies to teach mathematics in order to increase students' achievement.

INTRODUCTION

Mathematics has enormous value and contribution to all human activities and plays a key role in the scientific and technological development of all countries. Mathematics is often called the language of the universe, a tool for understanding and explaining the patterns and structures inherent in the world around us. It includes the study of numbers, shapes, quantities, patterns, structures, and the relationships between them. Mathematics teaches problem-solving skills that are important in many aspects of life, from everyday problems to complex scientific and technological advancements. By encouraging logical reasoning and critical thinking, we help people develop analytical skills that can be applied to a variety of fields. Mathematics helps us recognize patterns and patterns in data, nature, and society. The ability to identify patterns is essential to predicting and understanding the world. Mathematics is often revered for its elegance and beauty, manifested in the symmetry of geometric shapes, the harmony of mathematical equations, and the simplicity of its fundamental theorems. Knowledge of math opens the door to a wide range of career opportunities, including fields such as finance, engineering, data analytics, cryptography, academia, and more. Mathematics is a powerful tool that provides countless ways to understand the world, solve problems, and enrich our lives. Ale and Lawal (2010) as cited in Author et al. (2023) averred that the difference between a developed and developing nation is based on their level of mathematical attainment and

ingenuity. The importance of this singular subject made it a compulsory requirement for qualifying to read any course in any higher institution in Nigeria.

However, the students' outcome in this singular subject is not commensurate with the regards associated with it. West African Examinations Council (WAEC) Chief examiners (2020) report indicated a lack of improvement in students' achievement in the subject at the final secondary school examination over the years. Oni (2018) reported that poor performance in the subject is giving the public a serious concern, since it is viewed as a major impediment to the technological transformation of Nigeria. Graham-Brown, as cited in Oni (2018) stated that the importance placed on mathematics is reflected in the way parents and guardians show interest in their children's mathematics performance and further said that, people are often willing to pay for extra lessons in mathematics even when they can't afford to pay for extra lessons in other subjects. Causes of poor students' outcome in mathematics has been attributed to various factors such as, hatred, teachers' quality, teaching methods, curriculum issues, resource constraints, students' attitudes, evaluation processes, gender disparity and many others. Opolot-Okurot (2016) pinned the factors leading to learner's poor performance in Mathematics on inadequate teaching and learning resources, poor educational administration, teacher/learner attitude towards the subject, and poor teaching methodology.

Though several factors are reported to be responsible for students' poor performance in mathematics but teachers' method of teaching is more prominent in determining students' mathematics outcome. Ganyaupfu (2013) stated that poor academic performance of students is closely related to the use of ineffective teaching methods to convey information to students. Zalmon and Wonu (2017) linked the under achievement of Nigerian students to poor teaching practices in mathematics classrooms over several years. Similarly, Muharam et al. (2019) reported that teachers' teaching approaches significantly affect students' performance. The emphasis on teaching approaches and students' poor outcome in mathematics calls for a shift from the traditional teaching approach which is teacher-centered and seemingly unproductive to a more lucrative, student-centered and productive approach. Considering the importance of Mathematics to human and societal development, there is the need for adoption of effective teaching and learning strategies that improve students' academic achievement in mathematics so that youths can fully engage with science and technology, which are indicators of national development (Ayinla, 2015). The round robin instructional strategy is one innovative strategy that can transform students' mathematics achievement.

Round robin instructional strategy is defined as a teaching technique where students work in small groups of 4-6 members to share their knowledge on a given topic. In this strategy, each group member takes turns presenting or discussing a portion of the material, contributing their insights or findings. This strategy ensures that all group members participate actively in the learning process which helps promote collaboration and communication skills. Additionally, it provides opportunities for students to reinforce understanding of the topic through peer interaction. Also, students' cognitive abilities such as creativity, problem-solving skills and communication skills are developed by this strategy. Obafemi, et al (2024) has defined round robin instructional strategy as a collaborative learning approach that promotes student involvement, participation, and shared responsibility in the learning process. Slavin (2014) explained that round-robin strategy involves organizing pupils into groups and having them take turns presenting information, solving problems, or discussing topics. Every group member gets a chance to contribute, which promotes a collaborative learning atmosphere. The process typically follows a predetermined order, ensuring that every pupil gets an equal chance to participate. According to Aronson (2012), the Round Robin method of cooperative learning allows each member of a home group to arrive at a solution based on their own understanding and knowledge of the topic.

Round robin instructional strategy can enhance the teaching and learning of mathematics by promoting active participation, peer learning, communication skills, and critical thinking among students. The round robin instructional strategy is associated with the following importance: 1) Every student in the class gets an opportunity to actively engage in the learning process. Their contributions in turn, helps to maintain everyone's interest and focus. 2) It gives students the chance to express how they think and explain mathematical concepts. Peer explanations strengthen comprehension and foster the development of communication skills, both of which are essential in mathematics and other subjects. 3) Students can acquire knowledge from each other's explanations and approaches. This collaborative learning environment can cultivate a feeling of camaraderie in the classroom and allow students to benefit from diverse perspectives and problem-solving strategies. 4) As students take turns presenting their solutions, the teacher and peers can provide immediate feedback. This feedback loop allows for clarification of misunderstandings and reinforces correct mathematical reasoning. 5) it enables students build confidence towards their mathematical abilities. Regular opportunities to share their thinking and receive positive comments can give students more authority to take risks and become more confident problem solvers. 6) Students must listen attentively to their peers' explanations during round robin discussions. This helps develop active listening skills, which are essential for comprehending mathematical concepts and following complex mathematical arguments. 7) it enables students to think critically about their own and their peers' mathematical reasoning. Students acquire higher-order thinking abilities via the analysis and evaluation of various strategies and solutions, which are crucial for success in mathematics and other academic subjects.

Yaowamarn (2018) stated that learning should be student-centered and should use cooperative learning to help students develop their interpersonal skills. It supports the development of students' social skills, knowledge sharing, and community service. Johnson, Johnson, and Holubee (2015) stated that students higher academic test scores, increased self-esteem, more positive social skills, fewer stereotypes of people from different racial or cultural backgrounds, and a better understanding of the material and abilities they are studying are all associated with cooperative learning group tasks. Sholihah (2017) revealed that learners taught reading comprehension using round Robin strategy performed better than those taught using a conventional method. Obafemi et al (2024) in their study reported that, there was a significant effect of the round-robin strategy on the academic achievement of pupils in Mathematics. the resultant significant effect was pinned on the fact that the pupils had the opportunity to be actively engaged, interact, and learn from other children. Students taught electrochemistry utilizing the Round-Robin instructional strategy had a higher interest mean score than students taught using the usual way (Adigun et al., 2019). Roger and David (2017) suggested that the application of the Round Robin Cooperative Learning Strategy has a significant effect in the learning of mathematics concepts, including Geometry, Trigonometry, and Bearing and Distance, which appear to be harder. Usniati, et al. (2023) in a study on grade 3 SDK Tunas Daud, concluded that the introduction of the Round Robin Brainstorming cooperative learning model can enhance student learning results in theme lessons of mathematical materials.

Gender and students' performance in mathematics have been in dichotomy over time as no research consensus has been reached about them. For instance, Roger and David (2017) opined that gender contributes in the learning of mathematical concepts, hence male students tend to perform higher than female in Mathematics. Author et al. (2023) showed that there was no discernible difference in the mean achievement scores of male and female students taught mathematics using the flipped classroom technique, indicating that the achievement of students taught mathematics using this method was independent of gender. The poor performance of students in mathematics in secondary schools has become an academic virus that needs to be

terminated as its continuous existence will hinder the development of the nation economically, scientifically and technologically. Researchers have found that using the round robin educational technique helps pupils perform better in math and other areas. However, none of such studies have been reported within the locality of the presents study to the knowledge of the researcher.

Therefore, the study was carried out to determine the effect of round robin instructional strategy on development of students' mathematical skills in secondary schools in Ngor Okpala local government area of Imo state.

The main purpose of the present study was to investigate the effect of round robin instructional strategy on development of students' mathematical skills in secondary schools. Specifically, the study determined;

1). The difference between the mean achievement scores of students taught mathematics using round robin instructional strategy and those taught using conventional approach.

2). The effect of gender on the mean achievement scores of students taught mathematics using round robin instructional strategy.

The following research question were drawn to guide the study;

Ho_1: The mean achievement scores of students taught mathematics using round robin instructional strategy and those taught using a conventional approach do not differ significantly.

Ho_2: The mean achievement scores of male and female students taught mathematics using round robin instructional strategy do not differ significantly.

Ho_3: There is no significant interaction effect of treatment and gender on the achievement of students taught Mathematics using round robin instructional strategy.

METHOD

The study was a quasi-experimental type adopting the pre-test, posttest nonequivalent control design to determine the effect of round robin instructional approach on development of students' mathematical skills in secondary schools. Research design is shown thus;

$$X_1 \ldots\ldots\ldots\ldots n \ldots\ldots\ldots\ldots X_2$$
$$X_3 \ldots\ldots\ldots\ldots 0 \ldots\ldots\ldots\ldots X_4$$

Where, X_1 and X_3 = Pre-tests, X_3 and X_4 = Posttest, n = Treatment, O = No treatment.

Population of the study consists of all senior secondary school one (SS1) students in Ngor-Okpala local Government Area of Imo State, Nigeria. A sample of 150 students was drawn from 2 purposively selected coeducational secondary schools in the area. In each of the selected schools, 2 classes were randomly assigned to experiment and control groups. The sample consists of 66 males and 84 females. The experiment group consists of 70 participants (30 males and 40 females), while the control group consists of 80 participants (36 males and 44 females). The instrument for data collection was a researcher made 30 items objective test questions titled "Mathematics Achievement Test (MAT)". The construction of the instrument was guided by a table of specification. The validity of the instrument was determined by 2 mathematics teachers and a measurement and evaluation expert. Their expert judgement guided the reorganization of the instrument. The reliability of the instrument was determines using persons product moment correlation coefficient (PPMC) which gave a reliability coefficient of 0.75. Both groups were given a pre-test to ensure their cognitive equity. The experiment groups were taught factorization by a trained research assistant using a round robin strategy designed lesson plan, while the control groups were taught the same concept by their various classroom mathematics teachers using a conventional approach designed lesson plan. The researcher

monitored the progress of the entire process to ensure that the procedures were duly maintained. The entire process lasted for 4 weeks after that, a posttest was administered to both groups and scored over 100%. The generated data were analyzed using Analysis of Covariance (ANCOVA) to test the hypotheses at 0.05 level of significance.

RESULTS AND DISCUSSION

H_{o1}: The mean achievement scores of students taught mathematics using round robin instructional strategy and those taught using a conventional approach do not differ significantly.

Table 2: Summary of analysis of ANCOVA.

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	13805.774[a]	4	3451.444	45.657	.000
Intercept	14503.320	1	14503.320	191.857	.000
Pretest	119.940	1	119.940	1.587	.210
Gender	**95.908**	**1**	**95.908**	**1.269**	**.262**
Method	**13516.989**	**1**	**13516.989**	**178.809**	**.000**
Sex * Method	.923	1	.923	.012	.912
Error	10961.219	145	75.595		
Total	260863.000	150			
Corrected Total	24766.993	149			

Table 2 shows that f(1, 145= 178.809, $P < 0.05$), based on the result, the null hypothesis is rejected and the alternative accepted. This implies that the mean achievement scores of students taught mathematics using round robin instructional strategy and those taught using a conventional approach differ significantly

H_{o2}: The mean achievement scores of male and female students taught mathematics using round robin instructional strategy do not differ significantly.

Table 3: Summary of analysis of ANCOVA.

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	13805.774[a]	4	3451.444	45.657	.000
Intercept	14503.320	1	14503.320	191.857	.000
Pretest	119.940	1	119.940	1.587	.210
Gender	**95.908**	**1**	**95.908**	**1.269**	**.262**
Method	13516.989	1	13516.989	178.809	.000
Sex * Method	.923	1	.923	.012	.912
Error	10961.219	145	75.595		
Total	260863.000	150			
Corrected Total	24766.993	149			

Table 3 shows that f(1, 145= 1.269, P > 0.05), based on the result, the null hypothesis is upheld and the alternative rejected. This implies that the mean achievement scores of male and female students taught mathematics using round robin instructional strategy do not differ significantly.
H_{O3}: There is no significant interaction effect of treatment and gender on the academic achievement of students taught Mathematics using round robin instructional strategy.

Table 4: Summary of analysis of ANCOVA.

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	13805.774[a]	4	3451.444	45.657	.000
Intercept	14503.320	1	14503.320	191.857	.000
Pretest	119.940	1	119.940	1.587	.210
Gender	95.908	1	95.908	1.269	.262
Method	13516.989	1	13516.989	178.809	.000
Gender * Method	**.923**	**1**	**.923**	**.012**	**.912**
Error	10961.219	145	75.595		
Total	260863.000	150			
Corrected Total	24766.993	149			

Table 4 shows that f(1, 145= .923, P > 0.05), based on the result, the null hypothesis is upheld and the alternative rejected. This implies that there is no significant interaction effect of treatment and gender on the academic achievement of students taught Mathematics using round robin instructional strategy.

The study's findings demonstrated that using a round robin instructional strategy is a useful way to raise students' mathematics proficiency. The test of the hypothesis showed that, the mean achievement scores of students taught mathematics using round robin instructional strategy and those taught using a conventional approach differ significantly. The result is not strange because, the strategy is student-centered, allowed the students to have a deep study of the concept, interacting with each other, communicated freely and participated actively. This result is in agreement with Obafemi et al. (2024) and Asari et al. (2017) who variously in their study revealed the effectiveness of the round Robin strategy in improving students' achievement and holistic ability.

The study revealed that the mean achievement scores of male and female students taught mathematics using round robin instructional strategy do not differ significantly. This result is suspected to have emanated from the liberal nature of round robin instructional strategy as it did not give room for any form of gender stereotype and allowed equity in participation. The result is in line with Author and Ajuzie (2021) which revealed that the achievement of male and female students taught mathematics utilizing a multimedia instructional approach (MIA) did not differ significantly.

Finally, the revealed that, there is no significant interaction effect of treatment and gender on the academic achievement of students taught Mathematics using round robin instructional strategy. This result is in tandem with the finding of Obafemi et al. (2024) which

showed that the academic achievement of students in mathematics was not significantly interact with treatment and gender.

Recommendations

Considering the findings of the study, the following recommendation are made;

1) To increase students' achievement, secondary school teachers should make an effort to teach mathematics utilizing the round robin instructional strategy.

2). Mathematics associations, the government, and school administrators should host conferences, workshops, and seminars on cutting-edge methods that help raise students' mathematics proficiency, such the round-robin instructional strategy.

3) To help teachers implement the round robin instructional strategy in the classroom, curriculum planners should include it in the mathematics curriculum.

CONCLUSION

The study was conducted to investigate the effect of round robin instructional strategy on development of students' mathematical skills in secondary schools. The findings of the study demonstrated that the use of a round robin instructional strategy increased gender equity in secondary school mathematics achievement and proficiency.

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