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The Influence of Problem-Based Learning Assisted by Interactive Media on the Learning of Fractions in Elementary School

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Abstract

Fraction learning in elementary school can be challenging because students need to connect mathematical symbols with visual representations and everyday situations. This article examines the potential influence of Problem-Based Learning (PBL) supported by interactive media on elementary students' fraction learning. The study uses a narrative literature review of relevant scholarly articles on PBL, interactive digital media, and fraction instruction. Findings were organized around student engagement, conceptual understanding, problem-solving, and learning outcomes. The reviewed literature suggests that contextual problems in PBL encourage students to identify relevant information, discuss ideas, and develop solution strategies, while interactive media provide visual representations of fractions and immediate practice feedback. Previous research has reported improved mathematics outcomes through PBL assisted by Wordwall and has highlighted the potential of digital media in fraction learning. However, the magnitude of the effect in a specific classroom needs to be verified through empirical research using direct student data. This review concludes that combining PBL and interactive media is a promising alternative for active and contextual fraction instruction.

Keywords: *elementary school; fraction; interactive media; mathematics learning; Problem-Based Learning.*

INTRODUCTION

Mathematics instruction in elementary school plays a crucial role in developing students' logical and critical thinking skills, as well as their problem-solving abilities, from an early stage. Fractions, in particular, remain a challenging topic; students are expected not only to perform calculations but also to grasp the relationships between symbols, visual representations, and their applications in everyday life. Problem-solving is a key skill for addressing challenges in daily life, whether or not they are explicitly mathematical in nature (Annizar, Jakaria, Mukhlis, & Apriyono, 2020). Furthermore, research by Putri, Syam, and Chandra (2025) indicates that elementary students continue to struggle with understanding the fundamental concepts of fractions, representing them visually and symbolically, performing calculations, and connecting these concepts to real-world contexts. This situation reveals a gap between the expectations of mathematics education—which requires students to solve problems independently—and the reality that students' understanding of fractions remains suboptimal. Consequently, there is a need for an instructional approach that introduces contextual problems while helping students visualize fractional concepts in a more concrete and interactive manner.

One relevant model for addressing these challenges is Problem-Based Learning (PBL), which uses problems as a starting point for students to construct knowledge and discover solution strategies. Effective learning designs are essential for fostering and enhancing students' thinking skills (M. Kholil, 2020). Through stages such as problem orientation, investigation, discussion, solution formulation, and evaluation, PBL enables students to engage actively in the process of solving mathematical problems. However, the implementation of PBL for the topic of fractions is most effective when supported by interactive media that can transform abstract concepts into

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more visual, engaging, and easily manipulable forms for students. Research by Astuti, Poerwanti, and Chumdari (2024) indicates that the implementation of Problem-Based Learning (PBL) supported by digital media leads to differences in the cognitive mathematics learning outcomes of elementary school students. Meanwhile, Pradarta, Jayanta, and Diputra (2025) found that interactive, PBL-based e-modules covering the topic of fractions demonstrate high levels of validity, practicality, and effectiveness in fostering students' critical thinking skills. These findings suggest that combining a problem-based learning model with interactive media has the potential to create a more active and meaningful mathematics learning experience.

Several previous studies have examined the implementation of Problem-Based Learning (PBL) using various types of media in elementary school mathematics instruction. Sulistyowati, Poerwanti, and Chumdari (2024) found that PBL supported by comic-based media improved the problem-solving skills of fifth-grade students when dealing with fraction-related word problems, with the average score increasing from 66.76 at the initial stage to 87.74 by the second cycle. Furthermore, Rahmadini and Matsuri (2025) reported that PBL supported by the platform *Matific* enhanced the problem-solving skills of fourth-grade students, with the average score rising from 38.6 before the intervention to 92.4 by the second cycle. Research by Putri, Agusdianita, and Juarsa (2026) also demonstrated the use of PBL supported by *Wordwall*-based interactive media to investigate the critical thinking skills and mathematical understanding of elementary school students through a quasi-experimental design. Although these studies have yielded positive results, most have focused on specific types of media, critical thinking skills, conceptual understanding, learning outcomes, or classroom action research. Consequently, there remains room for further quantitative research specifically examining the use of PBL supported by interactive media for teaching fractions and its impact on the mathematical problem-solving abilities of elementary school students.

Conceptually, PBL and interactive media possess complementary characteristics for the study of fractions. PBL encourages students to identify problems, determine the necessary information, devise strategies, and evaluate solutions, while interactive media enables students to observe and manipulate representations of fractions that might otherwise remain abstract. Research by Pradarta et al. (2025) indicates that the limitations of certain interactive media can pose a challenge in teaching fractions; however, the use of PBL-based interactive e-modules can enhance student engagement and thinking skills. Other research findings also suggest that integrating PBL with interactive media when teaching fractions can improve both students' understanding and their motivation to learn. On this basis, it can be assumed that the use of interactive media within the Problem-Based Learning (PBL) framework can help students understand problems involving fractions in a more concrete way, while simultaneously providing them with the opportunity to develop their own problem-solving strategies.

Based on these theoretical and empirical gaps, this study aims to analyze the effect of Problem-Based Learning (PBL) supported by interactive media on the mathematical problem-solving abilities of elementary school students regarding the topic of fractions. This research is expected to provide theoretical contributions by strengthening empirical evidence on the integration of PBL and interactive media in mathematics instruction, as well as practical benefits by offering an alternative teaching strategy that teachers can use to help students understand and solve problems involving fractions. The research focuses on the following question: does Problem-Based Learning supported by interactive media have an effect on the mathematical problem-solving abilities of elementary school students regarding the topic of fractions? Based on the conceptual framework and findings from previous research, the hypothesis for this study posits that the implementation of Problem-Based Learning supported by interactive media has a significant effect on the mathematical problem-solving abilities of elementary school students regarding the topic of fractions.

METHOD

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This article employs a narrative literature review method. The sources utilized consist of scholarly articles addressing the Problem-Based Learning (PBL) model, digital/interactive learning media, and the teaching of fractions in primary schools. An initial search was conducted via academic journal websites and online databases using the keywords "Problem-Based Learning," "interactive media," "fractions," "primary school," and "Wordwall." Sources were selected based on their topical relevance, connection to mathematics instruction at the primary level, and the availability of traceable bibliographic information.

Information from the selected sources was reviewed and summarized descriptively. The analysis involved categorizing findings into four aspects: (1) understanding of fraction concepts, (2) engagement and learning activities, (3) problem-solving skills, and (4) learning outcomes. This review does not calculate a combined effect size, nor does it involve the collection of primary data from students. Consequently, the results serve to illustrate trends within the existing literature rather than to quantify the magnitude of causal effects within a specific population.

RESULTS AND DISCUSSION

Fractions and the Challenges of Learning Them

Fractions require students to understand the relationship between a part and a whole, rather than simply reading two numbers separated by a line. Difficulties may arise when students are unable to connect symbols—such as 1/2—to images or concrete situations, or when they compare fractions based solely on the size of the numerator and denominator. Therefore, instruction should incorporate various representations and provide space for students to explain the reasoning behind their answers. Visual aids and concrete objects can be used in a complementary manner to help students transition from real-world experiences toward symbolic representation.

Contribution of Problem-Based Learning

Problem-Based Learning (PBL) can guide the study of fractions through problems relevant to students' daily lives. For instance, students might be asked to determine how to divide a pizza among several people or to compare two recipes that use different proportions of ingredients. The teacher introduces the problem, organizes students into groups, facilitates their investigation, asks them to present their solutions, and guides them in evaluating the process. This sequence encourages students to interpret information, select strategies, test their answers, and articulate their reasoning. Consequently, the success of PBL is measured not only by the final answer but also by the students' reasoning process and their collaboration.

The Role of Interactive Media in Learning Fractions

Interactive media can help students manipulate representations of fractions, observe changes in shaded regions, compare values on a number line, and work through problems with the benefit of feedback. Quizzes—such as those created with Wordwall—can be used during the practice or evaluation stages, while visuals and simulations are better suited for introducing concepts and testing students' hypotheses. A study by Adi and Hidayat (2026) emphasizes that digital and conventional media serve complementary functions. Therefore, teachers must ensure that the media used is not only engaging but also supports conceptual learning objectives and discussions centered on problem-solving.

Synthesis of Findings from Previous Research

Research by Anggraeni et al. (2026) reports that the implementation of Wordwall-assisted Problem-Based Learning (PBL) among 16 fifth-grade students led to an increase in the average learning outcome—from 53.13 at the initial stage to 69.38 in the first cycle, and further to 79.38

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in the second cycle. The mastery rate also improved, rising from 37.5% to 87.5%. These findings indicate promising results within the context of this classroom action research. Meanwhile, Adi and Hidayat (2026) reviewed 20 studies concerning digital and conventional media for teaching fractions, concluding that both possess distinct advantages and can be utilized in an integrated manner. Pradarta et al. (2025) developed an interactive, PBL-based e-module for the topic of fractions, with a focus on fostering critical thinking skills. Collectively, these sources support the pedagogical rationale for integrating contextual problems with interactive visualizations.

Table 1. Summary of relevant previous research

Source	Focus	Relevance to the study
Adi & Hidayat (2026)	Literature review of digital and conventional media on fractions	Explaining the role of digital visualization and the importance of concrete media.
Anggraeni et al. (2026)	Wordwall-assisted PBL for fractions in grade V	Reporting improvements in learning outcomes within classroom action research.
Pradarta et al. (2025)	PBL-based interactive e-module on the topic of fractions	Supporting the use of interactive media in problem-based activities.

Implications for Implementation in Elementary Schools

The implementation of Problem-Based Learning (PBL) supported by interactive media should begin with the selection of problems that are relevant to students' personal experiences and appropriately challenging. Teachers should provide opportunities for students to work with images or concrete objects before transitioning to fractional symbols. Interactive media can then be used to explore alternative solutions, verify results, or provide practice exercises with feedback. Group discussions should be guided by prompts that encourage students to explain their strategies, rather than simply guessing the answers.

Several factors can influence the success of this approach, including the availability of devices and network access, the teacher's digital literacy, the time allocated for instruction, the students' prior knowledge, and how well the media aligns with the learning objectives. The use of technology should be accompanied by guidance to ensure that students remain focused on the underlying mathematical concepts. If digital devices are unavailable, teachers can offer non-digital alternatives, such as paper cutouts representing fractions.

Limitations of the Study

This review is narrative in nature and does not employ a systematic review procedure—such as predefined selection criteria, risk-of-bias assessment, or meta-analysis. Furthermore, the number of sources discussed is limited, and there is significant variation in terms of context and research design. Consequently, this review cannot statistically determine the magnitude of the effect of interactive media-assisted Problem-Based Learning (PBL). Future research could utilize a quasi-experimental design incorporating a comparison group, pre-tests and post-tests, and distinct instruments to separately measure conceptual understanding and problem-solving skills.

CONCLUSION

Based on a literature review, Problem-Based Learning (PBL) supported by interactive media has the potential to facilitate the learning of fractions in elementary schools through the use of contextual

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problems, group inquiry, conceptual visualization, and practice with feedback. PBL provides a structure for students to understand problems and explain their strategies, while interactive media helps bridge the gap between fraction symbols and visual representations. Previous studies have reported positive outcomes in specific contexts; however, the existing evidence is insufficient to determine the magnitude of the impact across all schools. Teachers are encouraged to integrate digital media with concrete representations, tailor problems to students' ability levels, and assess both the students' thought processes and their learning outcomes. Further empirical research is required to directly examine this impact using well-defined research designs and measurable instruments.

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