

Improving Fourth-Grade Students' Mixed-Arithmetic Learning Outcomes through Problem-Based Learning and Wayground: A Classroom Action Research

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Abstract

Background – Mixed arithmetic operations require understanding of the order of operations and systematic problem solving. Differences in students' initial abilities call for appropriate practice, feedback, and differentiated support.

Purpose – This study aimed to analyze and describe changes in fourth-grade students' mixed-arithmetic learning outcomes during the integration of Problem-Based Learning (PBL) and Wayground at SD Al Irsyad Surakarta.

Method/Approach – Classroom action research followed the Kemmis and McTaggart spiral model across two cycles of planning, action, observation, and reflection. Participants were 27 fourth-grade students. Observation, tests, and documentation provided data for quantitative descriptive and qualitative analysis. Differentiated instruction accompanied the intervention.

Findings – The initial assessment yielded a mean score of 51.9, with scores ranging from 7 to 87. The mean increased from 59.7 in Cycle I to 77.5 in Cycle II. Learning mastery rose from 44.4% to 74.1%, an increase of 29.7 percentage points. Difficulties persisted in multi-step word problems and complex combinations of operations.

Conclusion – Learning outcomes improved during the action cycles, although Cycle II mastery remained below the 75% target. The single-class descriptive design cannot isolate the contribution of PBL and Wayground from differentiated support. Further practice and reinforcement remain necessary.

Novelty/Originality/Value – The study documents a classroom application that connects PBL problem-solving stages with Wayground practice and assessment, while adapting instructional support to students' initial abilities in fourth-grade mixed arithmetic.

Keywords: Problem-Based Learning; Wayground; mixed arithmetic operations; learning outcomes; classroom action research

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INTRODUCTION

Education constitutes a fundamental process for developing students' knowledge, skills, attitudes, and potential, thereby preparing them to respond effectively to diverse challenges in life (Rahman et al., 2026). The educational process should extend beyond the acquisition of knowledge by offering learning experiences that develop students' thinking and problem-solving skills while enabling them to apply what they have learned in everyday situations (Faidul Abrori et al., 2026). Therefore, school learning should be designed in a meaningful manner by considering students' individual characteristics, needs, and abilities.

One area of learning that plays a role in developing students' thinking skills is mathematics. Mathematics learning in elementary schools is not only intended to enable students to perform calculations but also to develop logical, systematic, and critical thinking skills, as well as problem-solving abilities that can be applied in everyday life (Jannah et al., 2024). Through mathematics learning, students are expected to understand concepts, use procedures appropriately, and determine strategies for solving various problems.

One of the mathematics topics taught in Grade IV of elementary school is mixed arithmetic operations. This topic involves the use of several arithmetic operations within a single problem, requiring students to understand the rules and order of operations in order to obtain accurate results (Safirah, 2017). Mastery of mixed arithmetic operations requires not only the ability to perform calculations but also the ability to understand problems, determine the appropriate operations, and complete calculation steps systematically. These characteristics make mixed arithmetic operations a topic that requires both conceptual understanding and accuracy in the problem-solving process.

In learning, each student has different levels of ability and learning needs. Therefore, teachers need to obtain information about students' initial abilities before determining appropriate learning strategies. One way to do this is through an initial cognitive assessment. An initial assessment is used to identify students' levels of competency mastery so that teachers can design instruction based on their needs and abilities (Rahmadhani et al., 2025). The results of the initial assessment can also serve as a basis for teachers in determining subsequent learning activities, including providing assistance to students experiencing difficulties and enrichment activities for students who have mastered the material (Lovendra & Aisiah, 2023). Thus, an initial assessment plays an important role in providing an overview of students' initial conditions before the learning process begins.

In learning, each student has different abilities and learning needs, so instruction should be adjusted to accommodate these differences. This principle is reflected in differentiated learning, an approach in which teachers adapt tasks, activity structures, and forms of support to students' individual developmental stages and learning needs. In the context of mixed arithmetic operations, differentiated learning provides the instructional design principle that connects the initial assessment to classroom practice: the results of the initial assessment are used to determine the level of difficulty of problems, the practice activities provided, and the assistance given to each student.

Based on the initial assessment of mixed arithmetic operations in Grade IV at SD Al Irsyad Surakarta, differences were found in students' abilities to solve the problems. Some students were able to solve mixed arithmetic operations correctly, whereas others still experienced difficulties in determining the order of operations and completing calculations systematically. This condition indicates the need for learning that provides students with opportunities to understand problems, determine solution strategies, and receive practice and feedback gradually. This problem provided the basis for efforts to optimize students' learning outcomes in mixed arithmetic operations.

One learning model that can support this process is Problem-Based Learning. PBL is a learning model that uses problems as the starting point of the learning process. Through this model, students are guided to understand problems, identify relevant information, conduct investigations, determine solution strategies, present their results, and evaluate the problem-solving process (Nuraeni et al., 2025). In the integration designed in this study, PBL functions as the learning model that organizes the

syntax of instruction: it provides the problem-solving structure through which students encounter mixed arithmetic problems, reason about the order of operations, and determine systematic solution steps. Its contribution lies primarily in the learning process, training students to understand problems and independently determine solution strategies, which is precisely the demand of mixed arithmetic operations. Research at the elementary school level has shown that PBL has a significant impact on students' mathematics learning outcomes (Muliawati & Aldin, 2024), and its implementation in mathematics learning has been widely reported (Andani et al., 2021).

In addition to the learning model, the use of appropriate instructional media is necessary to support student engagement and to provide practice and feedback. In this study, the media function is filled by Wayground. This platform provides digital practice and assessment, enabling students to interact directly with questions and receive feedback on their work (Zaidan & Burhanuddin, 2026). Wayground contributes at the media level: it supplies the interactive exercises and assessment activities through which the problem-solving process initiated by PBL is consolidated, and through which students' mastery is measured. Its contribution therefore complements that of PBL, PBL structures how students think about problems, whereas Wayground structures how students practice, receive feedback, and are assessed.

The integration of PBL and Wayground is academically justified by their complementarity. PBL directs the learning process through problem-solving stages, but mastery of mixed arithmetic operations also requires sustained practice and accurate, timely feedback — a function that interactive digital media serve well, as students have been shown to prefer digital media for practicing and solving problems (Daryanes et al., 2023). Previous studies have likewise demonstrated the potential of integrating PBL with digital question-and-assessment media in mathematics learning (Simarmata et al., 2024). The integration of PBL and Wayground thus combines the process-oriented structure of a learning model with the practice- and assessment-oriented function of instructional media, so that problem solving, practice, and evaluation are connected within a single learning cycle. Differentiated learning frames this integration at the level of instructional design: the problems, practice activities, and support are adjusted to the differing levels of mastery identified through the initial assessment.

Various previous studies have examined the implementation of PBL in mathematics learning and demonstrated its potential to support students' learning outcomes and problem-solving abilities (Andani et al., 2021; Muliawati & Aldin, 2024). Studies on the use of digital media in mathematics learning have also continued to develop alongside the use of technology in education. However, these studies have generally examined the learning model and the digital media separately. Studies that specifically integrate PBL with Wayground as a digital practice-and-assessment medium, while simultaneously aligning the instruction with the principles of differentiated learning, for the topic of mixed arithmetic operations in Grade IV elementary school remain limited. Therefore, research is needed to examine the implementation of this integration in the context of actual learning in elementary schools. The novelty of this study lies in the integration of PBL as the learning model, Wayground as the instructional media, and differentiated learning as the instructional design principle, implemented gradually through classroom action research to optimize learning outcomes in mixed arithmetic operations.

Based on the foregoing discussion, this study aimed to analyze and describe the optimization of learning outcomes in mixed arithmetic operations through the integration of the Problem-Based Learning model and Wayground among Grade IV students at SD Al Irsyad Surakarta. In this study, the optimization of learning outcomes was examined through changes in students' learning outcomes from the initial condition before the intervention to the implementation of the intervention in Cycle I and Cycle II. The results of this study are expected to provide an overview of the implementation of PBL and Wayground integration as an alternative learning approach that can support mathematics learning, particularly in the topic of mixed arithmetic operations in elementary schools.

METHODS

Type and Design of the Research

This study is a classroom action research aimed at continuously improving the quality of learning (Siregar, 2025). The research used the Kemmis and McTaggart spiral model, consisting of the stages of planning, action, observation, and reflection (Saptono et al., 2023). The results of the reflection in each cycle were used as the basis for improvement in the following cycle (Syaifudin, 2021). The research was carried out collaboratively; the teacher acted as the implementer of instruction, while the researcher acted as the observer.

Location, Time, and Research Subjects

The research was conducted in Mathematics lessons on mixed arithmetic operations in Grade IV of SD Al Irsyad Surakarta during the odd semester of the academic year, in accordance with the school's academic calendar. The research was carried out over one week, from July 22 to July 29, 2026, in three sessions: the first session on July 22, 2026; the second session on July 25, 2026; and the third session on July 29, 2026, each cycle being implemented in a single session of 3×25 minutes (75 minutes). The research subjects were all 27 Grade IV students; the selection of subjects was based on the learning outcome problems in mixed arithmetic operations identified during the pre-action stage.

Research Procedure

The research began with observation and a pre-action test to determine the initial condition of students' learning outcomes (Saptono et al., 2023). The research was then carried out in two cycles, with each cycle consisting of one meeting (a single session) lasting 3×25 minutes. Each cycle comprised the stages of planning, action, observation, and reflection (Kota & Dewi, 2018; Syaifudin, 2021). At the planning stage, a PBL-based teaching module assisted by Wayground, student worksheets, test instruments, and observation sheets for teacher and student activities were prepared (Dahniar & Nurpahmi, 2023). The action was carried out by the teacher following the PBL syntax, while observation was conducted throughout the learning process. The results of the observation and evaluation were analyzed at the reflection stage as the basis for improvement in the following cycle (Rosmaliwarnis, 2021). The cycles were stopped once the success indicators had been achieved.

Implementation of Learning

Learning applied the five syntax stages of PBL, namely problem orientation, organizing students, individual or group investigation, presenting results, and analyzing and evaluating the problem-solving process (Darmuki et al., 2022; Nurdiansyah et al., 2022). The problems used were contextual word problems on mixed arithmetic operations. Wayground was used as a practice and evaluation medium to strengthen conceptual understanding and increase student engagement.

Data Collection Techniques and Instruments

Data were collected through observation, tests, and documentation (Sari & Koeswanti, 2023). Observation was used to observe the implementation of learning and student activities. Tests in the form of mixed arithmetic operation questions were administered at the pre-action stage, at the end of Cycle I, and at the end of Cycle II. Documentation included field notes, score records, and photographs of learning activities (Sari & Koeswanti, 2023).

Validity and Reliability of the Instruments

In classroom action research, the instruments used to measure learning improvement must be tested for validity and reliability before being applied to the action class (Mutakin, 2023). Content validity was established through expert judgment: the test instrument was assessed by the classroom teacher and an expert in educational evaluation for the relevance, clarity, and alignment of each item

with the material, learning objectives, and competency achievement indicators (Prasetya et al., 2021). Item validity was tested using the Pearson product-moment correlation technique; an item is declared valid if $r \text{ count} > r \text{ table}$ (Prasetya et al., 2021).

The instrument was piloted in a comparable class outside the research subjects to obtain the difficulty index, discriminating power, and reliability coefficient of each item (Zuhra & Nurdin, 2025). Reliability was calculated using the Alpha formula; the test is declared to have high reliability if the reliability coefficient is at least 0.70 (Prasetya et al., 2021). The reliability of the observation sheets was calculated using the percentage of agreement between the two observers, namely the researcher and the teacher (Zuhra & Nurdin, 2025).

Data Analysis Technique

Data were analyzed both quantitatively and qualitatively. Learning outcome data were analyzed using the class average score formula $\bar{X} = \Sigma X / N$ and the classical mastery percentage formula $P = (f / N) \times 100\%$. In these formulas, P is the mastery percentage, f is the number of students who achieved mastery, and N is the total number of students. Observation data were analyzed qualitatively through data reduction, data presentation, and conclusion drawing.

Success Indicators

The research was considered successful if there was an increase in learning outcomes from the pre-action stage to Cycle II and the classical learning mastery reached the set target, with student scores meeting or exceeding the school's Minimum Mastery Criteria (KKM).

RESULTS AND DISCUSSION

Initial Condition (Pre-Cycle)

Before the implementation of the action, a cognitive diagnostic assessment on mixed arithmetic operations was conducted using a 15-item multiple-choice test instrument, completed by 27 Grade IV students. The pretest instrument used is presented in Figure 1.



Figure 1. Pretest Instrument for Mixed Arithmetic Operations

The assessment results showed a fairly wide range in initial ability, with student scores ranging from 7 to 87 and a class average of 51.9. The distribution of students' initial ability categories is presented in Table 1.

Table 1. Initial Cognitive Assessment Results

Category	Number of Students	Percentage
Very Proficient	2	7.4%
Proficient	13	48.1%
Less Proficient	12	44.5%
Total	27	100%

The results of the answer correction showed that students in the Very Proficient category had understood the concept and order of mixed arithmetic operations very well. Students in the Proficient category generally understood the basic concept but still made some errors due to carelessness in determining the order of operations or performing calculations. Meanwhile, students in the Less Proficient category still had difficulty understanding the basic rules of the order of mixed arithmetic operations (multiplication, division, addition, subtraction) and performing basic calculations. This data formed the basis for designing differentiated instruction in Cycle I, namely intensive assistance for students in the Less Proficient category, more varied practice for students in the Proficient category to improve accuracy, and enrichment activities and peer-tutoring roles for students in the Very Proficient category.

Implementation and Results of Cycle I

Learning in Cycle I was designed following the Problem-Based Learning syntax. At the problem orientation stage, students listened to a contextual story about a student named Hamzah who became confused while making a payment at a stall, and then discussed where the error in the calculation occurred. At the organizing stage, students were divided into small groups of 4–5 members. Next, at the investigation stage, students extracted information from the problem into the student worksheet and developed problem-solving steps, followed by the stage of presenting the results in front of the class, and the stage of analyzing and evaluating the problem-solving process together with the teacher to draw conclusions about the correct order for performing mixed arithmetic operations (multiplication, division, addition, and subtraction). The end-of-cycle evaluation was carried out through a Wayground quiz containing 10 multiple-choice questions covering both direct computation items and contextual word problems. Regarding cognitive levels, the multi-step word problem (item 1) was classified as C4 (Analyzing/HOTS), routine computation and application items (items 2–6) as C3, and direct single-operation items (items 7–10) as C2 (Understanding/LOTS), as presented in Table 2. The same instrument was also used for the end-of-cycle evaluation in Cycle II.

Table 2. Wayground Evaluation Instrument (used in Cycle I and Cycle II)

Question	Key	Cognitive Level
Mother bought 5 boxes of pencils. Each box contains 12 pencils. 18 pencils were given to her younger sibling. The remainder was distributed equally to 6 children. How many pencils did each child receive? A. 7 pencils B. 8 pencils C. 9 pencils D. 10 pencils	A	C4 (Analyzing/HOTS)
The result of $36 + 24 \div 6 \times 5$ is A. 46 B. 50 C. 56 D. 60	C	C4 (Analyzing/HOTS)
The result of $80 - 6 \times (7 + 3)$ is A. 10 B. 20 C. 30 D. 40	B	C4 (Analyzing/HOTS)
Mr. Budi has 48 mangoes. The mangoes are placed into 6 baskets in equal amounts. From each basket, 3 mangoes are taken out. The total number of mangoes remaining is A. 24 B. 30 C. 36 D. 42	B	C3 (Applying)
The result of $45 + 28 \div 7 \times 6$ is A. 63 B. 69 C. 72 D. 75	B	C3 (Applying)
The result of $90 - 24 \div 6 + 8$ is A. 86 B. 90 C. 94 D. 98	C	C3 (Applying)

Question	Key	Cognitive Level
The result of $35 + 5 \times 8$ is A. 320 B. 75 C. 80 D. 40	B	C2 (Understanding/LOTS)
The result of $64 \div 8 + 27$ is A. 29 B. 31 C. 35 D. 43	C	C2 (Understanding/LOTS)
The result of $54 - 18 \div 3$ is A. 12 B. 36 C. 42 D. 48	D	C2 (Understanding/LOTS)
The result of $7 \times 9 - 18$ is A. 35 B. 45 C. 55 D. 63	B	C2 (Understanding/LOTS)

Table 3. Cycle I Results

Cycle I Result Indicator	Value
Class average score	59.7 ($\approx 60\%$)
Students passed (score ≥ 70)	12 students (44.4%)
Students not yet passed (score < 70)	15 students (55.6%)

The Cycle I evaluation results showed an increase in the class average compared to the initial condition, although the proportion of students reaching the mastery score (≥ 70) was not yet optimal, at 44.4%. Because the instrument consisted of 10 equally weighted multiple-choice items, each student's score was calculated as the percentage of correct items ($\text{number of correct items} \div 10 \times 100$), so that the reported averages and mastery counts can be traced directly to the item-response data. Analysis of achievement per item showed that question number 2, which tested the order of performing consecutive division and multiplication operations ($36 + 24 \div 6 \times 5$), obtained the lowest accuracy, at only 19%. This finding indicates that most students were still mistaken when they had to perform two operations of equal precedence (division and multiplication) in sequence from left to right. In contrast, word problems with clear and sequential solution steps (questions number 1 and 4) obtained the highest accuracy, at 78%. This finding became material for teacher reflection to provide additional reinforcement on the KABATAKU rule, particularly for cases involving two operations of the same type that must be performed consecutively, as a basis for improving instruction in Cycle II.

Implementation and Results of Cycle II

Based on the reflection results from Cycle I, learning in Cycle II was strengthened with additional explanation and practice on the KABATAKU rule, particularly for questions involving consecutive division and multiplication operations. The teacher also provided individual assistance to students in the Less Proficient category based on the results of the initial assessment mapping, while students in the Proficient and Very Proficient categories were given advanced practice and involved as peer tutors in group discussions. The PBL syntax in Cycle II continued to follow the same five stages as in Cycle I, with the problem context and practice questions adjusted based on the difficulties previously

identified. The end-of-cycle II evaluation was still carried out through a Wayground quiz using the same 10-item instrument as in Table 2, so that the results of Cycle I and Cycle II could be directly compared.

Table 4. Cycle II Results

Cycle II Result Indicator	Value
Class average score	77.5 ($\approx 77\%$)
Students passed (score ≥ 70)	20 students (74.1%)
Students not yet passed (score < 70)	7 students (25.9%)

The Cycle II evaluation results showed an increase compared to Cycle I, both in the class average score (60% to 77%) and in the learning mastery percentage (44.4% to 74.1%); in other words, an increase was observed across all aggregate indicators. Relative to the classical mastery target of 75% set in the Methods, however, the Cycle II mastery rate of 74.1% had not yet met the success criterion, even though the class average (77.5) exceeded the school's KKM of 70. This indicates that the classical mastery target was not fully achieved within the two cycles and would require continued reinforcement in subsequent cycles.

The most notable improvement occurred in question number 2, whose accuracy increased sharply from 19% to 93%, as well as question number 9, which achieved perfect accuracy (100%). This condition indicates that the reinforcement of understanding of the order of arithmetic operations carried out at the beginning of Cycle II was followed by a marked improvement in accuracy, suggesting that it supported students in overcoming the difficulties identified in the previous cycle.

Nevertheless, there were two items whose accuracy actually decreased, namely question number 4 (from 78% to 41%) and question number 6 (from 70% to 56%). Question number 4 was a two-step word problem involving division followed by subtraction within each group, then summing all the remainders, while question number 6 involved a combination of subtraction, division, and addition in a single mathematical sentence. The decrease in these two items indicates that some students still experienced difficulty with multi-step word problems and more complex combinations of mixed operations, even though understanding of the basic order of operations had generally improved. This finding serves as a note that optimizing learning outcomes in mixed arithmetic operations needs to be continuously accompanied by practice with multi-step word problems so that the improvement achieved is more evenly distributed across all types of questions.

Development of Learning Outcomes Across Stages (Pre-Cycle - Cycle I - Cycle II)

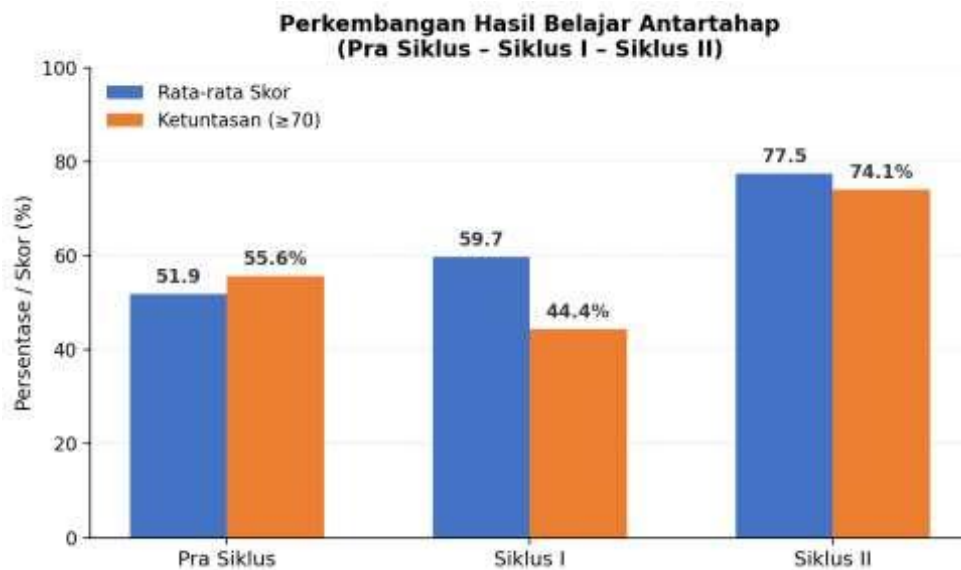


Figure 2. Development of Average Scores and Learning Mastery Across Stages

In general, students' average learning outcomes showed an increasing trend from the initial condition to Cycle II. The most relevant comparison for examining the effect of the action is between Cycle I and Cycle II, since both used identical instruments. This comparison shows an increase, both in the average score (60% to 77%) and in learning mastery (44.4% to 74.1%), an increase of 29.7 percentage points.

This increase was also evident in the individual progress of a number of students who were in the Less Proficient category during the initial assessment. For example, the student with the initials MH, who obtained a score of 7 on the initial assessment, achieved an accuracy of 80% in Cycle I, which increased to 90% in Cycle II. The student with the initials ZA, who also obtained a score of 7 on the initial assessment, showed an increase from 40% accuracy in Cycle I to 80% in Cycle II. This progress indicates that the intensive assistance and gradual practice given to students with low initial ability, as planned in the differentiated instruction, were followed by improved learning outcomes.

The findings of this study reinforce prior work indicating that the application of PBL has the potential to improve students' learning outcomes and problem-solving abilities, because learning does not only focus on the teacher providing solution procedures, but gives students the opportunity to build their own understanding through the problem-solving process (Andani et al., 2021; Zulfa et al., 2023). The stages of PBL applied in this study, starting from orientation to the contextual problem, group organization, investigation through the LKPD, presentation of results, to joint evaluation, provided space for students to be actively involved in identifying information and developing solution strategies (Nuraeni et al., 2025), which was reflected in the increase in the average score and learning mastery from Cycle I to Cycle II. Previous experimental research has likewise shown that the PBL model has a significant impact on elementary students' mathematics learning outcomes as tested with a t-test (Muliawati & Aldin, 2024). In contrast, the present classroom action research did not employ a control group or inferential statistical testing, so the improvement is reported descriptively as an observed increase rather than as a statistically significant effect.

The use of Wayground as an evaluation medium also accompanied this improvement because it provided practice and feedback interactively, allowing students to immediately know their level of understanding (Zaidan & Burhanuddin, 2026). This is consistent with evidence that students prefer digital media for practicing and solving problems, as such media enable them to work through problems and receive feedback more deeply (Daryanes et al., 2023). The competitive nature of the quiz and the immediate scoring provided by Wayground is thought to have increased students'

motivation and engagement in working on the questions, as reflected in the observed increase in accuracy on most items across cycles (Rejeki et al., 2026).

The individual trajectories of the initially low-performing students (MH: 7 → 80 → 90; ZA: 7 → 40 → 80) also point to the contribution of the differentiated assistance given during the action, in which the teacher adjusted the level of problems, practice activities, and support to the students' individual developmental states and learning needs (Prediger et al., 2022). This suggests that individual assistance and peer tutoring, implemented alongside the PBL and Wayground integration, are plausible contributors to the observed gains. Consequently, the improvement cannot be attributed solely to the PBL model and the Wayground medium; it more plausibly reflects the combined effect of the learning model, the digital media, and the differentiated instructional design.

Several methodological cautions qualify the interpretation of these results. First, because the same 10-item instrument was used in Cycle I and Cycle II, part of the observed increase may reflect a practice effect, students' familiarity with the items rather than genuine improvement in mastery. Second, the initial assessment used a 15-item instrument while the cycle evaluations used 10-item instruments, so comparisons of the class average across the three stages must be read with caution. Future cycles should use parallel but different test forms to separate learning gains from item familiarity. Third, the classical mastery rate of 74.1% in Cycle II remained slightly below the target of 75% set for this study, indicating that improvement was not yet evenly distributed.

Nevertheless, the results also showed that the improvement in understanding of the basic order of operations was not yet fully matched by improvement on multi-step word problems and more complex combinations of operations (questions number 4 and 6). This is consistent with the view that mastery of mixed arithmetic operations requires a comprehensive understanding of the hierarchy of operations, not merely computational skill (Safirah, 2017), so that reinforcement at the level of multi-step word problems needs to be given attention in both follow-up instruction and future research.

Finally, the limitations inherent in classroom action research should be acknowledged. The study involved a single class of 27 students, without a comparison group, and the analysis was descriptive; consistent with the orientation of classroom action research toward continuously improving the quality of learning in a specific classroom context (Siregar, 2025), the findings are best understood as evidence of local improvement rather than as a basis for generalizing causal claims to other settings. Overall, the results of the implementation of Cycle I and Cycle II show that the integration of the Problem-Based Learning model and the Wayground medium was followed by an improvement in the learning outcomes of Grade IV students at SD Al Irsyad Surakarta in mixed arithmetic operations during the action cycles, marked by an increase in the class average score and learning mastery percentage from Cycle I to Cycle II, although the classical mastery target was not yet fully reached and further reinforcement is still needed for word problems with more complex solution stages.

CONCLUSION

Based on the research results, an improvement in the learning outcomes of Grade IV students at SD Al Irsyad Surakarta in mixed arithmetic operations was observed during the action cycles. This improvement is shown by the increase in the average score from 59.7 in Cycle I to 77.5 in Cycle II, as well as the learning mastery percentage from 44.4% to 74.1%. The implementation of PBL through contextual problems, group work, investigation using the LKPD, and interactive Wayground evaluation was accompanied by increased student engagement and strengthened conceptual understanding. However, because the action was implemented simultaneously with differentiated instruction, including individual assistance for students in the Less Proficient category and peer tutoring, the observed improvement cannot be attributed solely to the integration of the PBL model and the Wayground medium. It more plausibly reflects the combined effect of the learning model, the digital media, and the differentiated instructional design. Nevertheless, this improvement was not yet evenly distributed across multi-step word problems and more complex combinations of operations. Therefore, the application of PBL and Wayground needs to be accompanied by multi-step practice

questions and differentiated assistance to comprehensively strengthen understanding of the hierarchy of mixed arithmetic operations. These findings indicate that the action applied has addressed the research problem, but reinforcement in the aspect of complex problem-solving is still needed in future instruction and research.

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