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Enhancing Third-grade Students' Learning Outcomes in Mathematics through Fraction Puzzle Activities

Meningkatkan Hasil Belajar Matematika Siswa Kelas Tiga melalui Puzzle Pecahan

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Abstract: This study seeks to improve the learning results of third-grade elementary school pupils by incorporating fraction puzzles into mathematics instruction. The research used the Classroom Action Research (CAR) approach, which was carried out in four stages: preparation, implementation, observation, and reflection. The study included 20 third-grade pupils as subjects, with 10 boys and 10 girls. The instrument employed was a multiple-choice test. Data analysis demonstrated an improvement in students' learning outcomes, with an average score going from 69.6 in the initial phase to 76 in the first cycle and then to 84.2 in the second cycle. Based on these data, it is concluded that the usage of fraction puzzles in mathematics education can improve students' learning outcomes. Future study should focus on using image-based media as a learning aid to increase student attention and improve mathematical learning results.

Keywords: learning outcomes, mathematics, fraction puzzles.

Abstrak: *Penelitian ini bertujuan untuk meningkatkan hasil belajar siswa sekolah dasar kelas tiga dengan memasukkan puzzle pecahan ke dalam pembelajaran matematika. Penelitian ini menggunakan pendekatan Penelitian Tindakan Kelas (PTK) yang dilakukan dalam empat tahap: persiapan, pelaksanaan, observasi, dan refleksi. Penelitian ini melibatkan 20 siswa kelas tiga sebagai subjek, dengan 10 anak laki-laki dan 10 anak perempuan. Instrumen yang digunakan adalah tes pilihan ganda. Analisis data menunjukkan adanya peningkatan hasil belajar siswa, dengan skor rata-rata meningkat dari 69,6 pada tahap awal menjadi 76 pada siklus pertama dan kemudian menjadi 84,2 pada siklus kedua. Berdasarkan data tersebut, dapat disimpulkan bahwa penggunaan puzzle pecahan dalam pendidikan matematika dapat meningkatkan hasil belajar siswa. Penelitian selanjutnya sebaiknya difokuskan pada penggunaan media berbasis gambar sebagai alat bantu belajar untuk meningkatkan perhatian siswa dan meningkatkan hasil belajar matematika.*

Kata kunci: *hasil belajar, matematika, puzzle pecahan.*

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INTRODUCTION

Mathematics is the foundation of education that supports various fields of study and has many practical applications in daily life. According to Sidabutar (2018), understanding mathematical concepts is not only crucial in academic settings but also has practical applications, such as in trade transactions or calculating building areas. Therefore, mathematics education at the elementary school level plays a critical role, as this stage introduces students to fundamental concepts that will serve as a foundation for more complex material in subsequent educational levels (Efendi et al., 2021; Ferlina & Fratiwi, 2024; Sitopu et al., 2024). However, despite mathematics being a highly useful subject, many students find it difficult to understand, which in turn hinders the learning process.

As facilitators in the learning course, teachers play an significant role in helping students grasp material in a simple and engaging way (Magdalena et al., 2021). Teachers are expected to continuously innovate and be creative in selecting and using effective teaching strategies. One challenge in mathematics instruction is the topic of fractions, which is often perceived as tough through students (Rosli et al., 2020). Based on observations conducted at an elementary school in Pringsewu, the learning outcomes in the topic of fractions were found to be relatively low. Of the 20 students, 15 (75%) did not meet the Minimum Completion Criteria (KKM) of 68, while only 5 students (25%) scored above 70. This condition indicates that many students face difficulties in understanding the material and have not achieved the expected results.

Based on this data, the students' learning outcomes on the topic of fractions are still suboptimal and require further attention. One way to improve student understanding is by using engaging and easily comprehensible learning media, such as visual media. In this study, Fraction Puzzles are used as a form of visual media. The use of Fraction Puzzles for teaching fractions is an innovation that has not been widely applied at the elementary school level. This media combines concrete visualization with manipulative activities, helping students gain a deeper understanding of fractions while creating a fun learning experience (Jannah, 2022; Musabihatul & Mijahamuddin, 2020; Prawismo et al., 2022). Fraction Puzzles, as a teaching tool, offer an advantage in helping students visualize fraction concepts, which facilitates their understanding (Nikmah et al., 2019; Rohmah et al., 2022). Various types of visual media, such as folded paper, fraction boards, fraction blocks, and animated videos, can be used to sustenance the learning process. The appropriate selection of visual media is expected to increase students' curiosity in learning, make the lessons more engaging, and facilitate their understanding of the material.

Several studies have shown that the practice of Fraction Puzzles has a positive bearing on students' understanding. Kusumaningrum et al. (2024) explain that this media not only helps students understand the concept of fractions but also contributes to developing critical thinking skills, problem-solving abilities, and spatial skills. Additionally, Fraction Puzzles can reduce the anxiety that often arises when students study mathematics. However, Arumanda et al. (2022), Sari (2019), dan Sulaeman et al. (2022) also mention that despite the potential benefits of visual media, several challenges such as difficulty with visualization, understanding concepts, problem-solving, and concept transfer still need to be addressed. This situation is frequently triggered by the teacher's lack of motivation and an uninteresting teaching technique, which leads to students losing focus and not paying attention to the instructions.

In light of this, selecting the right learning media becomes crucial to improving student learning outcomes. Visual media, such as Fraction Puzzles, can provide a concrete representation that helps students more easily understand fraction concepts. This study aims to enhance the learning outcomes of grade III elementary school students through the use of fraction puzzles in mathematics learning. By utilizing this media, it is expected that students will find it easier to comprehend the material, while teachers will be able to deliver lessons more effectively, making the learning process more engaging and improving student learning outcomes.

METHODS

This study employs the Classroom Action Research (CAR) technique and was conducted in partnership with a third-grade teacher from an elementary school in Pringsewu Regency. The research subjects comprised of 20 students, 10 male and 10 female, with an average age of 8 years. The study was conducted in two cycles, with each cycle consisting of planning, implementation, observation, and reflection. In the planning stage, the researcher, together with the teacher, developed a lesson plan based on the Fraction Puzzle media. This activity involved preparing the Lesson Plan (RPP), creating the learning media, and preparing evaluation questions to assess student learning outcomes. Figure 1 shows an example of the teaching aid used as a learning media.

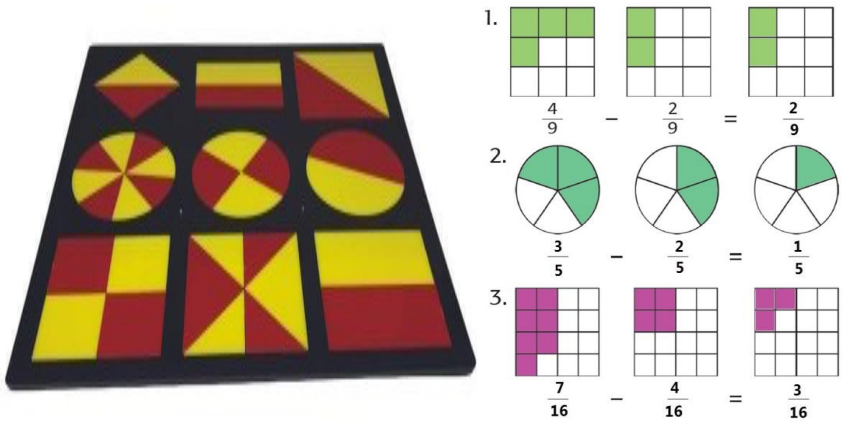

Figure 1. Example of Fraction Puzzle Media
(Source: https://bit.ly/puzzlepecahan)

The employment of the learning process was carried out through applying the Fraction Puzzle media conferring to the plan that had been completed. The teacher led the classroom activities, while the researcher observed student interactions, their involvement in the learning activities, and any challenges that arose during the learning process. Observations were made using observation sheets to record student engagement and the effectiveness of the teaching media used. Additionally, documentation in the form of photos and videos was used to strengthen the results of the observations. After the implementation stage, reflection was conducted to evaluate the consequences of the observations and written tests given to the students. This reflection was used to determine the necessary improvements for the next cycle if the learning objectives had not been achieved.

The instruments included written tests, observation sheets, and documentation. The written tests, in the form of multiple-choice questions, were used to measure students' understanding of the concept of fractions (learning outcomes), while the observation sheets were used to record student activities during the learning process. The data attained from observations and tests were examined using both qualitative and quantitative descriptive approaches. The qualitative data, in the arrangement of observation notes, were analyzed to assess the effectiveness of the learning process, while the quantitative data, in the form of student test scores, were analyzed to calculate the class average and the percentage of students' learning mastery. This study set the Minimum Completion Criteria (KKM) at 68. The success indicators of this study include an increase in the average student scores from Cycle I to Cycle II, as well as the achievement of a minimum learning mastery by 75% of the students. Additionally, learning is considered successful if students show an improvement in their engagement and enthusiasm toward the fraction material.

RESULTS AND DISCUSSION

One of the subjects that is difficult to teach in third-grade elementary school is fractions, which requires the support of effective learning media. In this study, fraction puzzle media was used as a tool to introduce simple forms of fractions concretely. The research was directed in two cycles in the mathematics subject, running from April 22 to May 13, 2024. The data obtained in this study include quantitative scores from the final tests of each cycle as well as the results of observations. The purpose of the observations was to assess the improvement of students' knowledge, while the evaluation was used to measure the effectiveness of the media used in the learning process. Details of the students' learning outcomes in the pre-cycle phase can be seen in Table 1.

In the pre-cycle, student learning outcomes showed that only 25% of students reached the Minimum Completion Criteria (KKM). Out of 20 students, 11 students had not yet achieved mastery, with an average class score of 69.6. The highest score obtained was 85, while the lowest score was 50. This data indicates the need for intervention in the learning process to progress student outcomes. The application of the puzzle fraction media in Cycle I led to improved outcomes, as detailed in Table 2, serving students comprehend the material in a more engaging and meaningful way.

Table 1. Student Learning Outcomes in the Pre-Cycle

No	Student's Name	Score	Information
1	AC	65	Under KKM
2	AHA	80	
3	AFS	85	
4	AZA	65	Under KKM
5	BF	60	Under KKM
6	DN	75	
7	EF	50	Under KKM
8	FKA	75	
9	FF	85	
10	IH	65	Under KKM
11	IPS	80	
12	JSA	78	
13	KM	60	Under KKM
14	KAS	55	Under KKM
15	LCP	65	Under KKM
16	MAA	80	
17	SW	60	Under KKM
18	SSP	60	Under KKM
19	PAN	65	Under KKM
20	PKW	85	
Total		**1.393**	
Average		**69,6**	
Completeness		**25 %**	

Table 2. Student Learning Outcomes in Cycle I

No	Student's Name	Score	Information
1	AC	75	
2	AHA	80	
3	AFS	90	
4	AZA	80	
5	BF	60	Under KKM
6	DN	80	
7	EF	75	
8	FKA	65	Under KKM
9	FF	85	
10	IH	75	
11	IPS	80	
12	JSA	65	Under KKM
13	KM	78	
14	KAS	80	
15	LCP	85	
16	MAA	80	
17	SW	60	Under KKM
18	SSP	80	
19	PAN	65	Under KKM
20	PKW	85	
Total		**1.523**	
Average		**76**	
Completeness		**80%**	

In Cycle I, the learning activities were conducted over two lessons. The test results showed an increase in the average class score to 76, through a mastery level of 80%. Out of 20 students, 15 students achieved scores overhead the Minimum Mastery Criteria (KKM), while 5 students still did not meet the criteria. Despite the improvement, there were some challenges, such as a lack of attention and active participation from some students during the lesson. Some students appeared to be distracted or not focused on the material presented by the teacher. This indicates the need for improvements in the teaching strategy for the next cycle, as reflected in the data presented in Table 3.

In Cycle II, the learning process was conducted over two lessons. The test results showed significant enhancement, through the average class score rising to 84.2 and the completion rate reaching 100%. All students attained scores overhead the Minimum Completion Criteria (KKM). In addition, students showed more active participation in the learning process. They were more confident in asking questions, answering, and engaging in discussions, making the classroom atmosphere more dynamic. This improvement indicates that the use of fraction puzzle media had a positive effect on enhancing student learning outcomes. Table 4 presents the detailed learning outcomes of the students.

Table 3. Student Learning Outcomes in Cycle II

No	Student's Name	Score
1	AC	80
2	AHA	85
3	AFS	85
4	AZA	90
5	BF	89
6	DN	80
7	EF	75
8	FKA	80
9	FF	85
10	IH	85
11	IPS	75
12	JSA	80
13	KM	80
14	KAS	95
15	LCP	95
16	MAA	80
17	SW	95
18	SSP	80
19	PAN	85
20	PKW	85
Total		**1.684**
Average		**84,2**
Completeness		**100%**

Table 4. Recap of Student Learning Outcomes

No	Students' Name	Pre-Cycle	Cycle I	Cycle II	Information
1	AC	65	75	80	Increase
2	AHA	80	80	85	Increase
3	AFS	85	90	85	Increase
4	AZA	65	80	90	Increase
5	BF	60	60	89	Increase
6	DN	75	80	80	Increase
7	EF	50	75	75	Increase
8	FKA	75	65	80	Increase
9	FF	85	85	85	Increase
10	IH	65	75	85	Increase
11	IPS	80	80	75	Increase
12	JSA	78	65	80	Increase
13	KM	60	78	80	Increase
14	KAS	55	80	95	Increase
15	LCP	65	85	95	Increase
16	MAA	80	80	80	Increase
17	SW	60	60	95	Increase
18	SSP	60	80	80	Increase
19	PAN	65	65	85	Increase
20	PKW	85	85	85	Increase
Total		**1.393**	**1.523**	**1.684**	
Average		**69,6**	**76**	**84,2**	
Completeness		**9 %**	**80%**	**100%**	

This study proves that a learning approach using creative media can yield significant results in enlightening student learning outcomes. The increase in the average student score from 69.6 in the pre-cycle, to 76 in cycle I, and reaching 84.2 in cycle II shows that this media successfully achieves the learning objectives. The use of puzzle media not only increases students' interest in learning but also motivates them to be more active and responsible in the learning progression.

These findings are consistent with Nisem's (2020) study, which revealed that the use of puzzle media can enhance students' skills in calculating equivalent fractions. Furthermore, Firdaus' (2018) research also supports this conclusion by stating that puzzle media is effective in improving students' ability to compare fractions. The fraction puzzle allows students to better understand abstract mathematical concepts through a concrete approach—by manipulating and assembling puzzle pieces. Additionally, research by Gulo & Muhid (2024) shows that game-based learning media, such as puzzles, can improve students' memory of mathematical concepts compared to conventional methods. Moreover, Bintang et al. (2024) found that

interactive visual media, such as puzzles, facilitate differentiated learning, providing opportunities for students with various learning styles to better comprehend the material.

The effectiveness of puzzle media can also be linked to constructivist theory, which states that active and experience-based learning enhances students' understanding. Puzzles offer opportunities for students to learn independently or collaboratively while developing problem-solving and creative skills. This is supported by Piaget's views (Astuti & Retnawati, 2017), which emphasize the importance of physical activity in learning to internalize abstract concepts.

Overall, the outcomes of the study indicate that the use of fraction puzzle media not only helps students better understand the concept of fractions nevertheless too creates a more enjoyable and interactive learning situation. The fraction puzzle provides a unique learning experience by emphasizing visual and manipulative aspects, which can capture students' attention and increase their engagement in the learning process.

CONCLUSION

Grounded on the results, it can be decided that the practice of visual media in the form of fraction puzzles can enhance students' learning outcomes in Mathematics at the elementary school level. Students are more engaged with learning media that are interesting, and fraction puzzles offer an interactive learning experience. This is evident from the improvement in students' average scores, which increased from 69.6 in the pre-cycle, to 76 in cycle I, and reached 84.2 in cycle II. Fraction puzzles are games that involve assembling image pieces, which are divided into several parts to form a complete picture. This activity not only enhances student participation in learning but also creates a more enjoyable learning atmosphere and reduces boredom.

The researcher confidences that the outcomes of this study can attend as a situation for teachers in selecting effective Mathematics learning media. Fraction puzzles can be used as an alternative media to help students better understand the material. Furthermore, teachers are encouraged to search for tutorials on how to use fraction puzzles as a learning medium, either through YouTube or other social media platforms. By doing so, it is expected that teachers will be able to be upgraded understand and optimize the use of this learning media in the teaching course.

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