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Bridging Abstract Mathematical Concepts through Metuba: A Problem-Based Learning Approach to Enhance Mathematical Problem-Solving Skills

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Abstract

Mathematical problem-solving ability is a crucial competency in elementary school. However, instructional practices reveal that students often struggle to connect abstract mathematical concepts with concrete problem situations, as instruction tends to prioritize rote exercises and procedural steps. This gap highlights a disconnect between the demands of problem-solving instruction and students' actual learning experiences. This study aimed to improve fourth-grade students' mathematical problem-solving skills in division word problems at SD Negeri 2 Piji by implementing the Problem-Based Learning (PBL) model supported by Metuba media. The study employed Classroom Action Research (CAR) conducted over two cycles—each comprising two meetings—following the stages of planning, action implementation, observation, and reflection. The participants consisted of 16 students. Data were collected through observation, tests, interviews, and documentation, and were analyzed using both quantitative and qualitative methods. The results demonstrated an increase in the class mastery rate from 31.25% in the pre-cycle stage to 43.75% in Cycle I and 87.50% in Cycle II. The implementation of PBL supported by Metuba not only improved mastery rates but also fostered student engagement in understanding problems, formulating strategies, performing calculations, and explaining solution processes. Thus, PBL supported by Metuba serves as a viable instructional alternative to bridge abstract division concepts with concrete experiences while simultaneously supporting the development of mathematical problem-solving skills among elementary school students.

Keywords: Problem–Based Learning, Metuba, Mathematical Problem-Solving Skills

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Abstrak

Kemampuan pemecahan masalah matematis merupakan salah satu kompetensi penting dalam pembelajaran matematika sekolah dasar. Namun, praktik pembelajaran menunjukkan bahwa peserta didik masih mengalami kesulitan menghubungkan konsep matematika yang abstrak dengan situasi masalah yang konkret, sementara pembelajaran cenderung berfokus pada latihan soal dan prosedur penyelesaian. Kondisi tersebut menunjukkan adanya kesenjangan antara tuntutan pembelajaran pemecahan masalah dan pengalaman belajar peserta didik. Penelitian ini bertujuan untuk meningkatkan kemampuan pemecahan masalah matematis dalam menyelesaikan soal cerita pembagian melalui penerapan model Problem Based Learning (PBL) berbantuan media Metuba pada peserta didik kelas IV SD Negeri 2 Piji. Penelitian menggunakan metode Penelitian Tindakan Kelas (PTK) yang dilaksanakan dalam dua siklus, masing-masing terdiri atas dua pertemuan dengan tahapan perencanaan, pelaksanaan tindakan, observasi, dan refleksi. Subjek penelitian berjumlah 16 peserta didik. Data dikumpulkan melalui observasi, tes, wawancara, dan dokumentasi serta dianalisis secara kuantitatif dan kualitatif. Hasil penelitian menunjukkan peningkatan ketuntasan klasikal dari 31,25% pada pra-siklus menjadi 43,75% pada siklus I dan 87,50% pada siklus II. Penerapan PBL berbantuan Metuba tidak hanya meningkatkan ketuntasan, tetapi juga mendorong keterlibatan peserta didik dalam memahami masalah, menentukan strategi, melakukan perhitungan, dan menjelaskan proses penyelesaian. Dengan demikian, PBL berbantuan Metuba dapat menjadi alternatif pembelajaran untuk menjembatani konsep pembagian yang abstrak dengan pengalaman konkret sekaligus mendukung pengembangan kemampuan pemecahan masalah matematis peserta didik sekolah dasar

Kata Kunci: Problem Based Learning, Metuba, Kemampuan Pemecahan Masalah Matematis

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INTRODUCTION

Mathematics has a strategic role in developing students' critical, logical, and systematic thinking skills when solving problems (Ramadhani et al., 2024). However, the reality on the ground shows that mathematics learning in schools is still teacher-centric. Learners often only receive information without the opportunity to construct their own understanding. As a result, they tend to memorize formulas without understanding basic concepts, which has an impact on their low mathematical problem-solving abilities (Sinaga et al., 2023). Problem-solving ability is a crucial aspect of mathematics learning because it helps students apply concepts, discover strategies, and determine solutions to various problems (Hadiyanti & Manurung, 2025). According to Samosir et al. (2024), problem-solving is the process of finding ways to overcome encountered difficulties, whereas Isnani et al. (2023) view problem-solving ability as the capacity to think and reason when applying knowledge to obtain mathematical solutions. Thus, in this study, problem-solving ability encompasses students' skills in understanding the problem, formulating it mathematically, applying solution strategies, and explaining the results obtained.

Mathematical problem-solving is also relevant to implementing the Merdeka Curriculum in Indonesia, which emphasizes active student participation, contextual learning, conceptual understanding, and applying knowledge to solve problems. Mathematics learning is therefore expected not only to focus on correct answers but also to give students opportunities to understand problems, choose appropriate strategies, and explain their reasoning. These demands require learning activities that position students as active participants rather than mere recipients of information (Wibowo et al., 2025), as realistic problem-based instruction has been shown to significantly enhance elementary students' mathematical connection and reasoning skills (Anugraheni et al., 2025). Similar conditions also occurred at SD 2 Piji. Based on the results of interviews with the fourth-grade homeroom teacher, it is known that the learning process is still centered on the teacher, and the use of learning media is not optimal. This has an impact on low motivation and student involvement in the learning process. Students still often struggle in understand the material, especially in mathematics. Pre-cycle results showed that of 16 students, only 5 (31.25%) met the Minimum Completeness Criteria (KKTP), while 11 (68.75%) did not meet the criteria, with poor completeness.

To meet these pedagogical demands, the utilization of appropriate learning media plays a critical role in helping students overcome abstract conceptual difficulties (Hunaepi & Suharta, 2024). Therefore, mathematics learning needs to give students opportunities to understand the information in a problem, determine appropriate solution strategies, carry out mathematical procedures, and communicate the results of their thinking. The role of learning media as a means of supporting the learning process was also emphasized by several researchers. Learning media can support students in overcoming these difficulties by providing representations of mathematical concepts. The utilization of appropriate instructional media plays an essential role in bridging teacher-student communication, fostering engagement, and cultivating an interactive learning atmosphere, which ultimately enables learners to comprehend mathematical concepts in a more meaningful way (Febrina & Setiawan, 2024; Pratama et al., 2023; Rahim et al., 2022; Salsabila & Setiawan, 2025).

Previous studies have shown that interactive and game-based media can increase student engagement and support numeracy learning (Gili et al., 2025; Ramli et al., 2020; Sari et al., 2025). Ramli (2020), for example, reported that game-based interactive media can support numeracy learning through contextual questions and interactive activities. Sari et al. (2025) also reported that educational games can encourage student participation and support the development of

numeracy skills. However, digital and game-based media are not necessarily suitable for every mathematical learning need. Digital media can provide interactive activities and immediate feedback, but screen-based activities may offer fewer opportunities for students to physically manipulate objects when learning the meaning of division. A calculator can help students obtain a numerical result, but it does not directly show how quantities are grouped or how the division process leads to the answer (Hussein et al., 2022). Therefore, when learning division word problems, students need a medium that can help them understand not only the answer but also the concrete process of division.

Metuba (Mesin Hitung Pembagian) is relevant to this need because it is a concrete division counting medium that allows students to manipulate objects and visualize the grouping process. Through direct manipulation, students can connect the quantities presented in division word problems with the process of forming groups and determining the quotient. This concrete feature distinguishes Metuba from media that mainly provide digital interaction or calculation results. Metuba can therefore help students connect the real situation described in a word problem with its mathematical representation. Integrating Metuba into PBL can also support students when they struggle in visualize abstract division concepts. During PBL activities, students are required to understand problems, investigate possible solutions, and explain the results of their reasoning. Metuba provides a concrete representation that students can use to interpret information in division word problems, organize quantities into groups, determine the quotient, and explain the solution process. Thus, Metuba does not replace the problem-solving process in PBL but supports students by providing a concrete representation during problem-solving activities. Lutfi (2024) reported that innovative media can improve learning quality and student motivation, particularly in learning division. This finding indicates that Metuba has potential as a concrete medium for supporting students' understanding of division concepts.

However, previous research has not specifically examined the integration of Metuba with the Problem-Based Learning model to support students' mathematical problem-solving skills in solving division word problems. Therefore, this study aims to examine the Problem-Based Learning model assisted by Metuba media to improve students' mathematical problem-solving skills in solving division word problems. By focusing on implementing the Problem-Based Learning model assisted by Metuba, the study will contribute to the practical improvement of elementary school students' mathematical problem-solving skills.

METHODS

This research is a Classroom Action Research (CAR) which aims to improve students' mathematical problem-solving skills through the application of the Problem-Based Learning (PBL) model assisted by Metuba media. This research follows the CAR model proposed by Kemmis and McTaggart, in which classroom actions are aimed at improving the quality of teaching practices carried out by teachers in their respective classes.

This research was carried out at SD 2 Piji, considering that the school is still facing the problem of low students' understanding of mathematics, especially in division materials. The subjects of this study were 16 fourth-grade students at SD 2 Piji, consisting of 10 male students and 6 female students. This research involves two variables, namely the independent and the dependent variables. The independent variable is the Problem-Based Learning (PBL) model assisted by Metuba media, while the dependent variable is students' mathematical problem-solving ability. The dependent variable was measured to determine the influence of the learning model on students' learning outcomes before and after the action was implemented.

This classroom action research was carried out in two cycles. The first cycle aimed to improve students' mathematical problem-solving skills by implementing PBL supported by Metuba media. The second cycle was conducted to improve the learning process based on the results of reflection from the first cycle. If the results of the second cycle had not reached the predetermined success criteria, the action could be continued to the next cycle.

This study uses a model developed by Kemmis and McTaggart (as cited in Djajadi, 2019), which consists of four main stages: planning, action implementation, observation, and reflection. These stages are cyclical, in which the results of reflection in one cycle become the basis for improving actions in the next.

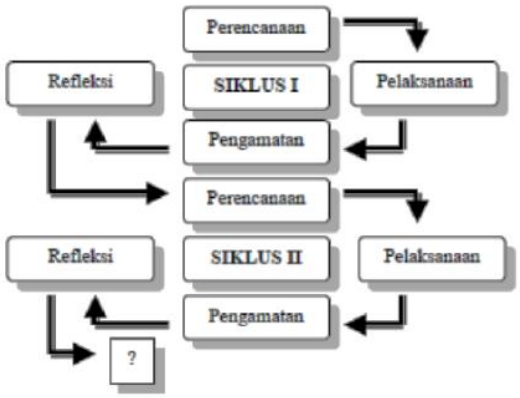


Figure 1. Design of the Classroom Action Research Model by Kemmis and McTaggart (Djajadi, 2019)

The first stage is planning, which involves preparing an action plan to be implemented. At this stage, several activities are carried out, including identifying problems, determining learning strategies, and preparing learning materials such as teaching modules, student worksheets, and observation instruments. The plan is prepared by the researcher in collaboration with the classroom teacher so that the actions are appropriate to the actual learning conditions. The second stage is implementation, namely carrying out the plan that has been prepared. In this stage, students participate in mathematics learning on division topics using the Problem Based Learning (PBL) model assisted by Metuba media. Each cycle consists of two meetings. The PBL activities include presenting problems, organizing students to investigate the problems, conducting individual or group investigations, developing and presenting solutions, and analyzing and evaluating the problem-solving process.

Metuba (Mesin Hitung Pembagian) is a physical, non-digital learning medium specifically designed to help elementary school students understand the concept of division. The medium is rectangular and divided into three sections. Metuba is used as a concrete and visual medium through which students can represent and understand the division process through direct learning activities. Students organize the quantities according to the information contained in the problem and use the resulting groups to determine the quotient. The concrete representation obtained through Metuba is then connected to the corresponding mathematical division operation.

The use of Metuba is integrated into the PBL activities, particularly when students investigate and solve the presented division problems. After receiving a contextual problem, students identify the known and unknown information, represent the quantities using Metuba, organize the quantities into groups, determine the quotient, and formulate the corresponding

mathematical operation. Students then explain and present the solution obtained. In this way, Metuba functions as a concrete learning medium that supports students in visualizing abstract division concepts during the PBL problem-solving process.



Figure 2. Metuba (Mesin Hitung Pembagian) as a Concrete Learning Medium for Division

As shown in Figure 2, Metuba incorporates distinct sections for the dividend, divisor, problem, and answer, allowing students to organize the elements of a division problem visually and physically. The arrangement lets students manipulate quantities and observe grouping and distribution, making the division process more observable and meaningful. The medium consists of a box divided into three sections representing the dividend, the divisor, and the area where the division takes place. Students use popsicle sticks to represent the quantity to be distributed among the divisor sections. Consequently, a process that might otherwise appear only as a symbol, such as the operation "24 ÷ 12" becomes a tangible experience through the direct act of distributing objects.

The third stage is observation, which involves reviewing the learning process during the action. Observations were conducted by the fourth-grade teacher simultaneously with the implementation of the action. The observation focused on the implementation of the learning activities and students' participation during the PBL process assisted by Metuba media. The observation results were used to determine the extent to which the planned actions were implemented and to identify aspects that needed improvement in the next stage.

The fourth stage is reflection, which involves evaluating the learning process and outcomes after the action and observation have been completed. At this stage, the researcher and teacher discuss the results obtained, identify obstacles encountered during the implementation, and formulate improvement plans for the next cycle. The reflection results were used to determine whether the actions had achieved the predetermined success criteria and to provide a basis for improving the subsequent cycle.

The data collection methods in this study used test and non-test techniques, including interviews, observations, tests, and documentation. The instruments used included test sheets, observation sheets, interview guides, and documentation sheets. The test used is in the form of multiple-choice questions to measure students' ability to solve mathematical problems related to division materials. The problem-solving ability was measured based on four indicators: (1) identifying known and unknown information, (2) formulating the mathematical problem, (3) applying an appropriate solution method, and (4) explaining the solution obtained. Before using

it in classroom action research cycles, the test instrument was assessed for validity and reliability. The validity of the test items was evaluated through expert judgment by validators. The validation assessed the relevance of the items to the division material, learning objectives, and indicators of mathematical problem-solving ability. The results of the validation showed that the instrument is valid. The reliability of the instrument was tested with acceptable reliability coefficient. The results indicated that the instrument was suitable and reliable for use in the research.

The data obtained were then analyzed using quantitative and qualitative approaches. Quantitative data were obtained from the students' test results and were used to determine the average score, individual learning mastery, and classical learning mastery. The calculation for this quantitative analysis uses the following formula:

$$X = \frac{\sum X}{\sum \mathrm{N}}$$

$$Score = \frac{\sum Obtained\ Score}{\sum Maximum\ Score} \text{ x } 100$$

Table 1. Criteria for the Level of Success

Criteria	Qualification	Success Rate
85-100%	Excellent	Successful
70-84%	Good	Successful
55-69%	Enough	Didn't work
0-54%	Low	Didn't work

Meanwhile, qualitative data were obtained from observations, interviews, and documentation describing the learning process and students' responses to the PBL model using Metuba media.

RESULTS AND DISCUSSION

Pre-cycle

The study was conducted in a fourth-grade class at SD Negeri 2 Piji, involving 16 students: 10 boys and 6 girls. The research aimed to improve mathematical problem-solving skills in division word problems through Problem-Based Learning (PBL) supported by the Metuba (Division Calculation Machine) learning aid. Prior to the intervention, a pre-cycle observation was carried out to establish a baseline understanding of the students' abilities in solving division word problems.

Observations revealed that instruction was still dominated by the teacher through explanations and demonstrations, while students primarily listened, took notes, and worked on problems. Students struggled to comprehend the problems, identify given and required information, formulate solution steps, and explain their results. This situation was reflected in the mastery results: only 5 out of 16 students (31.25%) achieved mastery, while 11 did not. These initial conditions formed the basis for implementing the intervention using the PBL model, supported by the Metuba aid, during Cycle I.

These findings align with initial observations indicating that only a small division of students actively responded to the teacher's questions, while others required guidance to understand mathematical problems. Learning activity levels during the pre-cycle stage were also rated as merely "sufficient," at 68.75%.

Cycle I

Cycle I was conducted over two meetings on July 24th and 25th, 2025. The intervention followed the Classroom Action Research (CAR) stages: planning, implementation, observation, and reflection. During the planning stage, the researcher and the teacher prepared the PBL teaching module, student worksheets (LKPD), the Metuba aid, observation instruments, and evaluation questions. The implementation stage used the five PBL syntax steps: problem orientation, organizing students, guiding inquiry, developing and presenting results, and analyzing and evaluating the problem-solving process.

In practice, students began using the Metuba aid to analyze division word problems and work in groups to carry out the solution process. Students engaged in discussions to understand the information in the problems, determine the solution, use the Metuba aid, and subsequently write down and present their results. During the second meeting, activities focused more on analyzing word problems and using the Metuba aid to determine division results.

The results of cycle I showed an improvement in mastery compared to the initial conditions, though the outcome was not yet optimal. Seven out of 16 students (43.75%) achieved mastery, an increase from the five students (31.25%) in the pre-cycle stage. Students began to demonstrate an ability to understand the problems and formulate steps for their solutions; however, errors in calculation and answer presentation were still observed.

Table 2. Students' Learning Completeness in the Pre-Cycle and Cycle I

No.	Completeness	Pre-Cycle		Cycle I	
		F	%	F	%
1.	Complete	5	31.25	7	43.75
2.	Incomplete	11	68.75	9	56.25
Total		16	100	16	100

Based on the reflection from Cycle I, students remained insufficiently active in discussions and were not yet accustomed to problem-based learning. Consequently, improvements in Cycle II focused on improving teacher-student interaction, incorporating ice-breaking activities, ensuring focused attention during group presentations, and motivating students to be more active in asking questions and expressing their opinions.

Cycle II

Cycle II was conducted over two sessions, on July 31th and August 1st, 2025. The intervention followed the standard Classroom Action Research (CAR) stages—planning, implementation, observation, and reflection—incorporating improvements based on the results of Cycle I. During the implementation phase, PBL supported by the Metuba method was again applied through its five-step syntax, emphasizing students' abilities to analyze division word problems, use Metuba to assist the solution process, engage in discussions, present results, and evaluate problem-solving steps.

A shift in student activity was evident during Cycle II. Students became more active in answering questions, participating in discussions, using Metuba, presenting their problem-solving results, and responding to other groups' presentations. By the second session, students were also able to explain the process of solving division word problems in a more coherent and structured manner.

This improvement was reflected in the mastery of mathematical problem-solving skills. The number of students achieving mastery rose to 14 out of 16 (87.50%), compared to 7 students (43.75%) in Cycle I and 5 students (31.25%) in the pre-cycle stage. Students showed improved ability in understand the problem, plan the solution, perform calculations, and explain the results of division word problems.

Table 3. Students' Mathematical Problem-Solving Completeness from the Pre-Cycle to Cycle II

No.	Completeness	Pre-Cycle		Cycle I		Cycle II	
		F	%	F	%	F	%
1.	Complete	5	31.25	7	43.75	14	87.50
2.	Incomplete	11	68.75	9	56.25	2	12.50
Total		16	100	16	100	16	100

The results indicate a gradual improvement in mathematical problem-solving skills following the implementation of PBL assisted by Metuba. The increase from 31.25% in the pre-cycle stage to 43.75% in Cycle I and 87.50% in Cycle II demonstrates that students became increasingly capable of solving division word problems by understanding the problem, determining the solution steps, performing calculations, and explaining the results. In Cycle II, the mastery level reached 87.50%, leading to the conclusion of the research intervention.

Overall, the progression from the pre-cycle stage to Cycle II reveals a relationship between changes in the learning process and changes in mathematical problem-solving abilities. During the pre-cycle stage, the mastery rate stood at 31.25%, with learning activities remaining largely passive. Following the implementation of Metuba-assisted PBL in Cycle I, the mastery rate rose to 43.75%, although learning activities and classroom management were not yet optimal. Refinements to the intervention in Cycle II resulted in a mastery rate of 87.50%, accompanied by improvements in participation, interaction, presentation skills, and the ability to explain the solution process. Thus, the research findings indicate that the success of the intervention stemmed not merely from the use of Metuba in isolation, but from the synergy between the PBL model, concrete manipulatives, teacher guidance, collaborative activities, and continuous reflection within the Classroom Action Research (CAR) cycle.

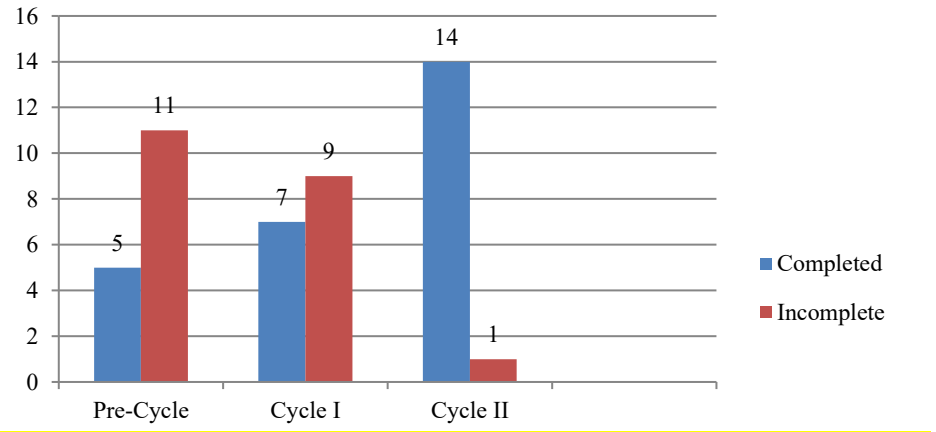


Figure 3. Comparison of Students' Learning Completeness across the Pre-Cycle, Cycle I, and Cycle II

Figure 3 shows a comparison of the number of students who achieved mastery versus those who did not at each stage of the research. In the Pre-Cycle, 5 students achieved mastery, while 11 did not. In Cycle I, the number of students achieving mastery rose to 7, while the number of those who had not yet achieved mastery fell to 9. A more significant improvement was observed in Cycle II, with 14 students achieving mastery and only 2 failing to do so. These data indicate a gradual improvement in student learning outcomes following the implementation of Problem-Based Learning assisted by Metuba.

Discussion

This study demonstrates that the Problem-Based Learning (PBL) model supported by Metuba effectively bridges abstract division concepts with concrete problem-solving experiences for elementary school students. Baseline conditions revealed that students' primary obstacle was not computational execution, but rather connecting verbal descriptions in word problems with formal mathematical procedures. Prior instruction was predominantly teacher-centered, leaving learners unaccustomed to systematic, multi-step problem solving such as identifying information, formulating models, and justifying solutions (Duha, 2024). While Sevani and Ramadan (2023) established that PBL positively influences general mathematical conceptual understanding, this study builds on that foundation by positioning PBL as a targeted instructional framework for division word problems, enhanced specifically through manipulative media.

The novelty of this approach lies in the pedagogical synergy between the PBL framework and the manipulative design of Metuba. Unlike generic instructional media that serve mainly as visual displays or calculation shortcuts, Metuba's three-part structure lets students physically translate dividends, divisors, and quotients using concrete objects. Rather than passively receiving procedural rules, students actively perform grouping and distribution. This hands-on engagement aligns directly with Bruner's theory of representation, which posits that conceptual mastery develops progressively from enactive manipulation to iconic visualization and symbolic reasoning (Sudarti et al., 2025). Manipulative experiences help young learners connect physical actions with abstract mathematical operations (Nabil & Sumadi, 2026). In line with this, realistic and problem-based approaches in Indonesian elementary schools have been shown to strengthen students' mathematical connection abilities, allowing them to link contextual problems with formal mathematical ideas (Anugraheni et al., 2025). Furthermore, these findings align with Gili et al. (2025) and Lacaba (2025), who showed that concrete manipulatives allow learners to explore mathematical relationships tangibly, fostering stronger problem-solving competencies than symbol-only instruction.

The iterative cycles of Classroom Action Research further illustrate how the integration of Metuba within PBL transforms classroom dynamics and student dispositions. The initial hesitation and passive participation observed during early group presentations reflected the inevitable adjustment period required when transitioning from conventional teacher-centered routines to collaborative inquiry (Sagita et al., 2023). Addressing these challenges through reflective pedagogical adjustments, such as structured teacher-student interactions, motivational encouragement, and targeted questioning, strengthened the collaborative environment in accordance with action research principles (Efron & Ravid, 2019). Consequently, students shifted from using Metuba simply to obtain answers to employing it as an explanatory tool. This shift stimulated mathematical dialogue, enabling students to formulate solution strategies, interpret mathematical terminology collaboratively, and articulate their reasoning with confidence (Diana et al., 2023; Febila et al., 2024; Riswari & Bintoro, 2020).

The iterative implementation across cycles demonstrates that the intervention aimed not merely to improve test scores, but to transform the learning process by actively engaging students in analyzing, discussing, and justifying mathematical solutions (Andayani & Gunawan, 2025). Building on their initial experience, students engaged with the five PBL stages more effectively, utilizing Metuba during the investigation phase to understand why a division procedure yields a specific value. Manipulating concrete counters allowed learners to connect physical grouping actions with symbolic mathematical expressions, supporting the transition from concrete experiences to abstract thinking (Ermawati & Zuliana, 2020). Moreover, student interactions matured markedly during the presentation and evaluation stages. Learners demonstrated greater confidence in articulating their mathematical reasoning, clarifying concepts such as the divisor, and defending solutions collaboratively (Febila et al., 2024). Unlike generic aids that serve only as static visualization tools, Metuba's dedicated three-part structure requires students to physically manipulate quantities and negotiate solution procedures collaboratively, making abstract division relationships tangible and observable.

Continuous improvement across cycles shows that problem-solving mastery develops through sustained engagement with structured, problem-oriented tasks (Bayan & Ermawati, 2023; Ula & Nugraha, 2023). In this context, the primary contribution of this study is the validated instructional sequence: contextual problem presentation, information identification, concrete manipulation via Metuba, mathematical representation, calculation, and communicative justification. Metuba does not replace the cognitive demands of problem solving; rather, it functions as an essential representational bridge. By anchoring abstract mathematical operations to concrete physical manipulation within a collaborative inquiry setting, the combination of PBL and Metuba provides a viable, developmentally appropriate approach to fostering mathematical problem-solving skills in elementary education.

These findings offer practical implications for primary mathematics instruction, demonstrating that concrete manipulatives combined with collaborative inquiry provide crucial cognitive scaffolding for understanding word problems. However, this study has limitations. Because it was designed as Classroom Action Research involving a single cohort of 16 students in one school, the findings cannot be generalized to broader populations. In addition, the intervention focused solely on division word problems. Future research should investigate the implementation of this model across larger samples using quasi-experimental designs, evaluate its effectiveness on other arithmetic concepts, and assess the long-term retention of students' problem-solving skills.

CONCLUSION

This Classroom Action Research demonstrates that implementing the Problem-Based Learning (PBL) model supported by Metuba media successfully improves fourth-grade students' mathematical problem-solving skills in division word problems at SD Negeri 2 Piji. This success is evidenced by the gradual increase in classical learning mastery, progressing from 31.25% in the pre-cycle baseline to 43.75% in Cycle I, and achieving 87.50% in Cycle II. Beyond quantitative gains, the intervention fostered a fundamental pedagogical shift from passive, teacher-centered routines to active learner engagement across all problem-solving stages, including problem identification, strategy formulation, procedural calculation, and reasoning justification. In this framework, PBL provides an investigative inquiry structure, while Metuba serves as an effective manipulative anchor that translates abstract division operations into observable, concrete actions.

These findings indicate that elementary mathematics learning requires contextual problems integrated with hands-on manipulatives to bridge conceptual understanding. Practically, primary school educators are encouraged to incorporate concrete manipulatives alongside collaborative PBL syntax to support students struggling with mathematical word problems. For future research, the application of Metuba can be expanded to investigate other mathematical operations, tested across broader cohorts using experimental designs, or adapted into diverse elementary classroom settings to verify its broader instructional transferability.

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