Journal of Capital Development in Behavioural Sciences Vol. 13 Issue II (September, 2025)
Faculty of Arts & Education, Lead City University, Ibadan, Nigeria
***ISSN Online:** 2449-0679 **ISSN Print:** 2354-3981*

Effects of Case-based and Team-based Teaching Strategies on Word Problems in Primary School Mathematics in Ibadan, Nigeria

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Abstract

This study investigated Effect of Case-based and Team-based Teaching Strategies on Word Problems in Primary School Mathematics in Ibadan North-West Local Government Area, Oyo State. Three hypotheses were formulated and tested at 0.05 level of significance. Quasi-experimental design was adopted for the study. Multi-stage sampling procedure was adopted where three private primary schools from 11 wards in Ibadan North-West Local Government Area, Oyo State were stratified and purposively selected. A sample size of 86 pupils comprised 43 boys and 43 girls were involved in the study. Primary four intact classes were used in each of the three selected private primary schools. Instrument used for data collection was Primary Mathematics Word Problems Achievement Test (KR-20=0.86). Analysis of Covariance (ANCOVA) was used for data analysis at 0.05 level of significance. There was a significant main effects of Case-based Teaching Strategy on Achievement of Primary School Pupils in Mathematics[$F_{(1,51)}=58.624$, $P<0.05$, $\eta^2=0.535$] and Team-based Teaching Strategy on Achievement of Primary School Pupils in Mathematics word problems[$F_{(1,55)}=45.008$, $P<0.05$, $\eta^2=0.450$]. From the findings, it was concluded that Case-based andTeam-based teaching strategies were effective in teaching word problems in primary school Mathematics. Based on the results, it was recommended that both teaching strategies should be

adopted by the teachers in teaching word problems in Primary school Mathematics to enhance pupils' academic achievement.

Keywords: Case-based teaching strategy, Team-based teaching strategy, Primary schools in Ibadan, word problems in mathematics, academic achievement.

Introduction

Mathematics affects every element of human life. Aspects of human life that are centred on numbers include social, economic, political, geographical, scientific, and technical. No matter what kind of employment or professional path a person chooses, Mathematics is still a necessary skill that will help him/her to be productive on their job (Mawaddah, Hasratuddin & Rajagukguk, 2020). Understanding Mathematics is essential for daily living and long-term planning while it is not only useful for one's career or the advancement of the country. Mathematical education has a major impact on national development even though it can enhance mental faculties and creativity. Any country's ability to improve technologically and scientifically is reliant on its ability to implement an efficient system of Mathematics education(Almira, Abdurrahman, Lengkana & Jalmo, 2022). Well-designed Mathematics curricula and educational systems have been shown to benefit industrialized nations much because they are the cornerstone of advancements in science, technology, and the economy. Nigerian government has made Mathematics a required subject from primary school through secondary school because it is dedicated to helping its citizens develop in this way (Mawaddah, Hasratuddin & Rajagukguk, 2020; Subawo, 2022).

Primary education is described by the Federal Republic of Nigeria in her National Policy on Education as instruction provided to children between the ages of six and twelve (Adebayo, 2023). Primary education serves as the foundation for the rest of the educational system and it is crucial to her success or failure. It is clear from this that, fundamentally

in primary education, sound attitudes and reading and numeracy abilities are developed in an appropriate manner. Every pupil in primary or secondary school is required to take Mathematics and English studies, with one of the three major Nigerian languages: Hausa, Yoruba, or Igbo as core courses (Helen, 2021). Not only is Mathematics taught as a vital subject in primary schools, but it is also called the father of all science subjects. The government of Nigeria has made Mathematics a core subject and requires it for primary school pupils, demonstrating the value of the subject (Muntian & Lebyedyeva, 2020).

The main goal of Mathematics is problem solving. Every decision is made after translating every statement to a mathematical statement and determining what and how to answer these questions in order to find the optimum solution. Word problems are commonly described as verbal descriptions of problem situations that are presented in an academic setting. These problems pose one or more questions, the answers to which can be found by applying mathematical operations to the numerical data that is either directly from the problem statement or can be derived from it. Across the globe, word problems have traditionally played a significant role in Mathematics education (Bari'ah, Shahrill & Asamoah, 2023). Their historical contribution to Mathematics instruction goes all the way back to antiquity. One type of problem that Mathematics learners find particularly challenging is word problems. Based on this, it has been the focus of an enormous amount of research for the past fifty years (Meghie, 2023).

Pupils' performance in both internal and external examinations, such as the National Common Entrance and State Common Entrance Examinations and other entrance examinations into secondary schools, is still very low and below expectation, despite efforts by the Federal and State governments to prioritise Mathematics in primary schools (Utkun & Birgili, 2023; Giancarla, 2020). However, over time, primary school pupils' academic performance in the subjects' components has not improved (Muntian & Lebyedyeva, 2020).

Effectively teaching word problems in Mathematics requires the use of a variety of techniques to aid pupils in comprehending the process of problem-solving. It is possible to establish a supportive learning environment where pupils feel competent and confident in their ability to solve mathematical word problems by instructing pupils on how to read the problem carefully and comprehend it. Assign pupils to the task of differentiating between the word problem's pertinent and irrelevant information. Urge them to concentrate on the specifics that are necessary to resolve the issue. To assist pupils in visualizing the problem, include visual aids like charts, graphs, and diagrammes. This can help with comprehension and make difficult problems more approachable (Utkun & Birgili, 2023; Svitlana, Onoprienko & Romanyshyn, 2021).

Case-based teaching involves presenting pupils with real-life scenarios or cases that are relevant to the subject matter. In the context of primary school Mathematics, this approach would entail using word problems that reflect practical situations, such as counting objects, sharing items among friends, or solving everyday Mathematics tasks. The goal is to engage pupils by relating mathematical concepts to their daily lives, fostering critical thinking, and encouraging problem-solving in context. Case-based teaching strategy in primary school Mathematics can be highly beneficial for several reasons such as: Case-based learning techniques give mathematical ideas real-world applications. By connecting mathematical ideas to real-world scenarios, pupils are able to make abstract ideas more approachable and clear. Pupils' attention can be piqued by real-world examples and situations. Pupils are more likely to be interested in and motivated to solve mathematical problems when they are presented in a relevant context (Choi, 2020).

A variety of learning styles and skill levels can be accommodated via case-based tactics. Varied approaches to the content can be used by pupils with varied degrees of mathematical skill by creating a more inclusive learning environment. Problem-solving abilities are crucial in real-world situations, and teaching Mathematics through examples

equips pupils for these kinds of situations. It aids in the development of their capacity to use mathematical reasoning to solve problems that they might run into in their daily life and in their future careers. A common tactic used in case-based learning is to pose questions and give pupils the freedom to investigate and come up with answers on their own. This encourages inquiry-based learning, which is a useful strategy for cultivating an autonomous and inquiring attitude (Irwan, 2022).

Team-based learning is an active teaching technique and small group learning approach that gives pupils opportunities to apply theoretical knowledge through a set of tasks that involve both individual and group work as well as instant feedback (Roossien, Tobias, Spaai & Rien de Vos, 2022). In large classrooms with over 100 pupils or smaller ones with under 25 pupils, it is utilised. Pupils are separated into groups, with each group consisting of five to seven pupils in a single classroom. The following three stages are repeated in sequence when team-based learning is applied: First section: pupils hunt up information on their own and study outside of class; in the second section, learners complete an individual readiness assurance test to gauge their level of basic comprehension of the theories and data they have learned. A group of five to seven pupils was pre-assigned and given the same test. In this group readiness assurance test, each option was settled by the team bureaucracy. Third section: groups of pupils work on activities that provide chances to apply knowledge in challenging real-world scenarios. Team-based learning improves peer teaching and learning, encourages pupils to actively learn and participate with the course material and in-magnificient activities, motivates primary school pupils to take responsibility for their own learning, and makes it possible for pupils to effectively apply the principles they have learned in class to real-world situations (Charles, 2022).

Pupils are divided into small groups to collaborate to solve problems as part of team-based teaching which is also referred to as collaborative or cooperative learning. Within the field of Mathematics,

pupils might be given word problems that call for group work to be solved. By encouraging collaboration, communication, and the sharing of ideas, this approach helps pupils to learn from one another and develop their problem-solving abilities in a group setting. Using team-based teaching techniques in Mathematics classes in primary school has a number of advantages that add up to a comprehensive and successful learning process (Kondratieva, 2020). Pupils work together more when they use team-based strategies. They can exchange ideas, debate topics, and gain knowledge from one another when they work in teams. This cooperative strategy promotes a sense of belonging and assistance between individuals (Charles, 2022; Chechukwu, 2021).

Pupils' social and emotional skills are enhanced through collaborative learning in groups. They gain skills in effective communication, dispute resolution, and teamwork toward shared objectives. These abilities are essential to their overall growth. Teams make differentiated instruction possible because they enable pupils with diverse skill levels to collaborate. A more inclusive learning environment can be created by peers helping and supporting one another. Pupils can explain topics to their teammates through the use of team-based tactics, which promote peer teaching. Pupils' comprehension of mathematical concepts is reinforced when they teach it to others, and it also enables them to better comprehend it themselves. Solving problems is a common task in Mathematics. Through cooperative learning and a variety of viewpoints, pupils can solve Mathematical problems as a group in team-based activities, which improves their problem-solving abilities. When pupils collaborate in groups, they are frequently more involved in their studies. Mathematical enjoyment can be increased by the social component of cooperative learning, which also lowers anxiety and fosters a positive attitude toward the subject (Giacomell, Gitahy & Terçariol, 2021; Charles, 2022).

Pupils' confidence can be increased through team-based learning. Their sense of accomplishment and confidence is bolstered when they

share their ideas, work well in a team, and get good feedback. Good communication is essential for teamwork. Pupils gain knowledge on how to listen to others, communicate their ideas clearly, and participate in productive debates. These are useful communication skills outside of the classroom as well. Solving problems that call for critical thought is a common part of team-based activities. Pupils can approach problems from numerous angles when they collaborate with classmates which improve their analytical skills. A lot of real-world scenarios need collaboration, which is similar to what collaborative learning in teams looks like. Pupils learn collaboration skills in the classroom, which are critical for success in their future academic and professional endeavors. When working as a team, pupils contribute a variety of viewpoints and methods to problem-solving. Their comprehension of Mathematical ideas is improved and their thinking is expanded when they are exposed to diverse points of view (Park, 2020).

Aim and Objectives of the Study

The aim of this study is to investigate "Effects of Case-based and Team-based Teaching Strategies on Word Problems in Primary School Mathematics in Ibadan, Nigeria."

The objectives are to:

i. determine the main effect of Case-based teaching strategy on academic achievement of primary school pupilsin Mathematics word problems.
ii. determine the main effect of Team-based teaching strategies on academic achievement of primary school pupilsin Mathematics word problems.

Hypotheses

The following Null Hypotheses were formulated at 0.05 significance level in the study.

$H_0$1: There will be no significant main effect of Case-based teaching strategy on academic achievement of primary school pupils in Mathematics word problems.

$H_0$2: There will be no significant main effect of Team-based teaching strategy on academic achievement of primary school pupilsin Mathematics word problems.

Methodology

This study used the pre-test – post-test method of quasi-experimental research design.Multistage sampling procedure that comprises two stages was employed. Stage one involves stratification of 11 wards in Ibadan North-West Local Government Area into three stratified groups

Stage two involves the purposive selection of three private primary schools, one from each stratified group. From group one: St. Mary's Model School, Oke Padre, Ibadan was selected. From group two: All Saints' Church School, Jericho, Ibadan was selected while from group three: Sacred Heart Private School, Onireke, Ibadan was selected.The three private primary schools in Ibadan North-west Local Government Area, Oyo State were purposively selected for this study because they are the oldest mission schools from each stratified ward range.

The instrument used to collect data to assess pupils' academic achievement in Primary school Mathematics word problems was Primary Mathematics Word Problems Achievement Test. The instrument consists of 30 items source from Common Entrance Examination past questions.

Face and content validity assessment of the instrument (PMWPAT) was used for validation by the experts through vetting of the instrument (PMWPAT) for necessary correction before being used to assess achievement of the participants in primary school Mathematics.

Kuder-Richardson (KR-20) was used to calculate the reliability value of the instrument (PMWPAT) by administer the instrument on another set of participants from another school apart from the selected

schools but share the same characteristics. The reliability value of the instrument (PMWPAT) was r = 0.86.

Analysis of Covariance (ANCOVA) was used to test the data collected and all the hypotheses were tested at 0.05 level of significance.

Results and Discussion of Findings

$H_0$1: There will be no significant main effect of Case-based Teaching Strategy on Academic Achievement of Primary School Pupils in Mathematics word problems.

The Analysis of Covariance (ANCOVA) result on the effect of Case-based Teaching Strategy on Academic Achievement of Primary School Pupils in Mathematics word problems was; $F_{(1,51)}=58.624$;$p < 0.05$ and $\eta^2= 0.535$. The null hypothesis $H_0$1 was rejected. There was significant main effect of case-based teaching strategy on Achievement of Primary School Pupils in Mathematics word problems [$F_{(1,51)}=58.624$, $p < 0.05$, $\eta^2= 0.535$]as revealed in Table 1.

Table 1: Test of Between–Subject Effects of Case-Based Teaching Strategy on Primary School Pupils' Academic Achievementin Mathematics word problems

Dependent Variable: Posttest

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	1175.513[a]	2	587.757	60.436	0.000	0.703
Intercept	54.840	1	54.840	5.639	0.021	0.100
Pretest	977.505	1	977.505	100.512	0.000	0.663
Strategy	570.129	1	570.129	58.624*	0.000	0.535
Error	495.987	51	9.725			
Total	**18845.000**	**54**				
Corrected Total	**1671.500**	**53**				

a. R Squared = 0.703 (Adjusted R Squared = 0.692)

* denote significant difference at $p < 0.05$

Source: *Fieldwork 2024*

$H_0$2: There will be no significant main effect of Team-based Teaching Strategy on Academic Achievement of Primary School Pupils in Mathematics word problems.

The Analysis of Covariance (ANCOVA) result on the effect of Team-based Teaching Strategy on Academic Achievement of Primary School Pupils in Mathematics word problems was; $F_{(1,55)}=45.008, P < 0.05$ and $\eta^2= 0.450$. The null hypothesis $H_0$2 was rejected. There was significant main effect of Team-based Teaching Strategy on Academic Achievement of Primary School Pupils in Mathematics word problems [$F_{(1,55)}=45.008$; $p < 0.05$, $\eta^2= 0.450$] as revealed in Table 2.

Table 2: Test of Between–Subject Effects of Team-Based Teaching Strategy on Primary School Pupils' Academic Achievementin Mathematics word problems

Dependent Variable: Posttest

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	1493.238[a]	2	746.619	52.419	0.000	0.656
Intercept	152.723	1	152.723	10.722	0.002	0.163
Pretest	950.002	1	950.002	66.698	0.000	0.548
Strategy	641.067	1	641.067	45.008*	0.000	0.450
Error	783.382	55	14.243			
Total	**23750.000**	**58**				
Corrected Total	**2276.621**	**57**				

a. R Squared = 0.656 (Adjusted R Squared = 0.643)

* denote significant difference at $p < 0.05$

Source*: Fieldwork 2024*

Discussion of Findings

There was a significant main effect of case-basedteaching strategy on achievement of primary school pupils in mathematicsword problems which is in line with previous studies.Developing mathematics written communication through Case-Based learning (Suratno, Hamid & Waliyanti 2023). The results of earlier research indicated that students who were assigned to learning instruction and those who receive conventional teaching differed in their aptitude for mathematical communication. Students in the experiment class were better at communicating than those in the control group. Thus, one choice for improving students' communication skills is case-based learning.Also the result is in line with this previous study: Effect of Visualised Case-based

Learning Strategy (VCBL) on Students' Performance in Chemistry in Ibadan Metropolis, Nigeria (Idika, 2021). The findings indicated a significant main effect of treatment on students' accomplishment in Chemistry; this suggests that there is a substantial difference in posttest scores between the treatment and conventional groups in terms of students' achievement. It was determined that by encouraging learning transfer, the VCBL approach has the potential to help students comprehend chemistry. This led to a discussion of the ramifications and the making of pertinent recommendations. In spite of the fact that this study and the previous studies were contrast in subject matter. They both applied the same teaching strategy (Case-based Learning) during the course of study with the same result.

There was a significant main effect of team-based teaching strategy on achievement of primary school pupils in Mathematics word problems which is in line with previous study: Students' Perception of the Application of Team-based Problem-Solving Method and its Effect on Mathematics Performance: The case of Secondary Schools in Awi-zone, Ethiopia (Ahmed, Melesse & Wondimuneh 2020).The study's findings demonstrated that students' reactions to the use of team-based problem-solving learning were favourable. The quantitative results showed that team-based problem-solving instruction has a significant impact on students' learning and, in turn, their performance in Mathematics. The qualitative information revealed the students' general skills and assisted teachers in comprehending how the students saw the knowledge they had acquired from the learning exercises. Additionally, it was shown that students were accustomed to collaborative projects in Mathematics classes. In conclusion, team-based problem-solving learning is an effective strategy for helping students learn Mathematics more quickly and more effectively than they have in the past. Irrespective of their different in geographical location and educational levels, the findings still shows the same results that team teaching strategy is significantly effective to improve academic achievement in Mathematics.

There was a significant interaction effectof Case-based and Team-based Teaching Strategies on Academic Achievement of Primary School Pupils in Mathematics word problems which opposed previous study: Problem-based learning and Case-based learning: Which is more Effective for Fostering Mathematical Connection (Dewi & Nurjanah 2022). The outcomes demonstrated that improving Mathematical connection ability was a successful goal of both the PBL and CBL strategies. But there was no discernible difference in the students' capacity to make Mathematical connections between the PBL and CBL study methods. The findings of this study lead educators to design suitable lessons that will develop students' capacity for Mathematical connection. There are notable distinctions in significance and approaches to teaching tactics even though both researches look at the effect of interactions on different topic matters.

Conclusion

From the findings of this study, it is concluded that case-based teaching strategy and team-based teaching strategy were effective to teach word problems in primary school mathematics.

Recommendations

Based on the findings, the following recommendations are made:

i. Class teachers should be encouraged to use Cased-based teaching strategy to teach word problems in Primary school Mathematics.
ii. Team-based teaching strategy should be used to teach word problems in Primary school Mathematics.

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