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Using Block Model Approach in Enhancing Pupils' Word Problem Solving Performance

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Abstract

The Block Model Approach plays a vital role in the pupils' problem-solving performance in Mathematics. This experimental study investigated the effectiveness of the Block Model Approach in improving problem-solving skills among Grade 2 pupils in a public school in Misamis Occidental. Using the Solomon Four-Group Experimental Design, 40 pupils were randomly assigned to experimental and control groups, with pretest and posttest measures. A researcher-made 20-item Word Problem Solving Test was used to assess students' performance. Data were analyzed using mean, standard deviation, t-test, and two-way ANOVA. The findings revealed that, in the pretest, most pupils in both groups did not meet expectations, with the experimental group slightly outperforming the control group. After using the Block Model Approach, the control group showed minimal improvement, while the experimental group demonstrated substantial progress, with many pupils reaching satisfactory levels. A significant difference between the experimental and control groups in pretest and posttest performance underscored the Block Model Approach's effectiveness. However, no significant differences were observed between the control or experimental groups, suggesting that the pretest did not impact the outcomes. The Block Model Approach independently contributed to the improved performance of the experimental group. Therefore, using the Block Model Approach can effectively enhance problem-solving abilities in elementary mathematics education. Math teachers may adopt the Block Model Approach to promote equitable learning and enhance problem-solving skills, regardless of students' prior knowledge.

Keywords: Block Model Approach, Intervention Strategies, Mathematics Education, Problem-Solving, Solomon Four-Group Design

1. Introduction

Teaching mathematics can be challenging since pupils frequently find it difficult to relate abstract ideas to practical applications. The nature of the subject, the diverse needs of pupils, and the possibility of subject anxiety are the reasons for this. In mathematics, the teacher and the learners must possess specific skills to lessen the complexity. Using appropriate techniques while encouraging deeper learning can make math more enjoyable and meaningful. Encouraging pupils to view challenges as opportunities for growth can reduce math issues. Acknowledging the difficulties that every pupil faces may make finding knowledge gaps easier. This includes clearing up misunderstandings, increasing their self-assurance, and demythologizing math.

Mathematics education is crucial for developing critical thinking and problem-solving skills, and it is foundational for personal development and national advancement (Ampofo, 2019). Mastering basic mathematical skills is vital for students' success and a fundamental tool for fostering human growth and societal progress (Yeh et al., 2019). Mathematical skills refer to acquiring, applying, and interpreting mathematical concepts to solve problems across various real-life contexts (Jade et al., 2023).

It has been noted that learners found mathematics difficult across all levels of education, from elementary to senior high school (SHS). This difficulty is reflected in students' poor performance on local and international assessments. In the Philippines, mathematics performance has been particularly concerning, with students consistently underperforming compared to their peers in other countries (Lapinid et al., 2022). Mathematics performance refers to how students engage with and master basic mathematical skills, often perceived as one of the more challenging subjects in their education (Yeh et al., 2019). Despite its significance in fostering individual learning and contributing to national development,

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there has been a consistent decline in student performance in mathematics over the past two decades, particularly in the Philippines (Ampofo, 2019).

For the past twenty years, the government of the Philippines has made changes to the educational system to better the outcomes of learners, particularly in reading and mathematics (Igarashi et al., 2023). Although these reforms helped enhance reading skills, the learners's performance in Mathematics continues to be a significant problem, as illustrated by the country's standings in the Programme for International Student Assessment (PISA) and the Trends in International Mathematics and Science Study (TIMSS) (Mullis et al., 2020). The country has consistently performed poorly in international assessments such as the Programme for International Student Assessment (PISA) and the Trends in International Mathematics and Science Study (TIMSS), with students from public schools outperforming their private counterparts (Lapinid et al., 2022 Mullis et al., 2020). Although recent educational reforms have improved reading skills, mathematics performance remains a critical concern (Igarashi et al., 2023).

The 2019 PISA results showed that the Philippines ranked second to last in mathematics, with public school students struggling more than private schools (Mullis et al., 2020). When the PISA 2022 results were released on December 5, 2023, they again sparked discussions on the country's education system. These findings underscore the urgent need for meaningful reforms to help students develop stronger mathematical skills.

The research claims that 31 economies and nations have maintained Math performance despite difficult conditions since PISA 2018. Filipino pupils rank among the least skilled in science, Math, and Reading (Acido et al., 2024). The TIMSS results further highlighted the country's poor performance, with Filipino students scoring significantly below the international average (Mullis et al., 2020). This issue is not only a matter of academic performance but also has broader implications for students' future opportunities, particularly in STEM-related fields (Alspaugh & Khurshid, 2023). Research indicates that early struggles with mathematics can lead to persistent difficulties throughout a student's educational journey (Bryant, 2019), with many high school students in the Philippines lacking sufficient engagement with math (Bernardo et al., 2022).

The Department of Education introduces various teaching strategies to make teaching and learning in Math more meaningful. Some strategies teachers use are differentiated instruction, multimodal, collaborative learning that focuses on group work and peer learning, problem-based learning, ICT integration, guided discovery learning, and Mental Math (Koskinen & Pitkäniemi, 2022). To raise Filipino students' scores on international large-scale tests, the Commission on Higher Education (CHED) may collaborate more closely with the Department of Education (Montemayor, 2023).

Numerous studies have explored strategies to address the challenges of teaching and learning mathematics. The Block Model Approach, rooted in the Concrete-Representational-Abstract (CRA) framework, has gained attention as a promising method for facilitating students' understanding of mathematical concepts (Chia & Ng, 2020). This strategy uses blocks and manipulatives to aid students in visualizing and solving complex mathematical problems, making abstract ideas more concrete (Jiang & Zhao, 2023).

The Block Model strategy focuses on building a strong foundation in mathematical concepts. It is used in teaching mathematics to simplify and solve word problems. Using blocks helps pupils understand the structure of a problem and how different quantities relate to each other. This encourages pupils to think critically, boosting confidence and encouraging more participation in math.

The study by Garzon and Casinillo (2021) discovered that using block models has great potential for increasing learners' strategic problem-solving abilities. Thus, mathematics teachers should incorporate this technique into their teaching strategies. They also discovered that visually altering problem values is frequently required to properly understand the concept and choose the proper solution method. Modelling blocks in a problem text is a visual, mathematical technique that uses bar models to represent the relationship between known and unknown numerical factors.

Using the Block Model approach in teaching may face limitations, such as a narrow geographical focus that may not fully capture variations in teaching quality and available classroom resources across different regions (Gonzalez et al., 2022). Furthermore, while there was a study centred on applying the Block Model Approach for solving problems in Mathematics, it may not encompass the full range of mathematical learning experiences and challenges that students encounter (Kilpatrick, et al., 2001). This could limit the generalizability of the findings.

Despite the promising outcomes of the Block Model Approach, limited research still focuses on its effectiveness in primary education, particularly among Grade 2 learners. Previous studies have primarily concentrated on older students, leaving a gap in understanding how this innovative teaching method can impact young learners (Jiang & Zhao, 2023). As a result, this investigation intends to investigate the usefulness of the Block Model Approach in enhancing second graders' mathematical problem-solving abilities. It aims to provide evidence to inform educational practices and curriculum development (Ng & Lee, 2022).

The Block Model Approach improves and enhances students' confidence and motivation in mathematics, specifically problem-solving skills (Lai & Murray, 2018). However, despite its proven benefits in various educational settings, limited research exists on its effectiveness in primary education, particularly among Grade 2 learners (De Koning et al., 2022).

Existing studies have highlighted the success of learners' performance in solving math problems using the Block Model Approach (Thanheiser et al., 2022). There is a noticeable empirical gap in empirical research that examines how early exposure to this approach impacts young learners' mathematical abilities, particularly in solving word problems, which are often cited as a significant area of difficulty for students (Ng & Yu, 2019). Addressing this gap is critical, as early intervention can significantly influence students' long-term mathematical success and attitudes toward the subject (Saxe & Gearhart, 2021).

To strengthen future research, it could be beneficial to expand the geographical scope to include diverse educational settings and populations, thereby allowing for a more comprehensive evaluation of the Block Model Approach's effectiveness (Wang et al., 2021). Additionally, future studies could incorporate a broader array of mathematical concepts beyond word problems to provide a more holistic view of students' learning experiences. Longitudinal studies may also be valuable, offering insights into how the Block Model Approach has long-term impacted students' mathematics skills and engagement.

The researcher identified an apparent knowledge gap in the prior research concerning the problem-solving abilities in Mathematics at the elementary level. Solving word problems can be challenging for elementary students because the word problems are being misrepresented. Additionally, the previous research failed to address the subject of problem-solving skills of elementary students. Numerous pertinent studies have been conducted on how math teachers apply problem-solving techniques and models, which are then connected to the learning objectives of their pupils (Sinaga et al., 2023). Students tend to symbolize the term difference as minus or subtraction, "less than," and the phrase "more than" as plus or addition. This includes some undiscovered dimensions recently receiving scholarly interest in other disciplines. In addition to influencing how students formulate their ideas and information, problem-solving helps them acquire the abilities necessary to address challenges in the actual world (Sukariasih et al., 2020). When measuring students' problem-solving skills, comprehension and learning activities at each phase are just as significant as learning results (Melawati et al., 2022).

This study aimed to investigate the effectiveness of the Block Model Approach in enhancing the problem-solving performance of Grade 2 learners in mathematics. The evaluation promotes the educational process by identifying qualitative shifts in the students' foundation of knowledge. Specifically, the research assessed how this teaching strategy, the block model approach, enhanced pupils' problem-solving ability, an important Mathematics curriculum skill. By providing empirical evidence on the impact of the Block Model Approach, this study hoped to contribute to the area of Mathematics education and advise educators about the best strategies for encouraging early mathematical proficiency. Additionally, the insights gained from this research may help shape curriculum development and teaching methodologies, ultimately improving the quality of mathematics education for young learners and addressing educational inequalities.

The study's results can be extremely valuable to the school head since this can be the basis of providing valuable insights to teachers that can improve pupils' performance in math word problems. By understanding its effectiveness, the school head can make informed decisions to adopt the strategy in school-wide. Second, the study's findings served as a resource for teachers to enhance pupils' learning engagement by showcasing the impact of the strategy on pupils' learning performance. This will boost their confidence in exploring more effective strategies, leading to more responsive teaching that meets the needs of learners. Third, the pupils. The result was significant to pupils because it helped develop foundational skills, enhancing their overall learning performance in mathematics. The teaching approach employed by the teacher would make their learning more accessible, engaging and successful. Fourth, other Researchers. This study is helpful because it provides a research-based model to be used as a foundation for future studies. They can use this as a reference for related studies.

Statement of the Problem

This study aimed to evaluate the usefulness of the Block Model teaching in enhancing the problem-solving performance of Grade 2 learners in Mathematics in one of the elementary schools in Municipal of Clarin, school year 2024-2025.

Specifically, it sought to answer the following questions:

1. What are the pupils' problem-solving performances in the pretest for the control and experimental groups before implementing the block model approach?
2. What are the pupils' problem-solving performances in the posttest for the control groups after using the block model approach?
3. What are the pupils' problem-solving performances in the posttest for the experimental groups after using the block model approach?
4. Is there a significant difference in the problem-solving performance of pupils in the pretest between control and experimental groups?
5. Is there a significant difference in the problem-solving performance of pupils in the posttest who underwent the Block Model Approach (experimental group) and those who did not (control group)?
6. Is there a significant difference in the problem-solving performance of pupils in the posttest between the two control groups?
7. Is there a significant difference in the problem-solving performance of pupils in the posttest between the two experimental groups?
8. Is there an interaction effect between the pretest and the Block Model Approach on pupils' problem-solving performance?

Research Method and Materials

Research Design

This quantitative study used the Solomon four-group design, a quasi-experimental study in which subjects are randomly divided into four groups to conduct both a pretest-posttest control group design experiment and a posttest-only control group design investigation simultaneously. In this design, the treatment and control groups have two subgroups: one that received a pretest before the intervention and one that did not, guaranteeing that the study controlled for pretest effects on outcomes. The dependent variable was the students' problem-solving performance. A control group would enable a comparison of the effectiveness of the Block Model Approach to traditional teaching approaches (Creswell & Creswell, 2017).

In this study, four groups are used to confirm the validity of the experimental results and account for the effects of pretesting. This Solomon four-group design is beneficial when examining whether a pretest, either by itself or in conjunction with the treatment, affects the outcomes.

Research Settings

The study was conducted in one of the public elementary schools in the municipality of Clarin, in the province of Misamis Occidental, Northern Mindanao. Grade 2 pupils in this setting were particularly appropriate for the study, as many learners require math intervention at this foundational level in rural education.

Participants of the Study

The participants comprised 40 Grade 2 pupils, with 20 pupils in the experimental group and 20 in the control group. Ten students in the experimental group took both the pretest and the posttest, while the remaining 10 took the posttest. Likewise, ten students in the control group took both the pretest and the posttest, while the remaining 10 students will only take the posttest. Pupils were randomly assigned to each group to reduce outside factors that could affect the results.

The participants involved members of the target population with similar demographic characteristics and learning needs. The sampling method involves purposive sampling to ensure a representative distribution of pupils based on academic performance. Inclusion criteria required that participants be enrolled in Grade 2 in one of the public schools in Clarin and demonstrate a need for intervention in mathematics, as identified by their teachers through prior assessments.

Research Instrument

The researcher used the following research instruments to gather data in the study:

Word Problem Solving Test. This contains 20 items, 70% of which are easy questions (remembering and understanding), 20% of which are average questions (applying and analyzing), and 10% of which are difficult questions (evaluating and creating).

The test questions are self-constructed and formulated based on the second quarter's learning competencies. The instrument's reliability was tested in a pilot study with a subset of Grade 2 pupils who were included in the study. With a Cronbach's Alpha Coefficient of 0.979, it was deemed dependable.

To determine the level of pupils' performance in the pretest and posttest, the researcher used the hypothetical mean range and its adjectival equivalent based on DepEd Order No. 8 s, 2015.

Scores	Grade Equivalent	Description
19 - 20	90 – 100	Outstanding
18	85 – 89	Very Satisfactory
16 - 17	80 – 84	Satisfactory
15	75 – 79	Fairly Satisfactory
14 - 1	Below 75	Did Not Meet Expectation

Data-Gathering Procedure

Before beginning the investigation, the researcher wrote a letter of approval from the Dean of the Graduate School after the thesis advisor's approval. The researcher obtained necessary approvals from various stakeholders, including the research ethics board, division superintendent, district supervisor, principal, teachers, and parents, ensuring compliance with ethical guidelines. Informed consent was obtained from the parents, while an assent form was sought from the learners involved in the study.

After the permissions were secured, teaching using the Block-model approach was conducted in the classroom. The investigator gave the participants an overview of the study's objectives, specifically the Grade 2 pupils. Before data collection, a formal letter of consent was presented to each participant's parent or guardian, outlining the purpose of the study and assuring confidentiality. This study employed the Solomon Four-Group design.

Data collection began with administering a researcher-made word problem pretest to the first (Control A and Experimental A) 2 groups, which consisted of 20 Grade 2 pupils. The test results were analyzed using the hypothetical mean range used in DepEd to determine the level of pupils' performance in the pretest.

The intervention was implemented over two weeks following the pretest, teaching the Block Model Approach. The teacher-researcher conducted a demonstration teaching using discussion and the chalk-talk method. This approach would incorporate a block model to enhance problem-solving abilities in mathematics.

After taking the test, the intervention or treatment was given to participants. After the intervention period, a posttest was provided to all four groups to assess the effectiveness of the Block Model Approach and the change in problem-solving skills. The posttest data were tallied and analyzed to determine the intervention's impact on the student's mathematical problem-solving skills, with appropriate statistical methods used for a thorough evaluation of the block model assisted in analyzing the results by controlling for differences between the blocked groups. After the posttest, the scores of the four groups will be compared accordingly.

Group 1 vs. Group 2 will show if the treatment had an effect after controlling for pretest sensitization. Group 3 vs. Group 4 shows whether the treatment alone, without the influence of a pretest, affects word-problem-solving ability. This method will help determine if the treatment (using the Block Model Approach) effectively improves word-problem-solving skills while controlling for potentially confounding factors like pre-existing skills or test sensitization. It will also help control for confounding variables that may impact the results, ensuring that any observed effects are due to the treatment rather than external factors.

Ethical Considerations

Before conducting the study, it was critical to construct an ethical framework that prioritized the respondents' well-being. The consent of the Misamis University Research Ethics Board (MUREB) was requested to perform the study properly. Participation in the research was entirely optional. Pupils and their parents were given a written consent letter outlining the study's objective, procedures, and potential advantages. Parents were asked to share the information with their children to ensure they understood participation. Importantly, participants can withdraw from the study at any time, including after first agreeing, with no consequences or penalties. This approach emphasizes respect for each pupil's autonomy and decision-making capacity, ensuring their consent is informed and freely given. Additionally, confidentiality was preserved during the investigation. Data collected will be anonymized and securely kept to protect participants' identities. The researcher ensured that the study's methods prioritized the kids' safety and comfort, creating a setting where they felt comfortable and valued throughout the research process.

Data Analysis

With the aid of SPSS software, the following statistical tools were used in the study:

Mean and standard deviation. These were used to determine the pre-test and post-test problem solving performance of pupils.

T-test. This tool was used in comparing the pupils' problem-solving performance between two groups (experimental vs. control, and two control groups).

Two-Way ANOVA. It was used to assess the interaction effects between the pretest and the intervention on the posttest results.

Results and Discussion

Pupils' Problem-Solving Performance in the Pretest for the Control and Experimental Groups Before the Use of Block Model Approach

Table 1 presents the pupils' problem-solving performance in the pretest for the control and experimental groups before implementing the Block Model Approach. In the control group, 100% of the pupils did not meet expectations. The mean performance for this group (M=7.50) indicated that their problem-solving skills were below the anticipated level. This suggests a lack of mastery in problem-solving, resulting in difficulty understanding the lesson and falling short of the required arithmetic abilities for their grade level.

In the experimental group, 90% of pupils did not meet expectations, while 10% performed reasonably satisfactorily. The mean performance for this group was (M=10.00), which still indicated a performance level below expectations, although slightly better than the control group. This suggests that while most pupils in the experimental group were still struggling, performance was slightly improved compared to the control group.

The experimental group showed a slightly higher proportion of pupils (10%) performing reasonably satisfactorily compared to the control group, where none performed above the "Did Not Meet Expectations" level. Overall, the pretest results indicate that both groups' problem-solving abilities were generally below satisfactory levels before introducing the Block Model Approach. This highlights the need for intervention to improve problem-solving skills. The experimental group's marginally better performance could be attributed to slight differences in prior knowledge or learning experiences. However, both groups demonstrated the need for significant improvement in their problem-solving abilities, which is essential for classroom success and national and international assessments like PISA.

The findings are consistent with earlier research emphasizing students' difficulties in mathematics, particularly problem-solving. Bautista (2023) stated that the Department of Education (DepEd) predicted no significant improvement in the average Mathematics scores of Filipino students, as seen by the most recent PISA results. Klang et al. (2021) highlighted problem-solving as an essential aspect of mathematics learning, yet many students struggle to understand problem-solving methods. Setiawan and Oka (2020) observed that difficulties in solving mathematical issues result from a lack of conceptual understanding and poor assessment performance. Furthermore, Lucasia (2020) stated that Filipino students frequently struggle with interpreting and representing word problems, contributing to their low mathematics performance as measured by PISA examinations.

This issue is not unique to the Philippines. Chand et al. (2021) found similar trends in Fiji, where poor achievement in Mathematics was linked to ineffective curricula and a lack of competent teachers, contributing to students' negative attitudes toward Mathematics. These challenges underscore the need for effective interventions to improve pupils' problem-solving abilities in mathematics. Pupils in both groups struggled to identify keywords in mathematical problems, often guessing answers without solving the problem. Additionally, they had difficulty modelling problems mathematically and determining the appropriate solution methods. As Kusumadewi and Retnawati (2020) noted, these challenges often lead to incorrect conclusions and inadequate problem-solving skills.

The results imply that the problem-solving performance in both groups is below the desired level, emphasizing the need for interventions such as the Block Model Approach. This approach helps foster a better understanding of concepts and enhances more sophisticated analytical reasoning. By visualizing numbers and their relationships, pupils gain confidence in their problem-solving abilities. Math teachers may consider incorporating structured problem-solving frameworks and interactive learning activities to improve their problem-solving skills. Providing professional development for teachers on innovative teaching methods could also be beneficial. Regular formative assessments also help monitor pupils' progress and identify areas for targeted support. Collaborative learning strategies, such as peer tutoring or group discussions, could further enhance the learning experience and improve the development of problem-solving abilities.

Table 1
Pupils' Problem-Solving Performance in the Pretest for the Control and Experimental Groups Before the Use of Block Model Approach

	Control Groups		Experimental Group	
Performance	Frequency	Percentage	Frequency	Percentage
Fairly Satisfactory	-	-	1	10.00
Did not Meet the Expectations	10	100.00	9	90.00
Mean Performance	7.50		10.00	

Note: Scale: 19-20 (Outstanding); 18 (Very Satisfactory); 16-17 (Satisfactory) ; 15(Fairly Satisfactory); 1-14 (Did not meet the expectations)

Pupils' Problem-Solving Performance in the Post-test for the Control Group After the Use of Block Model Approach

Table 2 highlights the pupils' problem-solving performance in the post test for the control group after employing the Block Model Approach. The findings show that all pupils in the control group with the pretest and the control group without the pretest fell within the "Did not Meet the Expectations" level (n = 10; 100%) in their respective groups. The mean performance for the control group with the pretest (M = 8.70) was slightly lower than that of the control group without the pretest (M = 9.20), suggesting a minimal outcome difference between the two groups. However, both groups exhibited unsatisfactory performance levels, with no pupils falling into the categories of "Outstanding," "Very Satisfactory," "Satisfactory," or even "Fairly Satisfactory."

Overall, pupils' problem-solving performance in the posttest for the control groups consistently "did not meet expectations." This indicates that the pupils struggled significantly with problem-solving tasks, suggesting a lack of foundational knowledge or ineffective strategies that the intervention failed to address adequately. The minimal difference in mean performance between the pretested and non-pretested groups further emphasizes that the pretest did not significantly improve outcomes. These results align with Setiawan and Oka (2020), who observed that learners' difficulties in understanding mathematical concepts and operations often lead to poor problem-solving performance. The study highlighted how a lack of conceptual understanding impairs students' ability to effectively solve complex problems.

The findings also suggest that pupils lack fundamental knowledge, making mathematics particularly challenging due to gaps in their understanding. Inadequate study and practice may contribute to a lack of fluency, making it difficult for pupils to apply their knowledge when solving problems. Additionally, unfamiliar mathematical terminology can further hinder students' comprehension and problem-solving ability, leading to poor performance. If not addressed, these challenges may cascade, impacting students' success in other disciplines that require quantitative thinking skills.

Similarly, Lucasia (2020) emphasized the difficulty many Filipino learners face when solving mathematical problems, particularly with word problems, which is a significant factor in their poor performance in both local and internationalassessments. The persistent nature of these struggles highlights the need for more effective instructional strategies tailored to address the specific difficulties students face in mathematical problem-solving. According to Lucasia, one of the core issues lies in learners' inability to comprehend and translate verbal information into mathematical expressions. This aligns with the findings of Bernardo and Mante-Estacio (2023), who pointed out that Filipino students often lack the metacognitive skills necessary to navigate multi-step problem-solving tasks. As a result, educators are encouraged to adopt visual and contextualized approaches, such as the Block Model Method, to help bridge understanding and improve performance (Roche, 2024).

Given these results, it is evident that the techniques utilized in the control groups failed to meet the pupils' learning needs. This underscores the importance of subject teachers, supported by school leadership, in implementing targeted interventions to improve pupils' conceptual understanding and problem-solving skills. Without such measures, the gap in mathematical proficiency is likely to persist. Teachers should consider integrating more engaging, interactive, and scaffolded teaching strategies tailored to pupils' developmental needs. Suggested strategies include using the Block Model Approach, differentiated instructional materials with step-by-step guides and practical examples, workshops for teachers on innovative problem-solving techniques, after-class tutorials, peer-assisted learning sessions, and formative assessments with feedback mechanisms to monitor progress and adapt teaching approaches.

The findings imply that pupils in both control groups—with and without a pretest—could not solve mathematical problems to the expected level. The traditional teaching approach in the control groups did not sufficiently improve pupils' problem-solving abilities. These results emphasize the need for alternative teaching strategies or interventions to enhance pupils' mathematical problem-solving skills. Despite being taught using conventional methods, the pupils' inability to grasp mathematical concepts and processes led to poor performance. This highlights the importance of creative, research-based teaching strategies to improve students' problem-solving skills in mathematics.

Table 2

Pupils' Problem-Solving Performance in the Posttest for the Control Group After the Use of Block Model Approach

	Control Group (With Pretest)		Control Group B (Without Pretest)	
Performance	Frequency	Percentage	Frequency	Percentage
Did not Meet the Expectations	10	100.00	10	100.00
Mean Performance	8.70		9.20	

Note: Scale: 19-20 (Outstanding); 18 (Very Satisfactory); 16-17 (Satisfactory) ; 15(Fairly Satisfactory); 1-14 (Did not meet the expectations)

Pupils' Problem-Solving Performance in the Posttest for the Experimental Group After the Use of Block Model Approach

Table 3 presents the pupils' problem-solving performance in the posttest for the experimental group after using the Block Model Approach, divided into two subgroups: the experimental group with a pretest and the experimental group without a pretest.

For the experimental group with the pretest, the majority of pupils performed at the "Very Satisfactory" (n = 4, 40.00%) and "Satisfactory" (n = 4, 40.00%) levels, with a smaller proportion achieving the "Outstanding" level (n = 2, 20.00%). Notably, no pupils in this group fell into the "Fairly Satisfactory" or "Did not Meet the Expectations" categories. The mean performance of 17.70 indicates a decisive outcome, reflecting a generally satisfactory level of achievement. This shows that the pretest played an important role in preparing the students for the posttest by familiarizing them with the problem-solving tasks and increasing their confidence. The enhanced mean performance relative to the control group demonstrates the pretest's usefulness in helping students absorb the requisite problem-solving skills.

On the other hand, the experimental group without a pretest exhibited a more varied performance distribution. While a smaller proportion of pupils reached the "Outstanding" category (n = 2, 20.00%), the majority were in the "Very Satisfactory" (n = 3, 30.00%) and "Satisfactory" (n = 2, 20.00%) categories. However, some pupils performed below the satisfactory threshold: 10.00% (n = 1) were in the "Fairly Satisfactory" category, and 20.00% (n = 2) did not meet expectations. The mean performance for this group was 16.90, also reflecting a "Satisfactory" level, but this result indicates that the Block Model Approach alone provided moderate success. The presence of pupils in the "Fairly

Satisfactory" and "Did not Meet Expectations" categories suggests that the lack of a pretest might have left some pupils less prepared for the demands of the posttest.

Comparing both experimental groups, the group with the pretest performed more favourably, with a higher concentration of pupils in the "Very Satisfactory" and "Outstanding" categories. The mean performance of 17.70 was more significant than the 16.90 found in the group without a pretest, demonstrating the relevance of pre-assessment in minimizing performance variability and maximizing the benefit of the Block Model Approach. The experimental group without a pretest displayed a wider distribution of performance, ranging from "Outstanding" to "Did not Meet the Expectations," emphasizing the necessity of preparatory activities in enhancing learning outcomes.

Both experimental groups exhibited overall "Satisfactory" performance, with the mean performance for the group with a pretest (M=17.70) and the group without a pretest (M=16.90). These results suggest that using the Block Model Approach can improve pupils' problem-solving performance, especially with pretesting. The posttest has significantly improved performance, particularly for the group with the pretest, by helping pupils internalize problem-solving strategies.

These findings align with previous research by Lucasia (2020), who confirmed that the Block Model Approach significantly improves pupils' mathematical performance. The study recommended that public school teachers integrate the Block Model into their activities to boost the abilities of Filipino learners. Similarly, Setiawan and Oka (2020) emphasized that structured problem-solving strategies, such as those offered by the Block Model Approach, can address learners' conceptual gaps, leading to enhanced academic outcomes. Furthermore, Klang et al. (2021) highlighted the crucial role of pre-assessment in identifying prior knowledge and learning gaps, enabling more targeted instruction that addresses the specific needs of students. Sarinas and Lopez (2019) also underscored that diagnostic assessments help tailor interventions, leading to better performance across diverse groups of learners. These studies show that the Block Model Approach successfully increases students' problem-solving skills and overall academic achievement, especially when combined with pretesting.

The findings also highlight the importance of pre-assessments in instructional design. Pretests help identify learning gaps, prepare pupils for the tasks ahead, and support the effective use of innovative teaching methods like the Block Model Approach. Teachers are encouraged to integrate pretesting into their instructional practices to improve pupil preparedness and learning outcomes. Regular diagnostic assessments and differentiated instruction can further address varying skill levels, ensuring that all pupils are supported in achieving their full potential. Furthermore, professional development programs for teachers could improve their capacity to effectively use the Block Model Approach and adapt it to different learner needs, resulting in consistent progress in students' problem-solving skills.

Table 3

Pupils' Problem-Solving Performance in the Posttest for the Experimental Group After the Use of Block Model Approach

	Experimental Group (With Pretest)		Experimental Group B (Without Pretest)	
Performance	Frequency	Percentage	Frequency	Percentage
Outstanding	2	20.00	2	20.00
Very Satisfactory	4	40.00	3	30.00
Satisfactory	4	40.00	2	20.00
Fairly Satisfactory	-	-	1	10.00
Did not Meet the Expectations	-	-	2	20.00
Mean Performance	17.70		16.90	

Note: Scale: 19-20 (Outstanding); 18 (Very Satisfactory); 16-17 (Satisfactory) ; 15(Fairly Satisfactory); 1-14 (Did not meet the expectations)

Significant Difference in the Problem-Solving Performance of Pupils in the Pretest Between Experimental and Control Groups

Table 4 presents the analysis of the significant difference in the problem-solving performance of pupils in the pretest between the experimental and control groups. The results indicate a considerable difference, with the experimental group achieving a higher mean ($M = 10.00$, $SD = 2.54$) than the control group ($M = 7.55$, $SD = 2.32$). The t-test value ($t = 2.54$; $p = 0.04$) is below the 0.05 significance threshold, confirming a statistically significant difference in pretest problem-solving skills between the two groups. As a result, the null hypothesis, which states no significant difference, is rejected, implying that the experimental group outperformed the pretest.

The higher performance of the experimental group in the pretest could be indicative of prior exposure to problem-solving tasks or methods that align more closely with the posttest intervention. Pupils in the experimental group may have had access to better foundational instruction, additional practice opportunities, or a classroom environment more conducive to developing problem-solving skills. This suggests that factors beyond the experimental treatment, such as prior learning experiences or teacher proficiency, may have contributed to initial performance differences. In contrast, the lower performance of the control group could reflect underlying challenges, such as limited exposure to structured problem-solving activities or gaps in foundational knowledge, highlighting the need for targeted instructional support.

While the data emphasize differences in readiness, they also point to the potential of pre-assessment as a strategic tool. The higher pretest scores of the experimental group suggest that pupils benefit from clearly understanding the task's nature before undertaking it, underscoring the importance of scaffolding and preparatory activities in instruction. Without such preparation, the control group may experience increased cognitive load, making it harder to fully engage in problem-solving tasks.

These findings are supported by the research of Hughes et al. (2014), who confirmed that model-based interventions in teaching Mathematics, such as the Block Model Approach, are more effective than traditional strategies. Similarly, Klang et al. (2021) underlined the impact of organized problem-solving approaches in increasing students' readiness and engagement, which may help explain the experimental group's higher pretest scores. Furthermore, Setiawan and Oka (2020) noted that prior exposure to problem-solving tasks and effective scaffolding enhances learners' ability to approach mathematical problems with greater confidence and competence.

The better performance of the experimental group suggests that factors such as prior learning experiences, instructional methods, and additional practice opportunities may have better prepared them for the pretest. In contrast, the lower performance of the control group highlights the need for interventions to address foundational gaps and develop problem-solving abilities. These findings highlight the need to include pre-assessment tools and preparatory activities in instructional designs. Lucasia (2020) pointed out that familiarizing learners with problem-solving expectations and methodologies before formal assessments can reduce cognitive load and increase student engagement. The findings further suggest that incorporating pre-assessment strategies into interventions like the Block Model Approach can optimize their effectiveness and address disparities in student readiness.

These findings have substantial consequences for teachers and administrators. First, diagnostic baseline assessments may be institutionalized at the beginning of instructional units to identify gaps in pupils' readiness and understanding. Such assessments would enable educators to construct targeted interventions suited to the individual requirements of students, particularly those with lower baseline performance. Second, professional development programs have been organized to equip teachers with strategies for developing problem-solving skills and addressing learning gaps. Workshops on scaffolding techniques and differentiated instruction could ensure that teachers are better prepared to meet the diverse needs of their students. Third, implementing peer-assisted learning programs, where high-performing pupils mentor their peers, could foster collaborative learning while reinforcing problem-solving skills for mentors and mentees. Finally, regular monitoring and feedback mechanisms may be established to evaluate pupils' progress and the effectiveness of educational tactics, ensuring continuous improvement and equitable learning opportunities for all.

This finding may be interpreted through the lens of Bandura’s (1977) Social Learning Theory, which emphasizes the role of observational learning in behavior and skill acquisition. Pupils in the experimental group may have already been exposed to effective role models—such as teachers or peers—demonstrating successful problem-solving strategies. The ability to observe, imitate, and internalize these behaviors could have positively influenced their initial performance, even prior to the formal implementation of the intervention. As Bandura noted, the modeling of behaviors accompanied by reinforcement fosters improved learning outcomes, which may explain the superior pretest scores of the experimental group.

In addition, the Constructivist Learning Theory supports this observation by highlighting how students actively build knowledge based on prior experiences and interactions. Learners who engage in environments that promote conceptual understanding, critical thinking, and reflection are likely to perform better in tasks requiring problem-solving skills. The higher mean score of the experimental group suggests that these pupils may have already been applying constructivist-based strategies, such as drawing connections between mathematical concepts and real-world context, prior to the intervention. This underscores the importance of learner-centered approaches that allow students to construct their own understanding through active engagement and meaningful learning experiences.

Thus, the pretest result, although not yet influenced by the experimental intervention, aligns with both Bandura’s Social Learning Theory and Constructivist Theory, highlighting the critical roles of observational learning and active knowledge construction in shaping students’ mathematical performance.

Table 4
Significant Difference in the problem-solving performance of pupils in the pretest between experimental and control groups

Variables	M	SD	*t* value	*p* value	Decision
Experimental Group	10.00	2.54	2.54*	0.04	Reject Ho
Control Group	7.550	2.32			

Ho: There is no significant difference in the problem-solving performance of pupils in the pretest between experimental and control groups
*Note: Probability Value Scale: **p<0.01 (Highly Significant); *p<0.05 (Significant); p>0.05 (Not significant)*

**Significant Difference in the Problem-Solving Performance of Pupils in the Posttest who Underwent Block Model Approach (Experimental Group)
and those Who Did Not (Control Group)**

Table 5 presents the significant difference in the problem-solving performance of pupils in the posttest who underwent the Block Model Approach (experimental group) and those who did not (control group).

The result revealed highly significant differences between the two groups, both with and without pretests. For the groups with pretests, the experimental group achieved a substantially higher mean (M = 17.70, SD = 1.25) compared to the control group (M = 8.70, SD = 2.11). The t-test value (t=11.41; p=<.001) led to the rejection of the null hypothesis (Ho). Similarly, for the groups without pretests, the experimental group outperformed the control group (M = 16.90, SD = 2.23) versus (M = 9.20, SD = 1.69), resulting in a t-value (t= 10.76; p=<.001), again rejecting the null hypothesis.

The highly significant data show that the Block Model Approach improves students' problem-solving abilities. The experimental group outperformed the pretest groups, indicating that the technique builds on existing knowledge and considerably improves problem-solving ability. The structured, visual, and hands-on nature of the Block Model Approach likely provides pupils with a more precise conceptual understanding and practical application of problem-solving techniques. This contrasts sharply with the control group's performance, where traditional methods may not offer the same level of engagement or conceptual reinforcement.

The Block Model Approach demonstrates remarkable effectiveness for the groups without pretests, as shown by the experimental group's higher mean performance. The results suggest that the approach fosters a deep understanding of problem-solving concepts even without prior exposure to preparatory assessments. However, the slightly lower mean score in this group (M = 16.90) compared to the group with pretests (M = 17.70) indicates that pre-assessment may enhance the intervention's impact, potentially by priming pupils for the instructional strategies used. The control group's limited improvement (M = 9.20) further underscores the limitations of using traditional ways to build problem-solving skills, especially in the absence of pre-assessments.

According to Morina and Vondrova's (2021) research, the Block Model Approach helps students effectively combine verbal, visual, and symbolic representations of word problems. This relationship promotes a more profound comprehension of problem-solving ideas and guarantees that students approach challenges systematically. This finding aligns with the results of Ng and Lee (2009), which emphasized that visual and structured teaching methods significantly enhance pupils' mathematical comprehension and problem-solving skills. Furthermore, Kaur (2017) emphasized the importance of scaffolding strategies, such as the Block Model, in helping students bridge the gap between abstract and concrete thinking. These findings support the considerable improvements shown in the experimental groups.

Even without pretests, the Block Model Approach was efficient, with the experimental group outperforming the control group regarding mean scores. This result mirrors the findings of Barmby et al. (2009), which underscored those well-designed instructional approaches can yield substantial learning gains even without preparatory activities. However, the experimental group had slightly lower mean scores without pretests (M = 16.90) compared to those with pretests (M = 17.70), suggesting that pre-assessments may further enhance the intervention by priming pupils for the instructional strategies, as supported by Pape and Smith (2002).

Teachers may consider incorporating the Block Model Approach into their educational repertoire to enhance problem-solving abilities, notably in mathematics and related areas. To maximize the approach's impact, pre-assessment activities can be integrated into lesson planning to identify pupils' initial readiness and effectively scaffold instruction. School administrators may support this initiative by providing training workshops on the Block Model Approach and offering resources such as manipulatives or digital tools that align with its methodology.

Additionally, collaborative peer learning activities could complement the approach, allowing pupils to discuss and apply problem-solving strategies in a shared context. Regularly monitoring pupils' progress through formative assessments can help ensure the method's effectiveness. Finally, additional research might look into the long-term advantages of the Block Model Approach on broader cognitive skills and its adaptability to other subjects, contributing to a more holistic enhancement of educational outcomes.

Table 5
Significant Difference in the Problem-Solving Performance of Pupils in the Posttest who underwent Block Model Approach (Experimental Group) and those Who Did Not (Control Group)

Variables	M	SD	*t* value	*p* value	Decision
With Pretest					
Experimental Group	17.70	1.25	11.41**	<.001	Reject Ho
Control Group	8.70	2.11			
Without Pretest					
Experimental Group	16.90	2.23	10.76 **	<.001	Reject Ho
Control Group	9.20	1.69			

Ho: There is no significant difference in the posttest performance of the experimental and control groups
*Note: Probability Value Scale: **p<0.01 (Highly Significant); *p<0.05 (Significant); p>0.05 (Not significant)*

Significant Difference in the Problem-Solving Performance of Pupils in the Posttest Between Two Control Groups

Table 6 presents the analysis of the significant difference in the problem-solving performance of pupils in the posttest between two control groups: those with pretests (Control Group A) and those without pretests (Control Group B).

The t-value of 0.53 and the p-value of 0.61 show no significant difference between the two groups. Control Group A's mean performance (M = 8.70, SD = 2.11) was marginally lower than Control Group B's. The findings support the null hypothesis (Ho), which states there is no significant difference in problem-solving skills between the two control groups. Thus, the null hypothesis was not rejected but instead accepted.

The non-significant difference indicates that the presence or absence of a pretest had no meaningful impact on students' problem-solving performance in the control groups. This means that both control groups used the same educational strategies or methodologies. This also implies that both control groups' instructional strategies or methods were relatively uniform in their impact on the pupils' learning outcomes. The slightly higher mean performance in the group without pretests could be attributed to minor variations in classroom dynamics, pupil engagement, or external factors unrelated to the instructional approach. However, the lack of a statistically significant difference underscores that these variations were not impactful enough to influence performance meaningfully.

The findings highlight the limitations of traditional instructional methods in improving problem-solving performance, regardless of whether a pretest is administered. The consistently low mean scores across both control groups suggest that these methods may not adequately address pupils' needs for developing problem-solving skills. This suggests the value of exploring alternative teaching approaches, such as the Block Model Approach, to enhance learning outcomes effectively.

Problem-solving as a mathematical exercise provides academic challenges that help pupils improve their mathematical understanding and progress. Problem-solving is critical to laying a firm basis for quality mathematics instruction. It improves students' thinking skills by allowing them to find and formulate new ideas, an activity that incorporates mathematics into real-life problems and situations (Pentang, 2019). Teachers can assist students in seeing the connections between mathematical concepts and practical problems by emphasizing problem-solving. This boosts pupils' motivation and helps them recognize the importance of what they are studying. (Mariano-Dolesh et al, 2022).

To address these findings, teachers in control group settings may consider integrating active learning strategies that promote engagement and critical thinking. Professional development workshops focused on innovative instructional techniques can empower educators to better support pupils in mastering problem-solving concepts. Administrators could provide additional resources, such as problem-solving guides or collaborative learning tools, to facilitate a more hands-on learning experience. Furthermore, schools may benefit from implementing formative assessments that identify specific areas where pupils struggle, enabling targeted interventions to improve their skills.

Table 6
Significant Difference in the Problem-Solving Performance of Pupils

in the Posttest Between Two Control Groups

Variables	M	SD	*t* value	*p* value	Decision
Control Group A (with Pretest)	8.70	2.11	0.53*	0.61	Do not reject Ho
Control Group B(Without Pretest)	9.20	1.69			

Ho: There is no significant difference in the problem-solving performance of pupils in the posttest between two control groups
*Note: Probability Value Scale: **p<0.01 (Highly Significant); *p<0.05 (Significant); p>0.05 (Not significant)*

Significant Difference in the Problem-Solving Performance of Pupils in the Posttest Between Two Experimental Groups

Table 7 presents the analysis of the significant difference in problem-solving performance in the posttestbetween two experimental groups: Experimental Group A (with pretest) and Experimental Group B (without pretest). The results indicate no significant difference between the two groups (t = 0.83, p = 0.43). Experimental Group A achieved a slightly higher mean score (M = 17.70, SD = 1.25) than Experimental Group B (M = 16.90, SD = 2.23). Thus, the two experimental groups have no significant difference in problem-solving performance. Therefore, the null hypothesis was not rejected.

The non-significant result (t = 0.83, p = 0.43) suggests that the presence or absence of a pretest did not substantially influence the performance of learners exposed to the Block Model Approach. While the slightly higher mean score of Experimental Group A may imply that the pretest could have offered some preparatory benefits, this advantage was minimal and not statistically supported. The more considerable variability observed in Experimental Group B (SD = 2.23) compared to Experimental Group A (SD = 1.25) highlights potential differences in how pupils without a pretest engaged with the instructional approach, possibly reflecting varying readiness or prior knowledge levels.

The findings emphasize the robustness of the Block Model Approach, showing that it consistently enhances problem-solving performance regardless of pretest exposure. However, the observed variability in Group B suggests a need to further support learners who may benefit from additional guidance or scaffolding during instruction. This aligns with the study of De Guzman and Belecina (2012), who demonstrated that students in the experimental group exposed to the Block Model Technique significantly outperformed those in the control group taught using conventional methods. Their findings suggest that the effectiveness of this visual and structured problem-solving strategy is not significantly influenced by learners' mathematical aptitude. Similarly, Min et al., (2014) emphasized that the use of visual models supports diverse learners by simplifying abstract concepts and promoting conceptual understanding. In addition, Sankalaite (2023) found that when problem-solving strategies were introduced through step-by-step visual aids, learners developed greater confidence and autonomy in mathematical reasoning. Therefore, regardless of students' initial proficiency levels, the Block Model Approach can be an inclusive and effective tool for improving problem-solving skills.

Teachers may consider incorporating informal diagnostic tools, such as formative assessments, to monitor pupil readiness and provide timely interventions. Scaffolding strategies, including step-by-step demonstrations and guided practice, can help address the needs of learners with varying levels of preparedness. School heads could also facilitate professional development opportunities focused on differentiated instruction and effectively applying the Block Model Approach. Additionally, integrating collaborative learning activities and peer mentoring programs may help mitigate disparities in pupil readiness, ensuring more equitable learning outcomes across diverse groups.

Table 7

Significant Difference in the Problem-Solving Performance of Pupils
in the Posttest Between Two Experimental Groups

Variables	M	SD	*t* value	*p* value	Decision
Experimental Group A	17.70	1.25	0.83	0.43	Do not reject Ho

(with Pretest)		
Experimental Group B (Without Pretest)	116.90	2.23

Ho: There is no significant difference in the problem-solving performance of pupils in the posttest between two experimental groups
*Note: Probability Value Scale: **p<0.01 (Highly Significant); *p<0.05 (Significant); p>0.05 (Not significant)*

Interaction Effect Between the Pretest and the Block Model Approach on Pupils' Problem-Solving Performance

Table 8 presents the interaction effect between the pretest and the block model approach on pupils' problem-solving performance (Table 7).

A two-way analysis of variance (ANOVA) was used to determine the impact of pretest and intervention status on posttest results. The analysis found that the main effect of Pretest Status was not statistically significant ($F(1,36) = 0.065, p = 0.800$). Thus, while there was no significant interaction impact between the pretest and the intervention, the Block Model Approach significantly affected students' performance.

This finding indicates that the participant's performance on the pretest did not significantly impact their scores in the posttest. It suggests that regardless of whether pupils had varying performance levels before the intervention, their baseline abilities did not play a critical role in determining their posttest outcomes. This result aligns with the possibility that the intervention effectively levelled the playing field for all participants, thereby mitigating the influence of prior knowledge or skills.

The main effect of intervention status, Block Model Approach, was highly significant $F(1,36) = 201.28$, $p <.001$), proving the intervention's significant impact on posttest performance. The large F-value and the extremely low p-value underscore the effectiveness of the intervention, with participants exposed to the intervention achieving significantly higher posttest scores compared to those who did not receive it. This finding underscores the Block Model Approach's critical role in improving pupils' problem-solving performance. It highlights the importance of the Block Model Approach in fostering skills, likely providing structured opportunities for pupils to develop and apply problem-solving techniques effectively.

The interaction between pretest and intervention status was insignificant ($F(1,36) = 1.22, p = 0.277$). This shows that the Block Model Approach intervention consistently affected posttest performance across pretest levels. In other words, the effectiveness of the intervention did not depend on whether the pupils had higher or lower initial performance levels. This finding is vital because it points to the general applicability and robustness of the intervention. The intervention appears equally beneficial for all participants, irrespective of their starting point, making it a versatile tool for improving problem-solving performance across diverse pupil groups.

The analysis revealed a residual variance, reflected in error data with a mean square (3.46), which accounts for the unexplained variability in posttest scores. This demonstrates the presence of other factors not captured in the current model that may have influenced the outcomes. For instance, individual differences in motivation, classroom environment, or external support could have contributed to variations in performance. Addressing these potential aspects in future research could provide a more complete picture of the influences on students' problem-solving ability.

The data show that, whereas pretest status had no significant impact on posttest performance, the intervention had a substantial and statistically significant effect on improving students' problem-solving abilities. The lack of an interaction effect further supports the intervention's universal applicability across different initial performance levels. These results emphasize the value of implementing structured and targeted interventions to promote problem-solving proficiency among pupils.

The Block Model Approach dramatically improved pupils' problem-solving abilities when solving word problems. The intervention had a significant favorable effect, with a statistical value of 201.28, exceeding the required threshold ($p <.001$). This demonstrates that the strategy is quite effective at improving pupils' skills. Interestingly, the pretest scores, which measured pupils' initial performance, did not significantly influence the outcomes, as evidenced by a result of 0.07 (more significant than $p = 0.08$). This means whether students performed well or poorly on the pretest did not affect how much they benefited from the intervention. Furthermore, the interaction between pretest scores and intervention was non-significant, with a value of 1.22 (higher than $p = 0.23$). This suggests that the Block Model Approach performed consistently well for all students, regardless of starting level.

The findings suggest that the Block Model Approach effectively enhances pupils' ability to solve word problems. Its effectiveness does not depend on students' prior knowledge or pretest performance but rather equips all learners with the tools and confidence to succeed. This supports the study by Bostic and Pape (2016), which emphasized that structured teaching methods like the Block Model improve problem-solving performance, while groups without such interventions often see little or no improvement. Using a block model method increases students' problem-solving skills and capacity to remember previously learned information.

These findings have practical implications for curriculum developers and mathematics educators. The Block Model Approach can serve as a universal instructional strategy that supports learners of varying proficiency levels, particularly in addressing persistent challenges in solving word problems. Since it does not rely on learners' prior understanding, teachers can adopt it confidently to promote equity in mathematics classrooms. Furthermore, integrating this approach into regular instruction may foster deeper comprehension and retention, making it a sustainable method for long-term learning outcomes.

Table 8
Test of Interaction Effect Between the Pretest and the Block Model Approach on Pupils' Problem-Solving Performance

Source	df	SS	MS	F	p
Pretest Status	1	0.23	0.23	0.07	0.08
Intervention (Block Model)	1	697.23	697.23	201.28	<.001
Pretest Status × Intervention	1	4.225	4.225	1.22	0.23
Error	36	124.70	3.46		

Ho: There is no interaction effect between the pretest and the Block Model Approach on pupils' problem-solving performance

Note. SS = Sum of Squares; MS = Mean Square; $p < .05$ indicates statistical significance.

Conclusion and Recommendations

The findings of the study reveal that the use of traditional methods in teaching problem-solving in mathematics demonstrates a lack of improvement, highlighting the insufficiency of conventional approaches in enhancing students' problem-solving skills. Pupils' performance in problem-solving remains concerning, indicating the need for timely interventions to address their deficiencies in this area. In contrast, the vast improvement in the learners' test performance clearly shows the effectiveness of the Block Model Approach in developing problem-solving abilities. The pretest advantage observed in the experimental group suggests that prior readiness or exposure may influence the outcomes of interventions. Nevertheless, the Block Model Approach consistently proves superior to traditional methods in bridging gaps in problem-solving skills. The absence of significant difference between the control groups confirms that pretesting alone does not lead to improved problem-solving performance. Furthermore, the similar performance across experimental groups demonstrates that the Block Model Approach works effectively regardless of pre-assessment, indicating that the intervention's impact is independent of pretesting. These results collectively affirm the Block Model Approach's consistent effectiveness in enhancing learners' mathematical problem-solving performance.

Based on these findings and conclusions, the following recommendations are presented. School heads and Mathematics coordinators are encouraged to implement targeted interventions, such as the Block Model Approach, to improve low problem-solving skills revealed during pretests, giving particular attention to students who failed to meet expectations. Mathematics teachers are advised to review and enhance their teaching strategies, emphasizing interactive and engaging methods since traditional approaches have shown limited success in improving problem-solving performance. Curriculum developers may integrate the Block Model Approach into the Mathematics curriculum to foster students' critical thinking and problem-solving abilities. School administrators are urged to conduct Learning Action Cell (LAC) sessions to address instructors' concerns, propose appropriate intervention plans and techniques, and provide technical support to elevate teaching and learning to the highest possible level. Mathematics supervisors should also advocate for the widespread adoption of the Block Model Approach to enhance learners' performance in

Mathematics across schools. Finally, Mathematics teachers are reminded not to rely solely on pretesting to improve learning outcomes but to combine it with structured intervention strategies for more effective and sustainable results.

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