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Implementation of the Problem Based Learning Model Assisted by Wordwall to Improve Mathematics Learning Outcomes on Fraction Material for Fifth-Grade Elementary School Students

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ABSTRACT

Fifth-grade students at SDN 2 Kalideres struggled with fraction material because learning was teacher-centered and interactive media were rarely used. This study aimed to improve students' mathematics learning outcomes on fraction material through the Problem Based Learning (PBL) model assisted by Wordwall. This Classroom Action Research (CAR) followed the Kemmis and McTaggart design across two cycles, each consisting of planning, acting, observing, and reflecting. The subjects were 16 fifth-grade students. Data were collected through observation, interviews, tests, and documentation, then analyzed descriptively and quantitatively. The pre-cycle results showed that only 6 students (37.5%) achieved mastery learning, with a class average score of 53.13. In Cycle I, mastery learning increased to 11 students (68.75%) and the class average rose to 69.38. In Cycle II, 14 students (87.5%) achieved mastery learning and the class average reached 79.38, exceeding the 75% success indicator. These findings indicate that integrating PBL with Wordwall effectively improved student engagement and the mathematics learning outcomes of fifth-grade students.

1. Introduction

Education is a conscious and planned effort to create a learning atmosphere that enables students to actively develop their potential, whether in spiritual, self-control, personality, intellectual, moral, or life-skill aspects (Abd Rahman BP et al, 2022). Improving the quality of learning at every level of education, including elementary school, is a shared responsibility of the government, educational institutions, and teachers so that the goals of national education can be achieved

optimally. Within this effort, the classroom teacher holds a central position because it is at the classroom level that curriculum goals are translated into everyday learning experiences. When teachers are able to design learning that is contextual, interactive, and responsive to students' needs, the potential of every student can be optimally developed, including in subjects that are traditionally considered difficult, such as mathematics.

Mathematics is one of the core subjects taught from elementary school through higher education because it plays an important role in developing students' critical, logical, analytical, and systematic thinking skills. Nevertheless, mathematics is still often regarded as a difficult subject that is disliked by most students, which negatively affects their motivation and learning outcomes (Lisa & Rachmani, 2025). Among the various topics in elementary mathematics, fraction material is frequently identified as one of the most challenging because it requires students to understand abstract relationships between numerators and denominators rather than merely memorizing procedures. Mathematics learning in fifth grade should ideally engage students actively in solving real-world problems so that concepts can be understood meaningfully, with learning outcomes meeting the Learning Achievement Criteria (KKTP) set by the school (Rifdah & Muhammad Zaini, 2023). When this active engagement does not take place, students tend to memorize procedures without understanding the underlying concept, so that their performance declines as soon as they are given problems presented in an unfamiliar format.

The initial condition of mathematics learning in the fifth grade of SDN 2 Kalideres showed that students' learning outcomes on fraction material were still suboptimal. The learning process tended to be teacher-centered, so students' active participation remained low; some students appeared passive, reluctant to express their opinions, and less engaged in discussions during lessons. Preliminary interviews with the classroom teacher revealed that students' difficulties were not limited to a general dislike of the topic, but were concentrated in specific sub-skills: most students had not yet been able to equalize denominators correctly before adding or subtracting fractions, were still confused when converting mixed numbers into common fractions and vice versa, and struggled to work through word problems that required contextual understanding and accuracy. These difficulties indicate that students had not yet built a robust conceptual understanding of fractions and were instead relying on partially memorized procedures that broke down whenever the problem format changed. Although the teacher had attempted to apply problem-based learning, its implementation had not been carried out systematically according to the Problem Based Learning (PBL) syntax, with the teacher more often giving example problems and asking students to work individually rather than guiding them through problem orientation, group investigation, and structured presentation of results. The use of interactive, technology-based instructional media was also still limited, making the learning process feel monotonous. This combination of an under-structured teaching model and a lack of engaging media made it difficult for students to obtain the varied practice and immediate feedback needed to master fraction operations, which is precisely the gap that this study sought to address through the use of the Wordwall medium alongside PBL.

The use of interactive digital learning media has also been shown to improve elementary students' learning outcomes (Fatimah et al., 2025). Various research findings indicate that the use of innovative learning models combined with digital instructional media has proven effective in improving students' mathematics learning outcomes. The Problem Based Learning (PBL) model positions students as active subjects in the learning process through solving contextual problems, thereby fostering critical thinking, collaboration, and problem-solving skills (Ardianti et al., 2021; Sari et al., 2024). Systematic implementation of the PBL syntax, comprising problem orientation, organizing students, guided investigation, developing and presenting results, and analyzing and evaluating the problem-solving process, has been shown to improve both the process and outcomes of mathematics learning on fraction material (Karmani, 2021; Novelni & Sukma, 2021). Mustika & Sastrawati, (2024) similarly found that applying the PBL model increased fifth-grade students' learning activity in mathematics, which is also consistent with the view that appropriate learning media can support active and meaningful learning in elementary classrooms (Siti Fatimah, Hema Widiawati, 2025).

In addition to the learning model, the use of interactive, technology-based instructional media also contributes to improved learning outcomes. Wordwall is a digital game-based learning medium that provides various interactive activities, such as quizzes, random cards, and matching games, which can be tailored to learning objectives (Sidik & Zamnah, 2025; Imanulhaq, R., 2022). A number of studies have shown that the use of Wordwall effectively increases elementary students' interest, motivation, and learning outcomes on fraction material (Kamswara et al., 2024; Patriamurti et al., 2024), while Hidayati & Lubis (2026) similarly reported that Wordwall educational games enhanced students' motivation and learning outcomes in other subject areas. The combination of the PBL model with Wordwall media is expected to create mathematics learning that is more active, contextual, and enjoyable for fifth-grade students, since Wordwall can provide the varied practice and immediate feedback that students need after engaging in problem-based investigation. Yusuf et al., (2025) similarly found that a concrete diagram-board medium raised fifth-grade students' mathematics mastery learning from 7.4% in the pre-cycle to 63% in Cycle I and 85% in Cycle II, indicating that concrete media can make learning more engaging regardless of the specific medium used.

Although PBL and Wordwall have each been widely studied, most previous research has examined them separately or has applied their combination to subjects other than mathematics. For example, Risma Nur Ardiana et al., (2025) demonstrated that PBL assisted by Wordwall improved fifth-grade students' learning outcomes in the IPAS (Social and Natural Sciences) subject, while other studies have focused on PBL alone in mathematics (Mustika et al., 2024; Rifdah et al., 2023) or on Wordwall alone in fraction material (Kamswara et al., 2024; Patriamurti et al., 2024)). Research that specifically integrates the PBL model with Wordwall media to improve fifth-grade students' mathematics learning outcomes on fraction material remains limited. This gap is important to address because fraction material requires both a systematic problem-solving process, which PBL

provides through its structured syntax, and repeated, interactive practice with immediate feedback, which Wordwall provides through its gamified exercises. The novelty of this study therefore lies in the integration of PBL and Wordwall as a combined learning strategy and digital medium, applied specifically to fraction material in fifth grade, so as to create mathematics learning that is more interactive and oriented toward problem solving than either component could achieve on its own. Based on this description, this study aimed to determine whether the implementation of the Problem Based Learning model assisted by Wordwall could improve fifth-grade students' mathematics learning outcomes on fraction material at SDN 2 Kalideres, as reflected in the increase in classical mastery learning and the class average test score from the pre-cycle condition through Cycle I and Cycle II.

2. Methodology

This study was a Classroom Action Research conducted at SDN 2 Kalideres, located in Dusun 2, Blok Sibango, Kalideres Village, Kaliwedi Subdistrict, Cirebon Regency. The research focused on fifth-grade mathematics learning, specifically on fraction material, and was conducted in the 2024/2025 academic year over a period of one month in February. The research subjects were all 16 fifth-grade students of SDN 2 Kalideres, consisting of both male and female students, with the classroom teacher serving as a collaborator in implementing the action. The research design followed the Kemmis and McTaggart classroom action research model, carried out cyclically and consisting of four main stages in each cycle: planning, acting, observing, and reflecting. The research was conducted over two cycles, in which the reflection results of the previous cycle formed the basis for improvement in the following cycle until the success indicators were achieved. The action research procedure is presented in Figure 1.

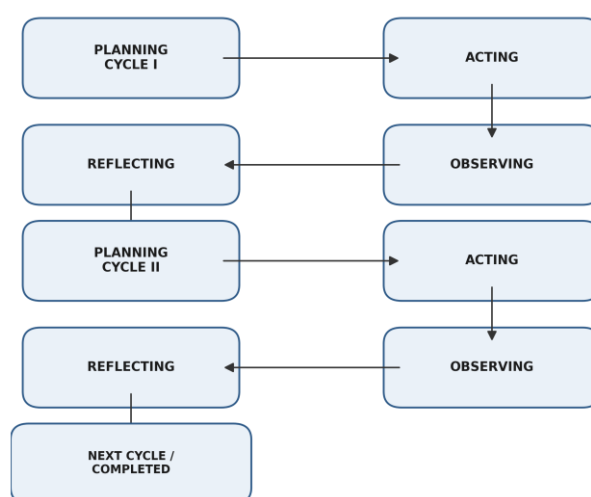


Figure 1. Classroom Action Research Procedure Based on the Kemmis and McTaggart Model

(adapted from Fauziyah et al., 2024)

During the planning stage, the researcher prepared a teaching module based on the PBL syntax, developed fraction material in the form of interactive activities on the Wordwall application, compiled the research instruments, and established the success criteria for the action. During the acting stage, learning began with orienting students to a contextual problem related to fractions, followed by organizing students into groups, guiding investigation, presenting group work results, and analyzing and evaluating outcomes, reinforced through interactive practice on Wordwall. The observing stage was carried out simultaneously with the action to monitor the implementation of the PBL syntax, student engagement, and learning outcomes. The reflecting stage was used to analyze the successes and constraints of the action as a basis for improvement in the following cycle.

Instrument

The instruments used in this study consisted of four types. The student observation sheet was used to record students' activeness, engagement, and understanding during learning, covering aspects such as student activeness, involvement in the PBL stages, implementation of the PBL model, use of the Wordwall medium, and student understanding when using Wordwall. The teacher observation sheet was used to evaluate the teacher's performance across the opening, core, and closing activities of learning, focusing on the extent to which the PBL syntax and Wordwall medium were implemented as planned. The teacher interview guide consisted of a structured set of questions covering initial information about students and their learning outcomes prior to the action, the learning process in the classroom, and the use of technology-based media, and was used to obtain in-depth information about the learning conditions before the action was implemented. The learning outcome test consisted of 10 multiple-choice questions measuring cognitive levels C4 through C6 on fraction material, administered at the end of each cycle, while documentation in the form of photographs of learning activities complemented the observational and test data at each stage of the research. The blueprint of the learning outcome test is presented in Table 1.

Data Collection

Data collection in this study was carried out using four techniques. Participant observation was conducted by the researcher together with the classroom teacher as collaborator to observe both student and teacher activities during each meeting, using the student and teacher observation sheets to record the extent to which the PBL syntax and Wordwall activities were implemented as planned. Interviews were conducted with the fifth-grade teacher prior to the action to explore the initial learning conditions, the teacher's usual instructional practices, and the extent of technology use in the classroom. Learning outcome tests were administered individually to all 16 students at the end of the pre-cycle, Cycle I, and Cycle II to measure their achievement on fraction material. Documentation in the form of activity photographs was used to complement the observational and test data, providing visual evidence of how the PBL model assisted by Wordwall was implemented at each stage of the research.

Table 1. Blueprint of the Multiple-Choice Learning Outcome Test

Question Indicator	Cognitive Level	Question Type	Item No.	Weight
Analyzing fraction relationships based on pictures/illustrations	C4	Multiple Choice	1	10
Analyzing the equivalence of two fractions	C4	Multiple Choice	2	10
Analyzing the result of adding fractions with different denominators	C4	Multiple Choice	3	10
Analyzing the result of subtracting fractions with different denominators	C4	Multiple Choice	4	10
Evaluating the steps for solving fraction multiplication	C5	Multiple Choice	5	10
Evaluating the steps for solving fraction division	C5	Multiple Choice	6	10
Analyzing contextual problems involving fractions	C4	Multiple Choice	7	10
Evaluating the most appropriate answer for a fraction word problem	C5	Multiple Choice	8	10
Determining a strategy for solving a fraction problem	C6	Multiple Choice	9	10
Formulating logical steps to solve a fraction word problem	C6	Multiple Choice	10	10

(Source: research data, 2026)

Data Analysis

Qualitative data from observations and interviews were analyzed descriptively to describe the implementation of the PBL syntax and student engagement. Quantitative data from the learning outcome tests were analyzed by calculating individual student scores ($N = \text{score obtained} \div \text{maximum score} \times 100$), the class average score ($\bar{X} = \text{total scores} \div \text{number of students}$), and the classical mastery learning percentage ($P = \text{number of students who passed} \div \text{number of students} \times 100\%$). A student was categorized as having achieved mastery learning if their individual score reached or exceeded the Learning Achievement Criteria (KKTP) for fraction material set by SDN 2 Kalideres, namely a minimum score of 70. The research was considered successful if classical mastery learning reached at least 75% of students with scores meeting or exceeding the KKTP, and if there was an increase in the class average learning outcome score in each cycle.

3. Results and Discussion

Overall, the implementation of the Problem Based Learning model assisted by Wordwall in this classroom action research was carried out across two cycles, each consisting of the planning, acting, observing, and reflecting stages in accordance with the Kemmis and McTaggart design. In each cycle, learning followed the PBL syntax, beginning with orienting students to a contextual problem related to fractions, organizing students into small groups, guiding group investigation using the Student Worksheet (LKPD), facilitating the presentation of group work results, and closing with analyzing and evaluating the problem-solving process; this final stage was reinforced through interactive quiz and matching-game activities on the

Wordwall application, which allowed students to practice fraction operations repeatedly and receive immediate feedback on their answers. The teacher acted as a facilitator throughout the investigation and presentation stages, while the researcher, together with the classroom teacher as collaborator, observed student engagement, group interaction, and the extent to which the PBL syntax and Wordwall activities were implemented as planned. This general implementation pattern was followed consistently in both cycles, with adjustments made in Cycle II based on the reflection results of Cycle I. An overview comparing the baseline condition with the achievements following the action is presented in Table 2, before the improvement in students' mathematics learning outcomes is discussed in more detail below.

Table 2. Overview of the Baseline Condition and Achievements Following the Implementation of PBL Assisted by Wordwall

Indicator	Pre-Cycle (Baseline)	Cycle I	Cycle II
Implementation of the PBL syntax and Wordwall activities	Not yet implemented systematically; use of interactive media still limited	Implemented following the PBL syntax and reinforced with Wordwall practice; some groups still passive	Implemented systematically with clearer group tasks; Wordwall used optimally for practice and evaluation
Student activity/engagement (based on observation)	Passive, reluctant to give opinions, low participation in discussion	Increased engagement in group activities; some students still passive	Active engagement in discussion; confident in presenting group work results
Class average cognitive test score	53.13	69.38	79.38
Classical mastery learning	37.5% (6 of 16 students)	68.75% (11 of 16 students)	87.5% (14 of 16 students)

(Source: research data, 2026)

Initial Condition of Students' Mathematics Learning Outcomes

The initial condition of students' mathematics learning outcomes on fraction material was obtained through a pre-cycle activity conducted before the action was implemented. Observations at this stage showed that some students had difficulty understanding fraction concepts and had not yet been actively engaged in learning. The pre-cycle evaluation results showed that of the 16 students, only 6 students (37.5%) achieved mastery learning, with a class average score of 53.13, while 10 students (62.5%) had not yet achieved mastery. These weaknesses matched the difficulties identified in the preliminary interview with the classroom teacher, namely equalizing denominators before adding or subtracting fractions, converting mixed numbers into common fractions, and solving contextual word problems. Learning also remained teacher-centered, and the teacher's earlier use of problem-based learning had not followed the PBL syntax systematically. Because only 6 of the 16 students reached the KKTP of 70, the pre-cycle result fell far below the 75% classical mastery target, which confirmed the need for a more structured and

interactive intervention. This condition became the basis for implementing the action through the PBL model assisted by Wordwall in Cycle I.

Implementation of the Problem Based Learning Model Assisted by Wordwall

The implementation of the PBL model assisted by Wordwall was carried out over two cycles, each consisting of planning, acting, observing, and reflecting stages. In Cycle I, learning began with an opening activity in which the teacher provided apperception by linking fraction material to situations in students' daily lives, followed by orienting students to a contextual problem they were required to solve. Students were then organized into small groups and given the Student Worksheet (LKPD) containing fraction-related problems to discuss, with the teacher acting as a facilitator who guided groups experiencing difficulty. During the investigation stage, students worked to find a solution using the information provided in the LKPD, after which group representatives presented their results while other groups gave responses. The final stage involved analyzing and evaluating the problem-solving process together with the teacher, followed by practice and evaluation through Wordwall media, which added variation and made the practice activities more interactive (Figure 2).



Figure 2. Implementation of PBL Learning Assisted by Wordwall in Cycle I

Observation results in Cycle I showed a positive change in student activity compared to the pre-cycle condition: students began to show engagement in group work and grew more confident in voicing their opinions during discussion, and the use of Wordwall received a positive response because the practice activities were presented in a more engaging format. However, the implementation of Cycle I still revealed several constraints: some students remained passive during group activities, several students required further guidance in understanding the problems, and time management during learning still needed improvement. The Cycle I evaluation results showed that 11 students (68.75%) had achieved mastery learning, with the class average score rising to 69.38, while 5 students (31.25%) had not yet achieved mastery. Based on these results and constraints, improvements in Cycle II were directed at providing clearer instructions on problem-solving steps, arranging

a more balanced division of tasks within groups, and optimizing time management and the use of Wordwall.

In Cycle II, the teacher again applied the PBL stages, beginning with orienting students to a problem presented in a context close to their daily lives so that it would be easier to understand, followed by having students identify the information given and determine what needed to be solved. Students then worked in groups with a clearer division of tasks so that every member could participate, and during the investigation stage the teacher provided guidance gradually while still giving students the opportunity to find answers independently. After the investigation, students presented their group work, which gave them the opportunity to communicate their reasoning and compare their problem-solving strategies with those of other groups. The lesson closed with analysis and evaluation, in which the teacher and students discussed the results and reinforced the fraction concepts learned, before Wordwall was used again in a more targeted way so that all students obtained a more even opportunity to participate, leaving them visibly more enthusiastic than during conventional written practice (Figure 3).



Figure 3. Implementation of PBL Learning Assisted by Wordwall in Cycle II
(Source: research documentation, 2026)

Observation results in Cycle II showed better development compared to Cycle I: students appeared more active in discussion, more able to cooperate, and more confident when presenting their work, and they had also grown more accustomed to following the stages of problem-based learning. When facing a problem, students increasingly tried to find a solution through discussion before asking the teacher for help, indicating a change in their engagement throughout the learning process. The Cycle II evaluation results showed that 14 students (87.5%) had achieved mastery learning, with the class average score reaching 79.38, while 2 students (12.5%) had not yet achieved mastery, so the research action was stopped at Cycle II because the success indicators had been achieved.

Improvement of Mathematics Learning Outcomes on Fraction Material

The improvement in students' mathematics learning outcomes on fraction material can be seen by comparing the classical mastery learning achieved at each stage of

the research, namely the pre-cycle, Cycle I, and Cycle II. This comparison reflects the number of students whose individual scores reached or exceeded the Learning Achievement Criteria (KKTP) of 70 relative to those who had not yet reached this threshold, and shows the extent to which the combination of the PBL model and Wordwall media contributed to increasing student mastery from one stage to the next. The class average score also rose from 53.13 in the pre-cycle to 69.38 in Cycle I and 79.38 in Cycle II, a total gain of 26.25 points, which shows that the improvement was not limited to the number of students who passed but was also reflected in higher scores across the whole class. The complete recapitulation of students' mastery learning outcomes across the three stages is presented in Table 3.

Table 3. Recapitulation of Students' Mastery Learning Outcomes

No	Stage	Number Passed	Percentage	Number Not Passed	Percentage
1	Pre-Cycle	6	37.5%	10	62.5%
2	Cycle I	11	68.75%	5	31.25%
3	Cycle II	14	87.5%	2	12.5%

Table 3 shows that the number of students who achieved mastery learning increased gradually from 6 students (37.5%) in the pre-cycle, to 11 students (68.75%) in Cycle I, and reached 14 students (87.5%) in Cycle II. Overall, there was an increase of 8 students who achieved mastery and an increase of 50 percentage points in mastery learning from the initial condition to Cycle II. Conversely, the number of students who had not achieved mastery decreased from 10 students in the pre-cycle to 2 students in Cycle II. Cycle II mastery of 87.5% also exceeded the 75% success indicator, whereas Cycle I (68.75%) had not yet reached it, which explains why a second cycle was needed. Even so, 2 students (12.5%) still had not reached the KKTP in Cycle II, which suggests that a small number of students may need additional individual support beyond the group-based activities used in this study. The comparison of the number of students who passed and did not pass at each stage is presented in Figure 4, while the trend in mastery learning percentage is presented in Figure 5.

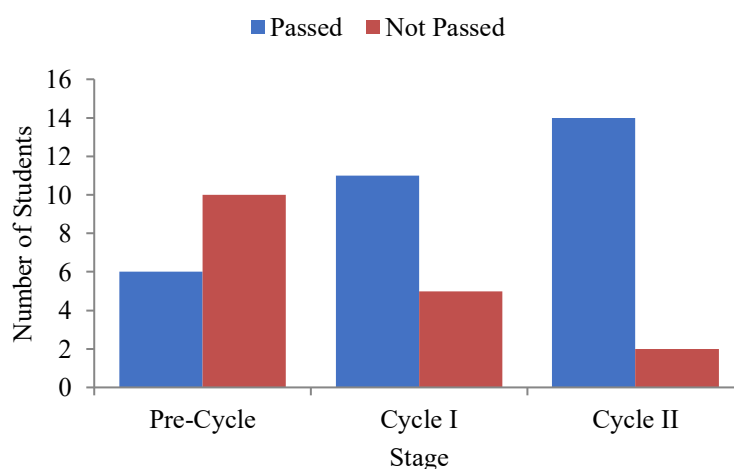


Figure 4. Comparison of the Number of Students Who Passed and Did Not Pass

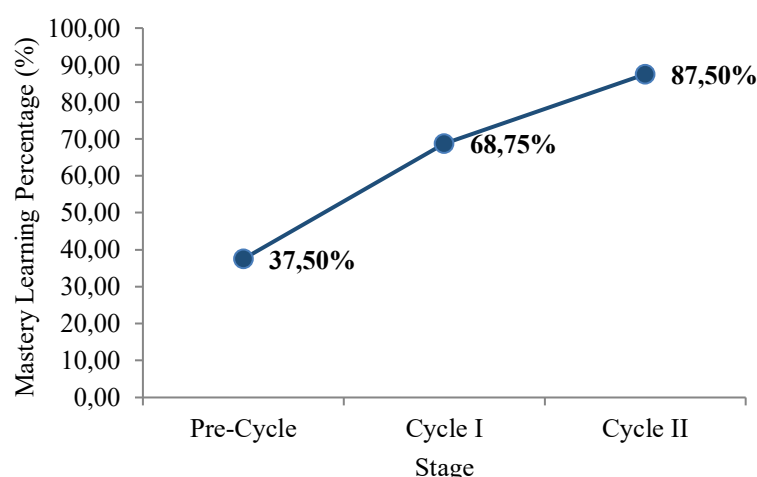


Figure 5. Trend in Students' Mastery Learning Percentage

The consistent improvement across cycles indicates that the implementation of the PBL model assisted by Wordwall made a positive contribution to students' mathematics learning outcomes on fraction material. Through PBL, students had the opportunity to understand the material through contextual problems, conduct investigations, engage in discussions, and present their ideas, while Wordwall provided varied, interactive practice and evaluation activities that increased student engagement and motivation during learning. The initial condition of students' mathematics learning outcomes on fraction material in this study, with a mastery rate of only 37.5%, indicates that students still experienced difficulty understanding fraction concepts prior to the action, which reinforces the need for learning models and media that can increase student engagement. Nurbaeti (2020) also found that the implementation of the PBL model was effective in improving fifth-grade students' mathematics learning outcomes on fraction operations, which is consistent with the finding of this study that a low initial condition can be improved through systematic problem-based learning.

Discussion

The implementation of the PBL model assisted by Wordwall in this study was carried out through the stages of problem orientation, organizing students, investigation, presenting results, and analyzing and evaluating outcomes, reinforced with interactive practice on Wordwall. This result is consistent with the study by Sari et al., (2020), who implemented the PBL model assisted by Wordwall to improve students' learning outcomes, as well as the study by Puri & Astria (2026), who implemented PBL assisted by Wordwall with fifth-grade students and found an improvement in mathematics learning outcomes after two cycles. Kamswara et al., (2024) similarly reported that Wordwall media effectively increased students' interest in learning fraction material, while Patriamurti et al., (2024) found an improvement in fourth-grade students' learning outcomes on fractions through a contextual approach assisted by the Wordwall application. Astuti et al. (2025) further reported that implementing PBL with animated video media likewise improved student learning outcomes, reinforcing the notion that

pairing PBL with varied digital media consistently supports better learning outcomes across different media types and that the success of implementing PBL assisted by Wordwall is influenced not only by the use of digital media, but also by the consistent implementation of the learning syntax across cycles.

The improvement in students' mathematics learning outcomes in this study can also be explained through the specific mechanisms offered by the combination of PBL and Wordwall. In the problem orientation and investigation stages of PBL, students were required to actively analyze contextual fraction problems, identify relevant operations, and construct their own solution strategies rather than passively receiving procedures from the teacher; this process is consistent with the constructivist principle that understanding of abstract concepts, such as fractions, develops more robustly when students construct meaning through problem solving rather than through rote memorization. The group investigation and presentation stages further gave students the opportunity to articulate their reasoning, receive peer feedback, and revise misconceptions before these misconceptions became entrenched. Wordwall then reinforced this conceptual work by providing interactive, game-based practice, such as quizzes and matching activities, that allowed students to repeat fraction exercises in a low-pressure format and receive immediate feedback on the correctness of their answers. This immediate feedback is particularly important for fraction material, where errors, such as failing to equalize denominators, often go unnoticed until they are pointed out; Wordwall's instant scoring allowed students to detect and correct these errors quickly, while its game-like format sustained their motivation and engagement across repeated practice sessions in a way that conventional worksheets could not. Taken together, the problem-solving structure of PBL and the interactive, feedback-rich environment of Wordwall complemented each other: PBL supplied the conceptual and reasoning demands, while Wordwall supplied the repeated, engaging practice needed to consolidate that understanding, which explains why the combination produced a more consistent improvement across cycles than either component would likely have produced on its own.

The improvement in mathematics learning outcomes on fraction material in this study is evident from the increase in the mastery learning percentage, from 37.5% in the pre-cycle to 68.75% in Cycle I, and 87.5% in Cycle II. This finding is consistent with the study by Yunita (2024), who found that the implementation of PBL assisted by Wordwall improved fourth-grade students' cognitive mathematics learning outcomes, as well as the study by Karmani (2021), who reported an increase in activity and learning outcomes on fraction arithmetic operations through PBL. Sinaga et al., (2025) further support this finding, having found that the implementation of PBL assisted by Wordwall significantly improved fifth-grade students' mathematics learning outcomes, with the class average rising from 59.33 (pre-test) to 79.88 (post-test) and 75% of students reaching the minimum competency criteria. Thus, the combination of the PBL model and Wordwall media has proven effective in gradually improving fifth-grade students' mathematics learning outcomes on fraction material at SDN 2 Kalideres across each cycle.

Beyond confirming that mathematics learning outcomes improved, this study also offers a specific contribution regarding what changed in the learning process itself.

Prior to the action, learning at SDN 2 Kalideres was teacher-centered, with limited opportunities for students to engage in problem solving or interactive practice; the combination of PBL and Wordwall shifted this pattern toward a more student-centered process in which students investigated problems collaboratively and practiced independently through a digital medium. This contribution goes beyond what has been reported in studies that examined PBL or Wordwall separately (Kamswara et al., 2024; Patriamurti et al., 2024; Rifdah et al., 2023), and is more directly comparable to studies that combined problem-based approaches with digital or game-based media in other elementary subjects, such as Ardiana et al. (2025) in IPAS learning and Gunawan et al. (2026) in general mathematics learning outcomes, both of which likewise reported that structured problem-based stages paired with engaging media produced greater gains than either element alone. For classroom teachers, these findings suggest that fraction material, which is often taught procedurally, can be made more meaningful and enjoyable by pairing a structured problem-solving model with a game-based digital medium; this combination can be considered as an alternative learning design when planning mathematics lessons on fraction material or other abstract topics that require both conceptual reasoning and repeated practice.

4. Conclusion

This classroom action research shows that the initial mathematics learning outcomes of fifth-grade students at SDN 2 Kalideres on fraction material were still below the expected standard, with most students struggling to understand fraction concepts and to apply the correct operations, particularly when working with different denominators or contextual word problems. The implementation of the Problem Based Learning model assisted by Wordwall was carried out across two cycles following the stages of planning, acting, observing, and reflecting, with the reflection results of Cycle I used to refine group organization, task clarity, and the use of Wordwall activities in Cycle II. Through this process, learning gradually became more student-centered, with students actively engaged in identifying and solving contextual fraction problems in groups and subsequently reinforcing their understanding through interactive practice on Wordwall. The action research was concluded after Cycle II because the predetermined success indicators, namely the classical mastery learning target and a consistent increase in the class average score across cycles, had been achieved, indicating that the intervention succeeded in addressing the initial learning problem. These findings confirm that combining a structured problem-based learning model with an interactive, technology-based instructional medium can serve as an effective and practical alternative for teachers seeking to improve elementary school students' understanding of fraction material, and more broadly, other mathematics topics that require both conceptual reasoning and repeated, engaging practice.

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