

## The Effect of Fraction Blocks Media on Elementary School Students' Mathematics Learning Outcomes in Fraction Topics: A Literature Review

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### Abstract

*Fraction instruction in elementary schools still faces several challenges because of its abstract character and the limited use of concrete media, which ultimately leads to subpar student' learning outcomes. This study aims to synthesize the effect of using fraction blocks on elementary students' mathematics learning outcomes in fraction topics. This study employed a systematic literature review approach based on PRISMA guidelines. The literature search was conducted within the 2015–2025 period through Google Scholar, Garuda, and DOAJ databases using relevant keywords related to fraction blocks, concrete fraction media, mathematics learning outcomes, and elementary students. The inclusion criteria covered studies on fraction learning using concrete media at the elementary level and reporting learning outcomes, while the exclusion criteria included irrelevant articles and those without full-text access. From an initial 38 articles, 32 remained after duplicate removal, 14 were screened, and six articles were analyzed. The results of the review indicate that the use of fraction blocks media consistently has a positive impact on students' mathematics learning outcomes, particularly in improving conceptual understanding of fractions, learning mastery, and student engagement in the learning process. Fraction blocks media help students connect abstract fraction concepts with concrete representations, thereby facilitating thinking processes and problem-solving skills. Overall, this study confirms that fraction blocks are an effective alternative instructional medium for improving mathematics learning outcomes in fraction topics at the elementary school level. These findings have practical significance for teachers in designing more contextual mathematics learning that aligns with the cognitive developmental characteristics of elementary school students.*

**Keywords:** *fraction blocks, mathematics learning outcomes, elementary school, instructional media*

### Abstrak

Pembelajaran pecahan di sekolah dasar masih menghadapi berbagai kendala karena sifatnya yang abstrak dan kurangnya penggunaan media konkret sehingga berdampak pada rendahnya hasil belajar siswa. Penelitian ini bertujuan untuk mensintesis pengaruh penggunaan media *fraction blocks* terhadap hasil belajar matematika siswa sekolah dasar pada materi pecahan. Penelitian ini menggunakan metode *systematic literature review* mengacu pada pedoman PRISMA. Penelusuran literatur dilakukan pada tahun 2015–2025 melalui database Google Scholar, Garuda, dan DOAJ dengan kata kunci *fraction blocks*, media konkret pecahan, hasil belajar matematika, dan siswa sekolah dasar. Kriteria inklusi meliputi penelitian tentang pembelajaran pecahan menggunakan media konkret pada siswa sekolah dasar dan memuat hasil belajar, sedangkan kriteria eksklusi mencakup artikel yang tidak relevan dan tidak tersedia *full text*. Dari 38 artikel awal, diperoleh 32 artikel setelah penghapusan duplikat, kemudian diseleksi menjadi 14 artikel, dan enam artikel dianalisis. Hasil kajian menunjukkan bahwa penggunaan media *fraction blocks* secara konsisten memberikan dampak positif terhadap hasil belajar matematika siswa, terutama dalam meningkatkan pemahaman konsep pecahan, ketuntasan belajar, dan keterlibatan siswa dalam proses pembelajaran. Media *fraction blocks* membantu siswa mengaitkan konsep abstrak pecahan dengan representasi konkret sehingga mempermudah proses berpikir dan pemecahan masalah. Secara keseluruhan, penelitian ini menegaskan bahwa media *fraction blocks* merupakan alternatif media pembelajaran yang efektif untuk meningkatkan hasil belajar matematika pada materi pecahan di sekolah dasar. Temuan ini memiliki signifikansi praktis bagi guru dalam merancang pembelajaran matematika yang lebih kontekstual dan sesuai dengan karakteristik perkembangan kognitif siswa sekolah dasar.

**Kata kunci:** blok pecahan, hasil belajar matematika, sekolah dasar, media pembelajaran



## INTRODUCTION

Education is a process of teaching and training provided to learners, both in schools and higher education institutions, with the aim of developing knowledge, skills, and attitudes (Saidah, 2016). Formal education plays a strategic role because it is implemented in a systematic, hierarchical, and structured manner in accordance with national education objectives, thereby serving to establish students' foundational competencies, character, and life skills in a holistic way. Elementary school is one of the official education levels that provides a basic foundation. In order to prepare students for further education, education at this level is crucial in imparting fundamental knowledge and skills (Indriani, 2018). This is in line with Law No. 20 of 2003 on the National Education System, Article 17(1), which stipulates that basic education constitutes the foundation for secondary education. According to Piaget's theory of cognitive development, elementary school pupils typically fall between the ages of 7 and 12, which corresponds to the concrete operational stage. As a result, they frequently struggle to understand abstract notions (Suparno, 2001). Therefore, it is anticipated that learning procedures that consider students' cognitive maturation phases will maximize learning outcomes. Additionally, a special difficulty in elementary school instruction is the degree of abstraction of the learning contents. Teachers must be extra cautious when choosing learning tactics because of this situation, particularly in disciplines where pupils cannot directly observe concepts.

Mathematics is one subject where abstract ideas are prevalent. According to Jumanah et al. (2019), mathematics is a discipline whose study objects are abstract in nature, and this feature persists even in elementary school instruction. Numerous fields, including numbers, geometry, measurement, and data handling, are included in mathematics. Furthermore, the National Research Council (NRC) highlights in *Everybody Counts* that mathematics is essential to many facets of life, including as economics, technology, health, and decision-making (Siregar et al., 2010). Students must acquire reasoning skills, critical and logical thinking abilities, and problem-solving competencies in order to fulfill this crucial job of mathematics. As a result, elementary school mathematics training should prioritize conceptual comprehension in addition to procedural proficiency. Presenting abstract mathematical ideas in a way that is compatible with students' cognitive abilities, which are still in the concrete operational stage, is a problem that teachers often encounter.

Fractions is one of the elementary school math concepts that frequently presents challenges for pupils. According to Sirait et al. (2024), fraction notions necessitate a comprehension of part-whole relationships, which elementary school kids find difficult to grasp. According to research Azanda et al. (2025) over 60% of elementary school kids struggle to comprehend fraction ideas, including how to interpret symbols and explain their visual representations. These challenges imply that learning fractions is still a problem that needs to be given careful consideration. Potential misunderstandings in connecting symbolic, visual, and conceptual representations of fractions are typically the root reason of students' issues comprehending fractions (Suwarno & Rahadian, 2020). Thus, it is necessary to develop learning mechanisms that can connect students' concrete experiences with abstract notions. Using concrete manipulatives as instructional media is one potential endeavor (Niagara et al., 2022). Since primary school kids typically rely on their senses to generate new understanding and knowledge, concrete manipulatives can give visual and aural stimuli that correspond with students' developmental stages (Lazuarni et al., 2024). This is extremely pertinent to teaching mathematics, especially when it comes to fraction issues, which highlight students' comprehension of basic number principles. Fraction concepts become less abstract when students use tangible manipulatives to directly see, manipulate, and compare fractional parts. Therefore, in order to help

primary school pupils understand fraction ideas, teaching materials that are specifically made to depict them in a concrete and visual way are needed.

One kind of tangible teaching tool intended to aid pupils in comprehending fraction ideas is fraction blocks. Specific fractional parts, such  $\frac{1}{2}$ ,  $\frac{1}{4}$ , and so on, are represented by fraction blocks, which are plane-shaped pieces (Azanda et al., 2025). Students can physically alter and explore fraction concepts using this media, which can be built from a variety of materials and customized with eye-catching images. The usage of fraction blocks improves students' mathematical learning outcomes in fraction themes, according to a number of prior research. After using fraction blocks in fraction education, students' average scores and mastery learning percentages increased, according to Wulandari & Amir (2021). Aras et al. (2019) also revealed similar results, demonstrating that students taught with fraction blocks outperformed those taught with traditional instruction in terms of learning outcomes. At a significance level of 0.05, a different study by Karunia & Handayani (2024), imilarly showed that using fraction blocks greatly enhanced students' learning outcomes. These results suggest that fraction blocks could be a useful tool for helping students grasp fraction ideas.

After engaging in the learning process, students' comprehension, mastery, and application of mathematical concepts are represented by mathematics learning outcomes. According to Sudjana (2017), learning outcomes include modifications in the psychomotor, emotional, and cognitive domains. Learning outcomes in mathematics education are assessed by students' capacity for logical thought, analysis, and problem-solving in addition to computational capabilities (Hudojo, 2018). Learning results in mathematics are influenced by a number of elements, such as students' past knowledge, media and instructional tactics, and the teacher's role in fostering a relevant learning environment (Purwanto, 2016). Therefore, it is anticipated that the use of concrete instructional media as one of the elements determining learning outcomes will promote gains in students' knowledge and competencies. As a result, choosing the right educational materials is essential to teaching mathematics in elementary schools. It is anticipated that the incorporation of concrete learning materials will enhance students' learning results in mathematics while also helping them develop a more profound and significant comprehension of mathematical ideas.

Previous studies have shown that the use of fraction blocks has a positive impact on fraction learning. While Azanda et al. (2025) discovered that students who utilized this media attained superior learning results than those taught through conventional instruction, Indriani (2018) demonstrated an improvement in students' learning outcomes following the use of fraction blocks. Furthermore, Zadolhaq et al. (2021) showed that using concrete media reduces misconceptions in fraction learning by assisting students in making connections between symbolic and visual representations. The use of fraction blocks in fraction instruction has been the subject of several studies, but the results are still dispersed and have not been methodically compiled. In order to incorporate research findings about the use of fraction blocks media and its impact on elementary school children' mathematics learning outcomes in fraction topics, a review of the literature is necessary. It is anticipated that this review will offer a thorough summary of fraction blocks' efficacy and act as a guide for teachers choosing the right teaching materials. Based on this justification, the purpose of this paper is to synthesize the effect of using fraction blocks media on elementary school students' mathematics learning outcomes in fraction topics.

## METHOD

This study employed a literature review approach to analyze and synthesize findings from previous studies (Snyder, 2024). The review was conducted systematically following the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) framework (Page et al., 2021). Using terms associated

with the research issue, such as fraction blocks, concrete fraction media, mathematics learning outcomes, and primary school pupils, literature searches were conducted in multiple databases, including Google Scholar, Garuda, and DOAJ. The articles were limited to relevant scientific publications focusing on elementary school mathematics instruction and discussing the use of concrete or manipulative media in fraction learning.

The literature search was limited to articles published between 2015 and 2025. The initial search yielded 38 articles, which were reduced to 32 after duplicate removal. The screening stage, based on titles and abstracts, resulted in 14 articles that were further assessed through full-text analysis using the following inclusion criteria: (1) discussing fraction-related mathematics instruction; (2) using concrete or manipulative media, especially fraction blocks or similar media; (3) using elementary school students as research subjects; and (4) reporting learning outcomes as one of the research variables. The exclusion criteria included: (1) studies not relevant to fraction learning, (2) studies that did not use concrete or manipulative media, (3) studies conducted at non-elementary education levels, and (4) studies that did not report learning outcomes. Based on these criteria, six articles met all requirements and were included in this study. These results are presented in Figure 1 below.

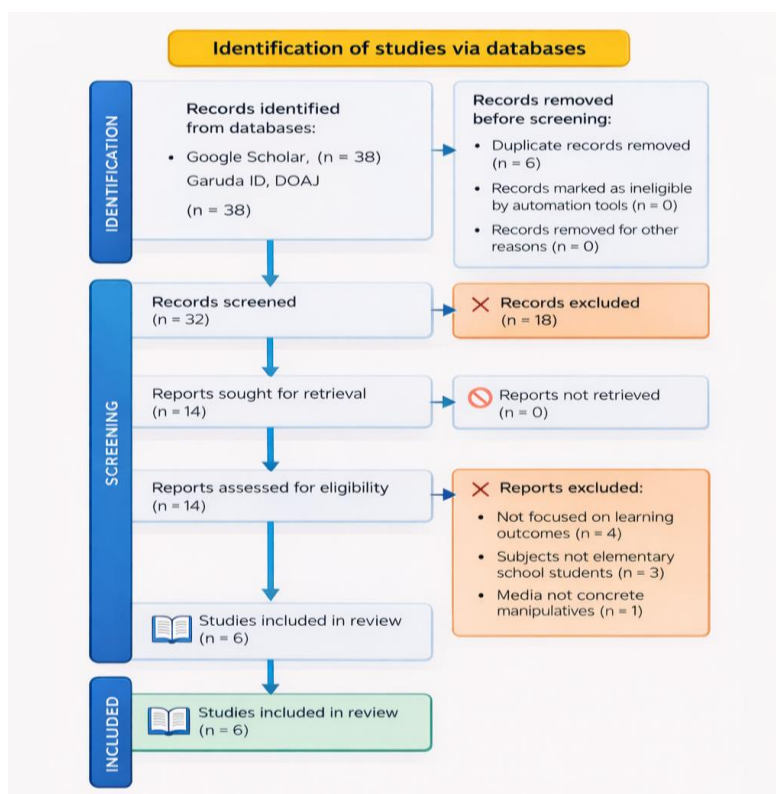


Figure 1. PRISMA Flow Diagram for Article Selection

The research aims, techniques, research subjects, media kinds, and key findings pertaining to students' learning outcomes in mathematics were identified from the data from the chosen publications. In order to obtain a thorough overview of the effects of fraction blocks media on elementary school students' mathematics learning outcomes in fraction topics, the results of the analysis were then presented in the form of a synthesis table of prior studies and discussed using a descriptive-analytical approach.

## RESULTS AND DISCUSSION

## Result

The results of the data analysis of scientific articles obtained from Google Scholar and several other sources are summarized in Table 1. To guarantee that the results are still applicable, every piece of literature was chosen using the research criteria.

Table 1. Synthesis of Studies on the Use of Fraction Blocks Media in Fraction Learning

No	Author(s)	Context	Method	Media	Main Findings
1.	Indriani, (2018)	Elementary School (Indonesia)	Experimental	Fraction blocks	The use of fraction blocks increased students' mean scores and learning mastery in fraction topics.
2.	Azanda et al. (2025)	Grade V Elementary School (Indonesia)	Quasi-experimental	Fraction blocks	Fraction blocks media helped students improve their understanding of fraction comparison concepts.
3.	Jumiati et al. (2020)	Grade III Elementary School (Indonesia)	Quasi-experimental	Fraction blocks	A significant effect on students' mathematics learning outcomes in fractions was observed.
4.	Zadulhaq et al. (2021)	Grade IV Elementary School (Indonesia) (Indonesia)	Case study/ quasi-experimental	Fraction blocks media	The use of concrete media reduced misconceptions and improved students' understanding of fraction symbols.
5.	Kamal et al. (2024)	Elementary School (Uni Emirat Arab)	Quasi-experimental	Concrete manipulative vs. virtual manipulative	Students who learned using concrete manipulatives showed better learning outcomes than those using virtual manipulatives.
6.	Bruce et al. (2023)	Elementary and Early Secondary School (Kanada)	<i>Mixed methods</i>	Fraction manipulative (number lines & unit fractions)	Manipulative representations supported conceptual understanding and strengthened connections among representations.

It is obvious from the synthesis shown in the table that fraction learning in elementary schools is consistently improved by the use of fraction blocks and other tangible manipulatives. As evidenced by higher average scores and learning mastery,

these media not only help students grasp concepts better but also improve learning outcomes. Additionally, by more meaningfully connecting symbolic and visual representations, concrete manipulatives aid in lowering students' misconceptions.

## **Discussion**

### **Fraction Blocks and Conceptual Understanding of Fractions**

The usage of fraction blocks and other tangible manipulatives has been shown to greatly aid elementary school pupils in comprehending fraction ideas, according to the synthesis of a few chosen studies. This result is in line with the cognitive traits of elementary school pupils, who still struggle to comprehend abstract mathematical ideas since they are at the concrete operational stage (Suparno, 2017). Students must concurrently make connections between symbolic representations, visual representations, and the underlying conceptual implications of fractions as a concept of pieces in relation to a whole.

According to Indriani (2018), using fraction blocks allows students to not only identify fraction symbols but also understand their underlying meanings by directly manipulating the relationship between parts and wholes. This conclusion is supported by Azanda et al (2025) who found that inconsistencies between symbolic and visual representations usually lead to elementary school students' errors concerning fractions. Fraction blocks reduce conceptual errors by enabling students to see firsthand how a single unit can be divided into several equal parts. According to this perspective, the usage of concrete media is in line with primary school students' growth stage since it allows pupils to experience and immediately apply mathematical concepts in addition to imagining them.

Additionally Zedulhaq et al. (2021) found that fraction blocks media are useful in assisting students in making the connection between fraction symbols and their visual representations. Students can more readily create conceptual understanding through direct, hands-on learning experiences offered by concrete media. This result is in line with a study by Kamal et al., 2024 that found that because students can physically touch and examine the objects, concrete manipulatives are more successful than virtual manipulatives in helping students learn fraction concepts. Fraction bars, fraction circles, magnetic pizza fractions, wooden fractions, fraction blocks, and fraction tiles were among the tangible manipulatives used in this study to teach fractions. By comparing fraction sizes, creating equivalent fractions, and dividing a fraction into equal parts before performing arithmetic operations, these manipulatives were used to give students the chance to watch, manipulate, and directly model the process of adding unlike fractions. Although many students first believed that  $\frac{1}{4}$  is larger since the number 4 is more than 2, they were able to clearly verify that  $\frac{1}{2}$  has a greater value than  $\frac{1}{4}$  through the use of concrete manipulatives in Figure.2. This practical exercise reduced misconceptions by assisting students in making connections between fraction symbols and their conceptual and visual representations.



**Figure 2. Using Concrete Manipulatives in Teaching Fractions (Kamal et al., 2024).**

The results show that using tangible manipulatives greatly improved students' conceptual grasp of fractions, especially when it came to comparing fractions, comprehending equivalent fractions, and carrying out fraction addition and subtraction in a more substantial manner. According to this viewpoint, fraction blocks serve as a link between students' practical experiences and formal mathematical ideas, which are necessary for studying mathematics in elementary school.

#### **The Effect of Fraction Blocks on Learning Outcomes in Mathematics**

The usage of fraction blocks not only enhances conceptual comprehension but also improves students' learning results in mathematics related to fraction themes. This is demonstrated by the consistent results of numerous research that show improvements in students' learning mastery and average scores following the use of concrete media. In terms of average scores and mastery percentages, Indriani (2018) found that students' learning results significantly improved after receiving instruction utilizing fraction blocks. Azanda et al. (2025) reported similar results, stating that pupils who received teaching utilizing fraction blocks outperformed those who received instruction using traditional methods without tangible material. It has been demonstrated in this study that using fraction blocks manipulatives enhances students' learning outcomes in fraction-related subjects. The average score increased from 65.74 on the pre-test to 84.80 on the post-test, indicating this improvement. The research hypothesis was supported by the analysis, which showed a substantial change in students' mental grasp of fractions before and after fraction blocks were implemented. Additionally, the N-Gain scores were in the moderate to high range, indicating that students' learning outcomes had significantly improved.

The use of instructional material was not the only factor contributing to the improvement in learning outcomes; fraction blocks also helped students get a stronger conceptual grasp (Jumiati et al., 2020). Through direct manipulation, fraction concepts and fraction comparison were taught using fraction blocks manipulatives. The modular media used in this study had both colored and uncolored components that served as visual representations of the denominator and numerator. In fraction comparison exercises, students compared the areas of the fraction blocks to find bigger values or to identify equivalent fractions, while whole numbers and fractions were represented as parts of a whole using circular fraction blocks. The use of fraction blocks manipulatives had a significant impact on students' learning outcomes in mathematics, as indicated by the calculated  $t$  value of 3.302 based on the data analysis. Students were able to reduce typical misconceptions in fraction learning by connecting mathematical symbols with tangible representations through direct manipulation of fraction components. According to this viewpoint, learning outcomes in mathematics are assessed by

students' comprehension, reasoning, and logical application of concepts in a variety of problem scenarios in addition to their computing abilities.

Bruce et al. (2023) reported that the use of manipulative representations strengthened students' conceptual understanding and mathematical reasoning, with a moderate-to-large effect size of 0.46. These findings are consistent with Kamal et al. (2024), who found that concrete manipulatives are more effective than virtual manipulatives, and Azanda et al. (2025), who reported significant improvements in students' learning outcomes. The use of tangible manipulatives, such as fraction blocks, is a successful teaching approach in basic mathematics education, according to the consistency of findings across different research and circumstances. In addition to serving as visual aids, these media also serve as long-term instruments for developing students' conceptual comprehension, logical reasoning, and problem-solving skills.

### **Concrete Media's Implications on Learning Elementary Mathematics**

The results of this study have important ramifications for elementary school mathematics instruction, especially with regard to fractions, which are conceptual and abstract in character. Due to their concrete operational level, primary school pupils need education that links mathematical ideas to real-world situations. As a result, educators must choose instructional techniques and media that help students grasp abstract ideas in more tangible and comprehensible ways. To address this need, fraction blocks offer a useful and efficient substitute learning tool. By enabling students to physically manipulate, compare, and depict fractions, fraction blocks transform the learning process from formula memorization to true conceptual understanding. The use of concrete media not only promotes conceptual comprehension but also increases students' active participation in their education. According to research by Zadhulhaq et al. (2021) when courses incorporate concrete media, pupils become more engaged and excited. Students' learning results are eventually improved by this active participation, which leads to more meaningful learning.

The duty of the instructor in creating lessons that are responsive to technological advancements is another implication. The results of this study show that concrete manipulatives continue to be important in basic mathematics teaching, despite the availability of several digital and virtual manipulatives. In contrast to virtual manipulatives, Kamal et al. (2024) stress that studying with tangible manipulatives offers a deeper learning experience. As a result, educators are urged to balance the usage of digital and tangible media in accordance with the content's features and learning goals. Digital media can be used for learning variety or reinforcement, while concrete media, like fraction blocks, can provide a basis for developing conceptual knowledge. The study's overall conclusions highlight the benefits of using fraction blocks to raise the standard of mathematics instruction in elementary schools. Concrete media improve learning outcomes, encourage active, engaging, and student-centered learning, and provide pupils a deeper comprehension of abstract ideas.

### **CONCLUSION**

The use of fraction blocks improves primary students' learning results in mathematics, especially when it comes to fractions, according to a survey of pertinent research articles. It has been demonstrated that fraction blocks assist students in turning the abstract idea of fractions into a more tangible form, which improves comprehension, raises student interest, and fosters better learning outcomes. When compared to traditional teaching without concrete media, the synthesis of the research shows that regular use of fraction blocks in mathematics training can enhance students' learning outcomes. Students' capacity to identify fraction concepts, compare fraction values, and resolve fraction operations-related problems clearly shows this increase. These results support the idea that manipulative media are necessary to help primary

pupils' cognitive development, as they are still in the concrete operational stage of learning mathematics. As a result, fraction blocks might be a useful substitute teaching tool, especially for teaching fractions in elementary schools. From a theoretical perspective, fraction blocks can be effectively implemented as an instructional medium to enhance students' understanding, comparison, and problem-solving skills in fractions. Therefore, teachers are encouraged to integrate concrete manipulatives into mathematics instruction to support meaningful learning. Future research is recommended to further examine the use of fraction blocks through experimental approaches or in combination with other teaching strategies.

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