Kaseba on Plane Shape Material to Improve Elementary School Students' Learning Outcomes

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Abstract: This study aims to measure the improvement in student learning outcomes after using the Kaseba (Polygonal Bag) learning media, determine the level of media effectiveness based on learning completeness, and determine the percentage of positive student responses in learning mathematics on plane geometry material. The study used a quasi-experimental method with a One Group Pretest–Posttest design involving 30 fourth-grade students from two elementary schools. The instruments used included a learning outcome test and a student response questionnaire. The results showed a significant increase in learning outcomes, indicated by an increase in the average score from 55.93 in the pretest to 91.43 in the posttest, with an N-Gain score of 0.81 which is included in the high category. Classical completeness reached 100%, so the Kaseba media was declared very effective for use in learning. In addition, the questionnaire results showed a student response of 90% with a very positive category, indicating that the Kaseba media is interesting, easy to use, and helps understand the concept of plane geometry concretely. Overall, this study concludes that Kaseba media is effective in improving learning outcomes, meeting classical completeness, and receiving positive appreciation from students, so it is worthy of being recommended as an alternative mathematics learning media in elementary schools.

Keywordi: Kaseba media, flat shapes, learning outcomes, effectiveness, student responses

PRELIMINARY

In the 21st century, the development of scientific knowledge in education has become a crucial need in line with the increasingly complex demands of the times (Alfiana, N., & Najicha, 2022). Quality education is not solely determined by the curriculum but is also greatly influenced by the quality of the learning process and the utilization of facilities and infrastructure that support student learning activities (Mokalu, R., 2022). This aligns with Government Regulation Number 57 of 2022, which states that education is a conscious and planned effort to create a learning atmosphere and process so that students can actively develop their potential, including spirituality, self-control,

personality, intelligence, morals, and the skills needed for life in society, the nation, and the state.

The learning process experienced by students is closely related to their cognitive development. According to Bruner, human cognitive development goes through three main stages: enactive, iconic, and symbolic (Lastini, W., Kurniawati, E., & Pratama, 2024). Elementary school students, particularly fourth graders, are in the symbolic stage, where they are able to understand symbols and abstract concepts, although they still require concrete objects to reinforce their understanding (Purnomo, 2022). Therefore, elementary school learning, particularly in abstract subjects, requires learning media that can bridge abstract concepts into more concrete ones. According to Minister of Education and Culture Regulation Number 103 of 2014, learning is an interactive process between students, educators, and learning resources within a learning environment. Learning success is largely determined by how teachers apply learning theories and provide learning tools appropriate to student characteristics (Rusmana, 2020). One important factor supporting successful learning is the use of appropriate learning media. Learning media can help students understand material more easily because they provide a more realistic and meaningful learning experience (Huda, M., & Susdarwono, 2023).

Mathematics is a subject with an abstract object of study, thus requiring strong deductive reasoning skills (Juwantara, 2019). Mathematics discusses regularity, patterns, and structures arranged systematically and hierarchically (Tampubolon, 2021). Therefore, in elementary school mathematics learning, the use of concrete objects is essential for students to optimally understand concepts (Betasari, 2020). The objectives of mathematics learning, as stated in Ministerial Regulation No. 36 of 2018 and Ministerial Regulation No. 22 of 2016, include enabling students to understand concepts, reason, solve problems, and communicate mathematical ideas logically and systematically. To achieve these objectives, mathematics learning must be implemented effectively, meaningfully, and tailored to students' cognitive development (Muna, F., & Fathurrahman, 2023).

At the elementary school level, fourth-grade students are in Phase B of the Independent Curriculum. One of the key topics in Phase B mathematics learning is plane figures, with learning outcomes requiring students to describe the characteristics of various plane figures, such as triangles, quadrilaterals, and polygons. This material

requires students not only to understand concepts symbolically but also to relate them to real-life objects (Hatip, A., & Setiawan, 2021). Therefore, learning about plane figures requires the support of concrete media (Ardika, D., & Tampubolon, 2015).

Over the past five years, research on the development of mathematics learning media in elementary schools has shown a growing trend toward the use of concrete media based on manipulatives and colorful visuals to enhance understanding of plane figure concepts. Various media innovations, such as Papin, Kajib, Kapindo, and Pakapin, have been developed with diverse characteristics, ranging from foldable media and interactive boards to card- and pocket-based media. The results of these studies indicate that the use of concrete media has been proven to significantly improve learning outcomes, student activity, and motivation in mathematics. This trend indicates that mathematics instruction in elementary schools is increasingly directed towards a student-centered learning approach that emphasizes hands-on learning experiences through the manipulation of concrete objects. However, most of the media developed still focus on the function of recognizing the shape and properties of plane figures and have not fully integrated composition and decomposition activities into a single, practical and portable medium, especially for schools with limited facilities.

Based on observations at SDN Bendungan 1, conducted from August 14 to December 2, 2023, several problems were identified in the mathematics learning of plane figures in fourth grade. Twenty-eight students stated that mathematics was difficult and disliked, particularly the plane figure material in fourth grade. Students' grades did not meet the predetermined criterion of 75. Teachers have not maximized the use of learning media, resulting in students' lack of interest in participating in the lesson. As a result, students have difficulty understanding the plane figure material, and most learning outcomes have not met the Learning Objective Achievement Criteria (KKTP).

Follow-up observations conducted on November 1, 2024, revealed similar conditions. Fourth-grade teacher, Mrs. Minarsih, S.Pd., had not yet used concrete learning media in her mathematics lessons. Instead, she used PowerPoint presentations. Limited facilities, such as limited Wi-Fi access in the classroom and a ban on gadgets, were among the obstacles. However, teachers also rarely created simple learning media due to cost considerations and concerns about student interest. This resulted in monotonous and unengaging learning.

Interviews with teachers on November 2, 2024, revealed that teachers relied solely on textbooks as their sole learning resource. They were reluctant to develop learning media due to concerns about ineffectiveness and the additional costs. This situation resulted in low student interest and learning outcomes that fell short of the KKTP (Competency Standards) standard, with an average score of 55.93, necessitating frequent remedial classes. Furthermore, a questionnaire administered to students on November 15, 2024, revealed that out of 30 students, 28 considered mathematics a difficult and unpleasant subject. A total of 26 students stated that they were more interested in learning using concrete media, while teachers almost never used them. Most students also preferred colorful and visually appealing media. This data indicates that students greatly need engaging, concrete learning media to aid their understanding.

Although various previous studies have demonstrated the effectiveness of concrete learning media in improving students' mathematics learning outcomes, several research gaps remain that have not been optimally addressed. First, most of the media developed do not fully consider the real-world conditions of schools with limited facilities, such as the lack of Wi-Fi access and prohibitions on the use of digital devices. Second, existing media are generally partial, used only to recognize the shape or properties of plane figures, and do not integrate the identification, classification, composition, and decomposition of plane figures into a single, integrated learning medium. Third, there is still little research developing learning media based on students' visual needs (colorful, attractive, and portable) designed directly based on observations and questionnaires of student needs. Therefore, the development of learning media that is not only pedagogically effective but also contextualized to the real-world conditions of schools and student needs is necessary.

Based on this research gap, this study presents a novelty in the form of the Kaseba (Polygonal Bag) learning medium. Kaseba is a learning medium in the form of a wooden block equipped with pockets containing various colorful geometric shapes. This medium is not only used to recognize the shapes and characteristics of geometric shapes but is also designed for direct composition and decomposition activities in a single integrated learning tool. Furthermore, Kaseba is equipped with a handle, making it portable and easy to use in various classroom settings, including schools with limited technological facilities.

Kaseba is a concrete visual medium in the form of a suitcase measuring approximately 50 cm × 45 cm × 15 cm, blue on the outside and gray on the inside, and has two sides: a pocket side and a side for storing images. This medium is equipped with three main pockets: a regular polygonal pocket, an irregular polygonal pocket, and a non-polygonal pocket. Kaseba media is developed from wood, cardboard, flannel, paper, sticks, glue, and paint and is used to help students observe, group, and differentiate types of geometric shapes based on their characteristics. Learning activities with Kaseba include observing shapes, grouping geometric shapes, and placing geometric shapes into appropriate bags. Kaseba media is characterized by its safety, durability, attractive design, colors that suit student characteristics, ease of use, and effectiveness in enhancing students' understanding of geometric shapes.

The development of Kaseba media is also based on observations, interviews, and student needs questionnaires. Therefore, this media is not only innovative in design but also contextual and adaptive to the real needs of learning in the field. Thus, Kaseba does not simply repeat the development of previous concrete media, but presents new innovations in integrated functions, portable design, and suitability to student characteristics and school conditions. The development of Kaseba is supported by various previous studies. Yosiva's (2021) research showed that Papin and Kajib media significantly improved student learning outcomes. Maghfiroh et al.'s (2023) research also demonstrated that Kapindo media significantly influenced mathematics learning outcomes. Furthermore, Anggraini's (2020) research demonstrated that Pakapin media is highly suitable and effective for learning. Based on these research findings, the use of concrete media has been proven to improve students' mathematics learning outcomes.

Therefore, the development of Kaseba learning media is expected to be an innovative solution to address the challenges of learning mathematics on plane geometry in fourth-grade students at SDN Bendungan 1. Through the use of Kaseba, students' conceptual understanding, learning interest, and mathematics learning outcomes are expected to achieve or even exceed the established minimum competency (KKTP). Based on this description, this study aims to measure the extent of improvement in student learning outcomes after using Kaseba media, determine the effectiveness of Kaseba media based on learning completion, and determine the percentage of positive student responses to Kaseba media.

The results of this study are expected to contribute theoretically to the development of educational science, particularly in mathematics learning in elementary schools. This research expands the study of the effectiveness of using concrete, manipulative-based learning media, specifically Kaseba, in improving learning outcomes in plane geometry. The findings are also expected to serve as a scientific reference for the development of similar learning media that are more innovative, contextual, and aligned with the cognitive developmental characteristics of elementary school students.

Practically, this research is expected to benefit students, teachers, schools, and future researchers. For students, the use of Kaseba media is expected to help improve their understanding of plane geometry concepts in a more accessible, enjoyable, and meaningful way, thereby improving learning outcomes. For teachers, the results of this study can be used as an alternative, innovative learning media that is easy to use, not dependent on technology, and capable of increasing student interest and engagement in mathematics learning. For schools, this research is expected to serve as a consideration in improving the quality of mathematics learning through the effective use of simple learning media that are appropriate to the available infrastructure. Meanwhile, for future researchers, the results of this study can serve as a reference source and the basis for developing further research related to learning media innovation and improving mathematics learning outcomes in elementary schools.

Learning is a process of interaction between teachers, students, and learning resources within a learning environment to achieve educational goals (Law of the Republic of Indonesia Number 20 of 2003 concerning the National Education System, n.d.). Learning is influenced by internal factors (interest, motivation, ability) and external factors (family, school, and community). Learning is characterized by goals, planning, interaction, and the teacher's role as a facilitator. Learning outcomes are student achievements after participating in the learning process, which encompasses aspects of knowledge, attitudes, and skills. Learning outcomes are influenced by student characteristics, motivation, learning models, and the media used. The purpose of learning outcomes is to determine the level of material mastery, the effectiveness of learning, and the development of student abilities.

Fourth-grade students, aged 9–10 years, are in the concrete operational development stage moving towards formal. At this stage, children are able to think

logically, analyze, group, and connect concepts with real-life experiences. Children's mathematical abilities are also developing, particularly in understanding shapes and the properties of plane figures, as well as problem-solving. Fourth-grade students at Bendungan 1 Elementary School are cheerful, active, enjoy concrete objects, and have a predominantly kinesthetic learning style.

Media is a tool for conveying messages from a source to a recipient (Hasanah, 2020). Media includes visual, audio, and audiovisual media. Learning media is a tool used by teachers to deliver material to make it easier for students to understand. Learning media serves to stimulate learning interest, concretize abstract concepts, and increase learning effectiveness. Learning is a relatively permanent process of behavioral change resulting from an individual's interaction with the environment (Gagne in Siregar & Widyaningrum, 2015). Learning encompasses not only cognitive aspects but also affective and psychomotor aspects. Types of learning include conceptual learning, verbal association, problem solving, and rule learning. Each student has a different learning style: visual, auditory, and kinesthetic. Fourth-grade students tend to be predominantly kinesthetic, requiring concrete media that can be touched and manipulated.

METHOD

This study used a quasi-experimental method with a One Group Pretest–Posttest design. This design was chosen because the study aimed to measure the effectiveness of Kaseba media by comparing student learning outcomes before and after treatment (media use). The research design is described as follows:

$$O_1 - X - O_2$$

Information:

O_1 = pretest (learning outcomes before using Kaseba)

X = treatment (learning using Kaseba media)

O_2 = posttest (learning outcomes after using Kaseba)

The research subjects were all 30 fourth-grade students of SDN Bendungan 1 and SDN Macanbang in the 2025 academic year. The research was conducted in June 2025. The research stages are carried out through the following steps:

a. **Preparation**

1) Develop lesson plans and learning materials using Kaseba media.

2) Develop pretest-posttest instruments and student response questionnaires.

3) Validate instruments with experts.

b. Implementation

1) Administer a pretest to determine students' initial abilities.

2) Administer mathematics learning on plane geometry using Kaseba media.

3) Administer a posttest to determine improvements in learning outcomes after the treatment.

c. Student Response Data Collection

1) Provide student response questionnaires after learning is complete.

d. Data analysis

1) Calculating the increase in learning outcomes (gain score).

2) Determining the level of media effectiveness.

3) Calculating the percentage of positive student responses.

The research instrument used a learning outcome test (in the form of 20 multiple choice questions and short essays that measure students' abilities in the material of plane figures. The test was given during the pretest and posttest) and a student response questionnaire (in the form of a Likert scale questionnaire) that measures students' perceptions of the attractiveness, ease, and usefulness of the Kaseba media.

Data collection techniques are described as follows.

a. Pretest and posttest to obtain learning outcome data.

b. Documentation in the form of photos of activities and data on school grades.

c. Questionnaire to find out student responses**.**

The data analysis technique uses the formula explained below

a. Analysis of Improving Learning Outcomes

To answer the first objective, the data was analyzed using gain score (g)**:**

$$g = \frac{(posttest - pretest)}{(skor\ maksimum - pretest)}$$

Gain categories according to Hake (1998):

Value g	Category
$g \geq 0{,}70$	High
$0{,}30 \leq g < 0{,}70$	Medium
$g < 0{,}30$	Low

b. Analysis of Media Effectiveness Based on Learning Completeness

Completeness is calculated using:

$$Ketuntasan = \frac{Jumlah\ siswa\ tuntas}{Jumlah\ seluruh\ siswa} \times 100\%$$

Effectiveness criteria:

Class Completeness	Interpretation of Effectiveness
≥ 80%	Very Effective
60–79%	Effective
40–59%	Quite Effective
< 40%	Not Effective

c. Analysis of Student Responses

The percentage of responses was calculated using:

$$Persentase\ Respon = \frac{Skor\ yang\ diperoleh}{Skor\ maksimum} \times 100\%$$

Category:

Percentage	Interpretation
81–100%	Very positive
61–80%	Positive
41–60%	Pretty positive
≤ 40%	Not positive

The validity test uses expert judgment and, if necessary, empirical testing using product-moment correlation. The instrument reliability test uses the Cronbach's Alpha formula for questionnaires.

RESULTS

1. Improvement in Student Learning Outcomes After Using Kaseb Media

A large-scale test was conducted on June 5, 2025, with 30 fourth-grade students as subjects. Based on the pretest and posttest scores, the average pretest score was 55.93. The average posttest score was 91.43. The results indicate that the posttest score is greater than the pretest score, which is 91.43 > 55.93. The classical completeness score was 100%,

meaning that Kaseba media can be used for the learning process of fourth-grade flat geometry material.

Table 1. Results of Pretest and Posttest Scores at SDN Bendungan 1

No	Name	Pretest Result	Posttest Result
1	AWR	70	100
2	ADW	56	85
3	ANK	71	90
4	AID	32	90
5	ASVK	69	95
6	BCL	56	88
7	DDA	60	85
8	GS	55	95
9	HFR	55	92
10	HCC	62	100
11	NFAY	41	92
12	QSAS	45	95
13	RFP	56	90
14	RSM	44	88
15	SHD	70	100
16	SLBM	85	100
17	SSR	70	95
18	YAR	60	85

Table 2. Results of Pretest and Posttest Scores at SDN Macanbang

No	Name	Pretest	Posttest Result
1	AAHP	43	86
2	AKEP	65	90
3	BFR	64	86
4	DBDR	50	92
5	DMFAH	51	85
6	MAFN	30	95
7	MFW	65	90
8	MYKA	70	100
9	MRA	35	83
10	MRYP	58	100
11	SED	35	82
12	ST	55	89

Then the pretest and posttest values are entered into the N-Gain formula and the following results are obtained..

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
NGain	30	.61	1.00	.8111	.12704
Valid N (listwise)	30				

Figure 1. Results of the N-Gain Test of the Wide Scale Test

The analysis results showed that the use of Kaseba learning media for the topic of plane figures significantly improved student learning outcomes. The average pretest score of 55.93 increased to 91.43 after the treatment. This improvement in learning outcomes was

confirmed through an N-Gain analysis, which obtained a score of 0.81. This result is in the high category. This indicates that students experienced an increase in their understanding of plane figure concepts after learning using Kaseba. Thus, the first research objective, which was to measure the magnitude of the improvement in learning outcomes, was met with strong evidence.

2. Effectiveness of Kaseba Media Based on Learning Completeness

The results showed that Kaseba media was highly effective in learning mathematics on plane figures, demonstrating 100% completeness. This means that all students achieved scores above the established Learning Objective Achievement Criteria (KKTP). The 100% classical completeness indicates that Kaseba media was able to help all students understand the material well, without exception. Therefore, based on the classical completeness indicator, Kaseba learning media is categorized as very effective. The second research objective, namely determining the category of media effectiveness based on learning completeness, was clearly fulfilled.

3. Percentage of Positive Student Responses to Kaseba Media

Table 3. Results of the Student Response Questionnaire at SDN Bendungan 1

No	Name	Score	Score
1	AWR	45	90%
2	ADW	46	92%
3	ANK	46	92%
4	AID	45	90%
5	ASVK	48	96%
6	BCL	46	92%
7	DDA	47	94%
8	GS	43	86%
9	HFR	44	88%
10	HCC	45	90%
11	NFAY	46	92%
12	QSAS	46	92%
13	RFP	48	96%
14	RSM	45	90%
15	SHD	45	90%
16	SLBM	45	90%
17	SSR	43	86%
18	YAR	44	88%

Table 4. Results of Student Response Questionnaire at SDN Macanbang

No	Name	Score	Score Persentase
1	AAHP	43	86%
2	AKEP	45	90%
3	BFR	44	88%
4	DBDR	46	92%

No	Name	Score	Score Persentase
5	DMFAH	44	88%
6	MAFN	47	94%
7	MFW	45	90%
8	MYKA	43	86%
9	MRA	44	88%
10	MRYP	43	86%
11	SED	45	90%
12	ST	47	94%

The results showed that Kaseba media received very positive responses from students. The student response questionnaire in the large-scale test obtained a score of 90%, also categorized as very practical. This indicates that they found Kaseba media interesting, easy to use, and helped them understand the material on plane shapes in a more concrete and enjoyable way. Kaseba media was positively received by direct users in learning activities. Thus, the third research objective, namely to determine the percentage of positive student responses, was also met.

DISCUSSION

The results of the research show that the Kaseba (Multi-faceted Bag) learning media has a significant impact on increasing understanding of the concept of flat shapes in class IV students. Based on the results of the pretest and posttest on the wide scale test, there was an increase in the average score from 55.93 to 91.43. This increase not only shows numerical changes, but also illustrates a shift in students' understanding from an initial level towards more mature mastery of concepts. This data is in line with Bruner's theory (Lastini et al., 2024) which emphasizes that learning at the concrete and symbolic operational stages will be more optimal if students are given manipulative media that enable them to understand abstract concepts through concrete representations. In this context, Kaseba media functions as an intermediary tool that bridges abstract flat material into real learning experiences.

The increase in student learning outcomes is also strengthened through N-Gain analysis with a score of 0.81, which is in the high category. This indicates that the Kaseba media intervention has a substantial increasing effect on student academic achievement. These results are consistent with research by Anggraini (2020) which found that concrete media such as Pakapin can significantly improve student learning outcomes. These findings indicate that the use of concrete media not only helps understanding, but also

creates meaningful learning experiences so that students are able to transfer concepts to new situations.

From the aspect of effectiveness based on learning completeness, the research results show that classical completeness reached 100%, which means that all students succeeded in exceeding the minimum score set in the KKTP. This proves that Kaseba media is not only effective for some students, but has also succeeded in reaching all students with various levels of initial ability. Perfect learning completion shows that this media is able to fulfill the principle of differentiation, namely providing equal learning opportunities for students who understand quickly and those who need concrete demonstration to build their understanding. This fact strengthens the view that learning media is not only a visual aid, but an integral part of the design of mathematics learning in elementary schools (Huda, M., & Susdarwono, 2023).

In addition to improving learning outcomes, student affectivity, which is reflected through student responses as indicators of attitudes, interest and comfort in learning, also shows positive results. Based on student response questionnaires from two schools, the percentage of student responses to using Kaseba media reached 90% in the very practical category. This shows that students feel happy, interested and comfortable learning using this media. This positive response is strongly correlated with the increase in learning outcomes achieved. Students' interest in learning media is often an important factor in encouraging learning motivation, which in turn has an impact on increasing concentration, activeness and ability to understand the material. These results support the research of Meida Maghfiroh et al. (2023) and Yosiva (2021), who state that concrete media such as Papin, Kajib, and Kapindo are able to increase student interest and learning outcomes significantly.

Overall, the findings of this research prove that Kaseba media is effective from three important aspects: increasing learning outcomes, learning completion, and positive student responses. The significant increase in grades, 100% completeness, and high positive responses show that Kaseba not only functions as a learning aid, but also as a learning innovation that is able to improve the quality of the mathematics learning process, especially in plane material. Thus, the use of Kaseba media can be recommended as a learning strategy that is able to overcome students' difficulties in understanding geometric concepts and create active, fun and meaningful learning.

CONCLUSION

Based on the research objectives which include: (1) measuring the magnitude of the increase in student learning outcomes after using Kaseba media, (2) determining the effectiveness category of Kaseba media based on learning completeness, and (3) knowing the percentage of students' positive responses to using Kaseba media, the following conclusions were obtained.

First, the use of Kaseba learning media has proven to be very effective in improving student learning outcomes in plane material. This is shown by an increase in the average score from 55.93 at the pretest to 91.43 at the posttest. N-Gain analysis of 0.81, which is included in the high category, further strengthens that this increase is significant and meaningful. In this way, Kaseba media is able to help students understand the concept of flat shapes more concretely, visually, and easily applied in the problems solving process.

Second, from the aspect of learning completeness, all students succeeded in achieving scores above the Learning Goal Achievement Criteria (KKTP), so that they obtained 100% classical completeness. These results confirm that Kaseba media is in the very effective category for use in mathematics learning, especially flat figures in class IV. This media makes it easier for teachers to convey material while making it easier for students to understand the relationship between elements of flat shapes through direct activities and visualization.

Third, students' responses to Kaseba media are in the very positive category, with an average percentage of 90%. Students find Kaseba interesting, easy to use, and helps them understand the material in a more enjoyable way. This high positive response shows that Kaseba media is not only effective from an academic perspective, but also supports an active, enthusiastic and student-centered learning atmosphere. In this way, all research objectives have been met consistently and are mutually reinforcing.

Research Follow-up

Based on very effective research results, Kaseba media has the potential to expand its use to other geometric materials such as geometric figures or the concept of perimeter and area with varying levels of difficulty. Future research can conduct trials at different grade levels or schools with other characteristics to see the consistency of its effectiveness. Teachers can also develop a more systematic guide to using Kaseba so that

it can be used as a routine teaching medium in schools. Apart from that, the integration of Kaseba media with digital learning or educational games can be a further innovation to increase student learning motivation.

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