



Effects of Storytelling and Problem-Based Teaching Strategies on Academic Achievement in Mathematics Word Problems among Middle Basic Pupils in Oyo South Senatorial District, Nigeria

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Abstract

The persistent challenges associated with pupils' underachievement in Mathematics word problems have been largely attributed to ineffective instructional approaches and variations in learning environments. This study examined the effects of two teaching strategies (Storytelling and Problem-based) on Middle Basic pupils' academic achievement in Mathematics word problems in Oyo South Senatorial District, Nigeria. One hypothesis was formulated and tested at 0.05 level of significance. This study was anchored on Constructivist Learning Theory. A quasi-experimental research design was adopted, while the population comprised 142,860 Middle Basic pupils in Oyo South Senatorial District, from which 85 pupils were selected using intact classes from selected public and private schools. A Middle Basic Mathematics Word Problems Achievement Test (MBMWPAT) (KR-20 = 0.79) and Instructional Guide for Teaching and Learning Middle Basic Mathematics Word Problems based on the treatments (storytelling, problem-based and traditional teaching strategies) adopted for this study. Data were analyzed using Analysis of Covariance (ANCOVA). There was a significant effect of treatment on Middle Basic pupils' academic achievement in Mathematics word problems ($F(2, 81) = 6.467, p < 0.05$, partial $\eta^2 = 0.138$). The study concludes that storytelling and problem-based teaching strategies significantly enhance pupils' achievement in Mathematics word problems. It therefore recommends the integration of these learner-centered instructional approaches into Mathematics teaching.

Keywords: academic achievement, mathematics word problems, storytelling strategy, problem-based learning

1 Introduction

Mathematics occupies a central position in the educational system because it provides learners with the logical reasoning, analytical thinking, and problem-solving skills required for academic success and everyday life. Despite its importance, pupils at the basic education level continue to experience considerable difficulties in solving Mathematics word problems. Mathematics word problems require learners to interpret linguistic information, identify relevant mathematical relationships, translate verbal statements into mathematical expressions, and apply appropriate solution procedures. Consequently, success in word-problem solving depends not only on computational ability but also on comprehension, reasoning, critical thinking, and application skills. The persistent underachievement of pupils in Mathematics word problems has been attributed to several factors. These include poor reading and comprehension skills, inadequate mathematical vocabulary, Mathematics anxiety, low motivation, limited critical-thinking abilities, poor problem-solving skills, insufficient instructional resources, and the continued dominance of teacher-centred instructional practices in many classrooms (Chan & Kwan, 2021; Moleko, 2021; Mallika & Mohammed, 2024; Xie et al., 2024). Among these factors, the widespread use of the traditional teaching method has received considerable attention in educational literature.

The traditional teaching method is characterized by teacher domination of classroom activities, excessive reliance on lecture and explanation, rote memorization, limited pupil participation, and minimal opportunities for active exploration and collaborative learning. Under this approach, pupils often become passive recipients of information rather than active constructors of knowledge. As a result, many learners struggle to connect mathematical concepts with real-life situations, particularly when solving word problems that require interpretation and critical analysis. Studies have consistently shown that conventional teaching methods contribute to low learner engagement, reduced motivation, poor conceptual understanding, and weak problem-solving performance (Hu, 2024; Damayanti et al., 2024; Amirova, 2025). The limitations of the traditional approach have encouraged educational researchers and practitioners to seek learner-centred instructional strategies capable of promoting meaningful learning and improving achievement. Among the innovative

approaches that have gained increasing attention are storytelling teaching strategy and problem-based teaching strategy. These strategies are rooted in constructivist learning principles, which emphasize active learner participation, contextualized learning experiences, collaboration, inquiry, and knowledge construction (Montecillo, 2024; Nurhasnah et al., 2024; Wibowo et al., 2025).

Storytelling teaching strategy presents mathematical concepts through narratives, real-life experiences, and meaningful contexts that help learners visualize abstract ideas and connect new knowledge with prior experiences. Through stories, pupils become emotionally and cognitively engaged, thereby enhancing comprehension, retention, and application of mathematical concepts. Similarly, problem-based teaching strategy engages learners in solving authentic and meaningful problems, encouraging critical thinking, collaboration, inquiry, and independent learning. Both approaches contrast sharply with the traditional teaching method by positioning learners at the centre of the instructional process. Given the growing body of evidence supporting innovative instructional strategies, it becomes necessary to examine whether storytelling and problem-based teaching strategies can significantly improve Middle Basic pupils' academic achievement in Mathematics word problems when compared with the traditional teaching method. This necessity provides the basis for the present study conducted among Middle Basic pupils in Oyo South Senatorial District.

Mathematics word problems remain one of the most challenging aspects of Mathematics learning among pupils at the basic education level. Despite the importance of word-problem solving in developing logical reasoning, critical thinking, and real-life application of mathematical concepts, many Middle Basic pupils continue to record poor achievement in this area. This persistent underachievement has been linked to difficulties in interpreting problem statements, translating verbal information into mathematical expressions, and applying appropriate solution strategies. The situation is further compounded by the continued reliance on the traditional teaching method, which is largely teacher-centred and often limits pupils' active participation, critical thinking, creativity, and engagement during instruction. Consequently, many pupils memorize procedures without fully understanding the underlying concepts required for effective problem solving. Although innovative instructional approaches such as storytelling and problem-based teaching strategies have been reported to improve learners' understanding, motivation, and achievement in Mathematics, their effectiveness in enhancing Middle Basic pupils' achievement in Mathematics word problems within Oyo South Senatorial District has not been sufficiently established. It is against this background that this study seeks to investigate the effects of storytelling, problem-based teaching strategy, and traditional teaching method on Middle Basic pupils' academic achievement in Mathematics word problems in Oyo South Senatorial District.

1.1 Aim and Objectives of the Study

The aim of this study is to investigate the Effects of Storytelling and Problem-based Teaching Strategies on Middle Basic Pupils' Academic Achievement in Mathematics Word Problems in Oyo South Senatorial District.

The objective is to:

1. Examine the effect of storytelling and problem-based teaching strategies, relative to the traditional teaching method, on Middle Basic pupils' academic achievement in Mathematics word problems in Oyo South Senatorial District, Nigeria
2. Determine the effect of Treatments on Middle Basic Pupils' Academic achievement in Mathematics word problems in Oyo South Senatorial District.

1.2 Research Question

What is the effect of storytelling and problem-based teaching strategies, relative to the traditional teaching method, on Middle Basic pupils' academic achievement in Mathematics word problems in Oyo South Senatorial District, Nigeria?

1.3 Hypothesis

The null hypothesis below was formulated and tested at 0.05 level of significance:

H_{01} : There is no significant effect of Treatment on Middle Basic Pupils' Academic achievement in Mathematics word problems in Oyo South Senatorial District.

2 Theoretical Framework

This study is anchored on Constructivist Learning Theory, which holds that learners actively construct their own understanding through experience, reflection, and interaction with their environment, rather than passively absorbing information transmitted by a teacher (Nurhasnah et al., 2024). The theory draws on the work of Piaget, whose account of cognitive development describes learning as a process of assimilation and accommodation as children build increasingly sophisticated mental models, and Vygotsky, whose concept of the Zone of Proximal Development highlights how learners achieve more with the scaffolding and guidance of teachers or more capable peers (Veraksa et al., 2022). Bruner further extended these ideas through discovery learning and the spiral curriculum, arguing that pupils learn best when encouraged to explore, hypothesize, and draw conclusions independently, and that complex ideas can be introduced at a simplified level early on and revisited later in greater depth as the learner's understanding matures (Rannikmäe et al., 2025).

Constructivist approaches to teaching have since been shown to support the development of critical thinking, collaboration, and other transferable competencies when learners are placed at the centre of instruction rather than positioned as passive recipients of knowledge (AlAfnan & Dishari, 2024). Storytelling and problem-based teaching strategies were selected for investigation in this study because both give practical expression to these constructivist principles within the Mathematics classroom. Storytelling embeds word problems within familiar narratives and real-life situations, allowing pupils to visualize abstract relationships and connect new mathematical knowledge to prior experience. Problem-based teaching strategy, by contrast, immerses pupils directly in authentic problem situations that call for exploration, reasoning, and often collaborative sense-making, echoing Bruner's emphasis on discovery through active investigation (Rannikmäe et al., 2025). Both approaches position the pupil, rather than the teacher, at the centre of the learning process (Nurhasnah et al., 2024). On this theoretical basis, it was hypothesized that pupils exposed to storytelling and problem-based instruction would record significantly higher achievement in Mathematics word problems than pupils taught through the traditional, teacher-centred method.

3 Methodology

This study adopted a quasi-experimental research design. The population of the study comprised 142,860 Middle Basic V pupils: 100,219 in public schools and 42,641 in private schools drawn from 3,312 primary schools (612 public and 2,700 private) across the nine Local Government Areas that make up Oyo South Senatorial District, Oyo State, Nigeria as at the time of conducting this research (Oyo State Universal Basic Education Board [SUBEB], 2025; Ministry of Education, Science and Technology, Oyo State, 2025). From this population, six basic schools (three public and three private) were purposively selected based on criteria such as the availability of qualified Mathematics teachers, adequate classroom facilities, and regular participation of pupils in internal and external examinations. Intact classes within the selected schools were then randomly assigned to two experimental conditions and one control condition. The first experimental group consisted of pupils taught Mathematics word problems using the Storytelling Teaching Strategy, the second experimental group comprised pupils taught using the Problem-Based Teaching Strategy, while the control group was taught the same word-problem concepts using the Traditional Teaching Strategy. Since intact classes rather than individually randomized pupils formed the basis of group assignment, the study followed a quasi-experimental design, and pupils' pretest scores were subsequently entered as a covariate in the ANCOVA to account for any initial differences in ability across the groups prior to the assessment of treatment effects.

A total of 85 Middle Basic V pupils constituted the final analytic sample for this study, comprising 39 pupils from public schools and 46 from private schools. Out of the 85 pupils, the Problem-Based group comprised 29 pupils in total, made up of 18 from public schools and 11 from private schools. The Storytelling group comprised 25 pupils in total, made up of 12 from public schools and 13 from private schools. The Traditional group, which served as the control, comprised the largest number of pupils at 31, made up of 9 from public schools and 22 from private schools. This distribution shows that while all three treatment groups included pupils from both school types, the proportion of public to private school pupils varied somewhat across groups, with the Traditional group drawing more heavily from private schools and the Problem-Based group drawing more heavily from public schools. This variation is taken into account in interpreting the results, given that school type was not formally tested as an independent factor in the ANCOVA model but is acknowledged as a contextual feature of the sample.

The instrument used for data collection was the Middle Basic Mathematics Word Problems Achievement Test (MBMW PAT). The instrument consisted of 30 multiple-choice items, each with four options lettered A to D, from which participants selected one correct answer. Pupils were given 45 minutes to complete all items. The instrument was divided into two sections: Section A collected pupils' demographic information, including school name and school type, while Section B contained the 30 achievement items, drawn from five word-problem content areas: Number and Numeration (17 items), Basic Operations (9 items), Measurement (2 items), Geometry (1 item), and Data Handling (1 item). Items were further distributed across four of Bloom's cognitive levels: Knowledge (9 items), Comprehension (7 items), Application (6 items), and Analysis (8 items) in line with the table of specification for the instrument. Each item was scored one mark for a correct response, giving a maximum obtainable score of 30 per pupil.

The instrument was subjected to face, construct and content validation by experts in Mathematics Education with the observed corrections effected. A pilot study was conducted among pupils outside the study area but with characteristics similar to those of the study participants. The reliability of the instrument was determined using the Kuder-Richardson Formula 20 (KR-20), which yielded a reliability coefficient of 0.79, indicating that the instrument was reliable for the study (Zakariya, 2022). Data collected from the 85 pupils were analyzed using Analysis of Covariance (ANCOVA) at the 0.05 level of significance.

4 Results

4.1 Answer to the Research Question

Table 1

Descriptive Statistics for Pretest and Posttest Scores by Treatment Group

Treatment	N	Pretest Mean	Pretest SD	Posttest Mean	Posttest SD
Problem Based	29	15.07	6.855	17.00	7.086
Storytelling	25	16.96	6.147	21.60	3.916
Traditional	31	19.52	3.501	19.55	4.007
Total	85	17.25	5.865	19.28	5.502

Source: Researcher's Fieldwork, 2026

The descriptive statistics presented in Table 1 reveal a number of noteworthy patterns. At the pretest stage, the Traditional group recorded the highest mean score (19.52) and the smallest spread of scores among its members (SD = 3.501), while the Problem-Based group recorded the lowest pretest mean (15.07) alongside the widest spread (SD = 6.855). By the posttest stage, however, the picture had shifted considerably: the Storytelling group recorded the highest mean score (21.60), representing a gain of close to five points from its own pretest mean, and did so with the smallest spread of scores among the three groups (SD = 3.916). The Problem-Based group also improved, moving from 15.07 to 17.00, while the Traditional group showed almost no change between pretest and posttest (19.52 to 19.55). Taken together, these figures suggest that pupils in the Storytelling group experienced the most pronounced gain in achievement over the course of the study, with the Problem-Based group showing a more modest improvement and the Traditional group showing little to no change.

While these mean differences are informative on their own, a difference observed in raw descriptive figures does not, by itself, establish whether that difference is statistically meaningful or whether it could simply have arisen by chance within this particular sample. To determine whether the observed variation in posttest achievement across the three treatment groups was statistically significant, the dataset was therefore subjected to an inferential statistical test, specifically Analysis of Covariance, with pretest score entered as a covariate to adjust for any differences in pupils' initial ability prior to treatment.

Table 2

Tests of Between-Subjects Effects of Treatment on Posttest Achievement

Source	Type III Sum of Squares	df	Mean Square	F	p-value	Partial Squared	Eta
Corrected Model	1428.363 ^a	5	285.673	20.243	.000	.562	
Intercept	764.367	1	764.367	54.164	.000	.407	
Treatment	349.285	2	174.643	12.375	.000	.239	
Pretest	433.760	1	433.760	30.737	.000	.280	
Treatment * Pretest	253.856	2	126.928	8.994	.000	.185	
Error	1114.860	79	14.112				
Total	34147.000	85					
Corrected Total	2543.224	84					

a. R Squared = .562 (Adjusted R Squared = .534)

The result in Table 2 shows that the main effect of Treatment on pupils' posttest achievement was statistically significant, $F(2, 79) = 12.375$, $p < .05$, partial $\eta^2 = .239$. This confirms that the instructional strategy pupils were exposed to had a meaningful bearing on their achievement in Mathematics word problems once their pretest performance had been accounted for. It is worth noting, however, that the interaction term, Treatment $\times$ Pretest, was also significant, $F(2, 79) = 8.994$, $p < .05$, partial $\eta^2 = .185$, indicating that the relationship between pupils' initial ability and their eventual posttest performance was not uniform across the three treatment groups; in other words, the benefit each pupil derived from a given strategy appears to have depended, in part, on the ability level they brought into the study.

Table 3

Estimated Marginal Means of Treatment on Posttest Achievement

Treatment	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
Problem Based	18.945 ^a	.733	17.486	20.404
Storytelling	21.680 ^a	.752	20.183	23.177
Traditional	19.010 ^a	.808	17.402	20.618

a. Covariates appearing in the model are evaluated at the following values: Pretest = 17.25.

Table 3 presents the adjusted posttest means for each treatment group once pretest score was held constant at the sample mean of 17.25. The Storytelling group recorded the highest adjusted mean (21.68), followed by the Traditional group (19.01) and the Problem-Based group (18.95). The confidence interval for the Storytelling group (20.18 to 23.18) does not overlap with that of the Problem-Based group (17.49 to 20.40), suggesting a meaningful difference between these two groups, whereas the intervals for the Traditional and Problem-Based groups overlap considerably, indicating their adjusted performance was broadly similar. These adjusted means offer a clearer, ability-controlled comparison of group performance than the raw descriptive means in Table 1, and the practical significance of the differences observed here is confirmed through the pairwise comparisons that follow.

Table 3

Pairwise Comparisons of Treatment Groups (Bonferroni-Adjusted)

(I) Treatment	(J) Treatment	Mean Difference (I-J)	Std. Error	p-value	95% Confidence Interval for Difference ^b	
					Lower Bound	Upper Bound
Problem Based	Storytelling	-2.735*	1.050	.033	-5.305	-.166
	Traditional	-.065	1.091	1.000	-2.734	2.603
Storytelling	Problem Based	2.735*	1.050	.033	.166	5.305
	Traditional	2.670	1.104	.054	-.030	5.370
Traditional	Problem Based	.065	1.091	1.000	-2.603	2.734
	Storytelling	-2.670	1.104	.054	-5.370	.030

Based on estimated marginal means

*. The mean difference is significant at the .05 level.

b. Adjustment for multiple comparisons: Bonferroni.

Table 3 shows that the adjusted posttest mean for the Storytelling group was significantly higher than that of the Problem-Based group (mean difference = 2.735, $p = .033$). The difference between the Storytelling and Traditional groups approached significance but fell marginally short of the conventional threshold (mean difference = 2.670, $p = .054$), while the Problem-Based and Traditional groups did not differ significantly from one another (mean difference = .065, $p = 1.000$). These comparisons confirm that the overall significant treatment effect reported in Table 1 is attributable primarily to the superior performance of the Storytelling group relative to the Problem-Based group, with the comparison against the Traditional group trending in the same direction without reaching full statistical significance at the stricter Bonferroni-adjusted threshold.

Table 4

Levene's Test of Equality of Error Variances

F	df1	df2	p-value
.141	2	82	.869

Tests the null hypothesis that the error variance of the dependent variable is equal across groups.

a. Design: Intercept + Treatment + Pretest + Treatment * Pretest

Source: Researcher's Fieldwork, 2026.

Table 4 presents the result of Levene's test, conducted to verify that the assumption of homogeneity of error variances across the three treatment groups was satisfied prior to interpreting the ANCOVA results. The test was not statistically significant, $F(2, 82) = .141$, $p = .869$, confirming that the variances in posttest scores did not differ significantly across the Problem-Based, Storytelling, and Traditional groups. This result supports the validity of the ANCOVA conducted in Table 5, as the assumption underlying the use of this inferential test was reasonably met.

4.2 Test of Hypothesis

H_{01} : There is no significant effect of Treatment on Middle Basic Pupils' Academic achievement in Mathematics word problems in Oyo South Senatorial District.

Table 5

Tests of Between-Subjects Effects of Treatments on Middle Basic Pupils' Academic Achievement in Mathematics Word Problems

Source	Type III Sum of Squares	Df	Mean Square	F	p-value	Partial Eta Squared	Eta Squared
Corrected Model	1174.507 ^a	3	391.502	23.169	<.001	0.462	
Intercept	691.756	1	691.756	40.938	<.001	0.336	
Pretest	886.960	1	886.960	52.490	<.001	0.393	
Treatments	218.569	2	109.285	6.467	0.002	0.138	
Error	1368.717	81	16.898				
Total	34147.000	85					
Corrected Total	2543.224	84					
a. R Squared = 0.462			(Adjusted R Squared = 0.442)				

Source: Researcher's Fieldwork, 2026

From Table 5, the Analysis of Covariance (ANCOVA) result on the effect of treatment on Middle Basic pupils' academic achievement in Mathematics word problems in Oyo South Senatorial District showed that $F(2, 81) = 6.467$, $p < 0.05$, partial $\eta^2 = 0.138$. Since $p < 0.05$, the result indicates that the effect of treatment was statistically significant at the 0.05 level of significance. Therefore, there was a significant effect of treatment on Middle Basic pupils' academic achievement in Mathematics word problems. This implies that the different instructional strategies employed had a meaningful influence on pupils' achievement in Mathematics word problems. This suggests that exposure to different teaching strategies led to observable differences in pupils' performance, with the treatment accounting for a moderate proportion of the variation in posttest scores.

Table 6

Estimated Marginal Means of Treatment on Middle Basic Pupils' Academic Achievement in Mathematics Word Problems

Treatment	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
Problem Based	18.274 ^a	0.783	16.716	19.833
Storytelling	21.768 ^a	0.822	20.132	23.404
Traditional	18.221 ^a	0.761	16.707	19.734

a. Covariates appearing in the model are evaluated at the following values: Pretest = 17.25.

Source: Researcher's Fieldwork, 2026

Table 6 presents the estimated marginal means, which show the adjusted post-test performance of pupils in each treatment group after controlling for their pre-test scores. When the pre-test score was held constant at 17.25 for all pupils, those taught using the storytelling technique recorded the highest adjusted mean score of 21.77, while pupils in the problem-based group had a mean score of 18.27, and those taught using the traditional method had a closely similar mean score of 18.22. The results indicate a clear difference in performance across the groups, with the storytelling group showing a noticeably higher achievement compared to both the problem-based and traditional groups. Furthermore, the confidence intervals for the storytelling group (20.13 to 23.40) do not substantially overlap with those of the other two groups, suggesting that the difference in performance is meaningful and not due to chance. In contrast, the confidence intervals for the problem-based (16.72 to 19.83) and traditional groups (16.71 to 19.73) largely overlap, indicating that their performances are quite similar.

In practical terms, after adjusting for pupils' initial ability levels, those exposed to storytelling demonstrated superior performance in Mathematics word problems compared to their counterparts in the other groups. This finding supports the earlier ANCOVA result, which showed a significant effect of treatment. Therefore, the evidence further justifies the finding, confirming that instructional strategy has a significant effect on pupils' academic achievement in Mathematics word problems.

5 Discussion of Findings

There was a significant effect of treatments on Middle Basic pupils' academic achievement in Mathematics word problems. This finding indicates that the instructional strategies employed in the study contributed meaningfully to differences in pupils' performance, with the storytelling technique producing the highest achievement compared to the problem-based and traditional methods. The result suggests that when pupils are exposed to teaching approaches that make learning more engaging and meaningful, their ability to understand and solve word problems improves significantly. The superior performance of pupils in the storytelling group highlights the value of connecting mathematical concepts to familiar and relatable contexts, which enhances comprehension and retention. This finding is consistent with earlier empirical studies that have emphasized the effectiveness of storytelling in Mathematics instruction. For instance, a quasi-experimental study involving 120 primary school pupils reported that those taught using storytelling significantly outperformed their counterparts who were exposed to the conventional teaching approach, thereby confirming the positive impact of storytelling on pupils' achievement in word problems (Ekeh, 2023). Similarly, a comparative study conducted in Iran and Azerbaijan found that storytelling had a statistically significant effect on pupils' learning outcomes in Mathematics, reinforcing its effectiveness as an instructional strategy (Eisazadeh Nazif et al., 2024). These studies support the present finding by demonstrating that storytelling enhances pupils' engagement and deepens their understanding of mathematical concepts.

The present result also aligns with evidence from qualitative and experimental studies that highlight the instructional value of storytelling in Mathematics. Research involving pre-service teachers showed that storytelling can effectively cover a wide range of mathematical concepts and objectives, suggesting its versatility and relevance in classroom instruction (Doğan, 2021). Furthermore, studies on digital storytelling have shown that integrating technological elements into storytelling can further enhance pupils' academic performance by making abstract concepts more concrete and accessible (Tosun & Engin, 2023). This is particularly important in the context of word problems, where pupils are required to interpret and translate verbal information into mathematical expressions. In addition, empirical findings on digital storytelling in teaching fractions indicate that learners exposed to story-based instruction demonstrate improved understanding and performance, as the approach helps them visualize real-life applications of mathematical concepts (Karadeniz, 2024). Another study also reported that interactive digital storytelling significantly improved both academic achievement and motivation among students, highlighting its dual benefit in enhancing cognitive and affective learning outcomes (Jabali & Alhassan, 2024). Although some studies noted that the development of digital stories may be time-consuming for teachers, many still acknowledged its effectiveness and expressed willingness to adopt it in classroom practice (Şen, 2024).

It should be noted that the storytelling strategy adopted in the present study was delivered through direct oral narration by the classroom teacher, without the use of digital tools, videos, or multimedia applications. Several of the studies drawn upon above examined digital or technology-mediated storytelling rather than this more traditional, orally delivered form. For instance, findings on digital storytelling and fraction instruction (Karadeniz, 2024), interactive digital storytelling and motivation (Jabali & Alhassan, 2024), and technology-integrated storytelling (Tosun & Engin, 2023) all involved multimedia or interactive elements that were absent from the present study's treatment. These studies are cited here to support the broader instructional value of narrative-based teaching in Mathematics, but the specific gains they report may partly reflect the additional visual, interactive, or technological dimensions of digital storytelling rather than the oral narrative technique used in this study alone. Future research comparing digital and non-digital storytelling directly within the same population would help clarify how much of the benefit is attributable to narrative structure itself as opposed to the medium of delivery.

The present finding also reveals that although the problem-based teaching strategy improved pupils' achievement compared to the traditional method, its effect was not as pronounced as that of the storytelling technique. This suggests that while problem-based instruction supports learning, its effectiveness may depend on how well pupils are guided in navigating problem situations, especially at the middle basic level where learners may still require structured support.

Nonetheless, the improved performance recorded under the problem-based group indicates that engaging pupils in active problem-solving processes contributes positively to their understanding of Mathematics word problems. This observation is supported by several empirical studies which have consistently reported the effectiveness of the problem-based teaching strategy in enhancing both academic achievement and learning interest (Suparya et al., 2022; Nasrullah et al., 2023). For example, a quasi-experimental study involving elementary school pupils found that those exposed to the problem-based teaching strategy demonstrated significantly higher achievement and greater interest in Mathematics compared to those taught using conventional methods (Suparya et al., 2022). The study further showed that the combined effect on both cognitive and affective outcomes was significant, indicating that problem-based learning not only improves performance but also fosters a positive disposition toward learning Mathematics.

Similarly, another empirical investigation revealed that the problem-based teaching strategy significantly enhanced students' problem-solving abilities and increased their interest in Mathematics (Nasrullah et al., 2023). This aligns with the current finding, as word problems require not only computational skills but also the ability to analyze situations, interpret information, and apply appropriate strategies. By engaging pupils in meaningful problem-solving activities, the problem-based approach helps to develop these essential skills, thereby improving overall academic performance. Further support is drawn from a study that examined the impact of problem-based teaching strategy on students' mathematical literacy. The findings indicated a significant improvement in students' ability to understand, interpret, and solve mathematical problems after exposure to the strategy (Ekaputri & Simanjorang, 2022). This is particularly relevant to the present study, as difficulties in interpreting word problems have been identified as a major challenge among pupils. The improvement in literacy skills suggests that problem-based instruction can help bridge this gap by encouraging deeper engagement with problem contexts. In addition, evidence from a meta-analysis of 55 experimental studies showed that the problem-based teaching strategy has a strong positive effect on students' academic achievement when compared to traditional teaching methods (Uluçınar, 2023). The consistency of these findings across different educational levels and contexts underscores the robustness of the strategy as an effective instructional approach. Although the meta-analysis focused on science education, its implications are transferable to Mathematics, particularly in areas that require analytical thinking and problem-solving.

Moreover, qualitative evidence indicates that the problem-based teaching strategy enhances students' motivation and conceptual understanding. A study on elementary school pupils reported that learners found the approach enjoyable and were better able to apply mathematical concepts such as multiplication and division to real-life situations (Fatayan et al., 2022). This increased engagement and practical understanding are critical in solving word problems, which often require learners to connect classroom knowledge with everyday experiences. Another study further highlighted that the problem-based teaching strategy significantly improves students' performance in key stages of problem-solving, including understanding the problem and executing solution strategies (Arévalo-Duarte et al., 2024). This reinforces the idea that the approach supports both cognitive development and procedural competence, which are essential for success in Mathematics word problems. In relation to the present study, while the problem-based teaching strategy demonstrated positive effects, the storytelling technique appeared to produce superior outcomes. This difference may be attributed to the ability of storytelling to simplify complex ideas and present them in a more relatable and engaging manner, especially for younger learners. Nevertheless, the effectiveness of the problem-based approach remains evident, and its integration alongside other innovative strategies could further enhance pupils' learning experiences.

The superior performance recorded by pupils in the storytelling group, and the improved outcomes observed among those exposed to problem-based instruction relative to their counterparts in the traditional group, lend strong support to the constructivist principles that underpinned this study. Rather than positioning pupils as passive listeners waiting to be filled with formulas and procedures, both strategies required them to actively engage with mathematical ideas, which aligns with Piaget's argument that children build understanding by continually adjusting their mental models through direct engagement with their environment (Veraksa et al., 2022). The storytelling approach, in particular, appears to have created the kind of guided, socially situated learning experience that Vygotsky described in his account of the Zone of Proximal Development, where narratives delivered by the teacher served as a form of scaffolding that helped pupils bridge the gap between familiar, everyday reasoning and the more abstract demands of interpreting Mathematics word problems (Veraksa et al., 2022). Similarly, the gains recorded by the problem-based group reflect Bruner's conviction that pupils learn most effectively when they are given room to explore, test ideas, and draw their own conclusions from authentic problem situations, rather than being handed ready-made solutions (Rannikmäe et al., 2025). Taken together, these findings reinforce the view that Mathematics achievement improves when instruction moves away from rote transmission of rules and toward approaches that actively involve pupils in constructing meaning for themselves, whether through the relatable context of a story or the open-ended demands of a real problem to solve (Nurhasnah et al., 2024).

The comparatively modest performance of the traditional group, by contrast, illustrates the limitations of an instructional style that leaves little room for the kind of exploration, dialogue, and prior-knowledge activation that constructivist theory identifies as central to durable learning (AlAfnan & Dishari, 2024).

6 Conclusion

Based on the findings of this study, it is concluded that storytelling and problem-based teaching strategies significantly enhance Middle Basic pupils' academic achievement in Mathematics word problems compared with the traditional teaching method, with the storytelling strategy producing the strongest gains in adjusted posttest performance. The study draws on constructivist learning theory in explaining why both strategies, by actively engaging pupils and grounding mathematical concepts in meaningful contexts, outperformed conventional instruction. It is therefore recommended that Mathematics teachers at the Middle Basic level should make effective use of storytelling and problem-based teaching strategies during instruction to improve pupils' understanding and performance in Mathematics word problems.

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