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Picture Media as a Solution for Mathematics Learning: A Classroom Action Study on Fourth Grade Elementary School Students

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ABSTRACT

Purpose of the study: The aim of this research is to improve mathematics learning outcomes by using image media for angle measurement material for fourth grade elementary school students.

Methodology: This classroom action research used observation sheets, essay-type achievement tests, lesson plans, and image-based learning media. The method used followed two cycles of Classroom Action Research (planning, action, observation, and reflection). Data were collected through student achievement tests and then analyzed descriptively using percentage calculations without special software.

Main Findings: The use of image-based learning media improved mathematics learning outcomes of fourth-grade students. Classical mastery increased from 25% in the pre-action stage to 50% in Cycle I, showing a 25% improvement. In Cycle II, classical mastery reached 83.3%, indicating a further increase of 33.3% and exceeding the minimum mastery criterion of 75%.

Novelty/Originality of this study: This study offers novelty by systematically applying image-based learning media within a classroom action research framework to improve elementary students' understanding of angle measurement. It provides practical evidence of step-by-step improvement across cycles, enriching empirical knowledge on effective visual media integration in primary mathematics learning.

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1. INTRODUCTION

Mathematics is a core subject in elementary school and plays a crucial role in developing students' logical, critical, and systematic thinking skills [1]-[3]. Mastering mathematical concepts from an early age is fundamental to students' success in learning other sciences and in facing everyday life challenges [4], [5]. Therefore, mathematics instruction in elementary schools needs to be designed effectively to optimally achieve learning objectives [6], [7].

However, mathematics instruction in elementary schools often faces various challenges [8], [9]. One common problem is low student learning outcomes. This is often caused by the perception that mathematics is a difficult and abstract subject, leading to students' lack of interest and active participation in the learning process [10], [11]. Consequently, students' understanding of mathematical concepts is low, impacting learning outcomes [12], [13].

Low mathematics learning outcomes are also influenced by the methods and media used by teachers [14], [15]. Learning that is still dominated by lectures without the support of engaging media tends to make students passive and easily bored [16], [17]. Elementary school students are at the concrete operational stage of development and therefore require the assistance of visual and concrete learning media to facilitate their understanding of mathematical concepts [18], [19].

One learning medium that can be used to address this problem is images. Visual media has the advantage of presenting abstract concepts in a more concrete and understandable way for students [20], [21]. Through visual media, students can observe, interpret, and relate learning material to real-life experiences, making the learning process more meaningful and engaging [22], [23].

The use of visual media in mathematics learning is believed to increase student engagement and motivation [24], [25]. This media allows for better interaction between teachers and students and encourages students to be directly involved in the learning process [26], [27]. Thus, visual media serves not only as a teaching aid but also as a means of creating a conducive and enjoyable learning environment [28], [29].

Various previous studies have shown that the use of visual learning media can improve elementary school students' understanding and mathematics learning outcomes [30]-[32]. However, most of these studies emphasize comparing learning outcomes before and after media use, without examining the ongoing learning improvement process. Furthermore, there is limited research specifically applying visual media through a classroom action research approach that emphasizes reflection and learning improvement in each cycle. Therefore, there is a research gap related to the need for empirical studies that describe the gradual improvement in learning outcomes through the application of visual media in classroom action cycles, particularly on angle measurement in fourth grade elementary school [33], [34].

The novelty of this research lies in the structured application of visual media in classroom action research cycles focused on improving mathematics learning outcomes in angle measurement in fourth grade elementary school. This study not only assesses final learning outcomes but also traces the gradual increase in learning mastery throughout each cycle, thus providing a more comprehensive empirical picture of the effectiveness of visual media in mathematics learning.

The urgency of this research is based on the urgent need to improve the quality of mathematics learning in elementary schools, particularly to address low student learning outcomes. Teachers need learning strategies that are practical, easy to implement, and appropriate to students' developmental characteristics. Therefore, the results of this study are expected to provide an alternative, relevant and applicable learning solution for teachers in improving students' understanding of mathematics concepts and learning outcomes. Therefore, this study aims to improve the mathematics learning outcomes of fourth-grade elementary school students through the use of visual media in learning. This research is expected to provide practical contributions for teachers in selecting and implementing appropriate learning media, as well as enrich empirical studies on the effectiveness of visual media as a solution for mathematics learning in elementary schools.

2. RESEARCH METHOD

2.1. Research Design

This study uses a Classroom Action Research design aimed at improving and enhancing the quality of mathematics learning practices in the classroom. Classroom Action Research is conducted as a form of observation of learning activities that are intentionally designed and implemented collaboratively between teachers and students in the classroom [35], [36]. The problems examined in this study stem from real-life learning conditions and are directly experienced by the teachers, ensuring that the actions taken are contextual and applicable.

The Classroom Action Research design in this study follows a cyclical model consisting of four main stages: planning, implementation, observation, and reflection [37], [38]. These four stages form a learning cycle that is carried out repeatedly. If the expected results are not achieved in one cycle, the research is continued in the next cycle with improvements based on the reflection results. Thus, this Classroom Action Research is not a one-time event, but rather a continuous process until optimal learning improvements are achieved.

2.2. Subjects and Objects of Research

The research subjects are the data sources and the place where the research variables are embedded [39], [40]. The subjects in this classroom action research were all 24 fourth-grade students at Kaliabu Public Elementary School, consisting of 13 boys and 11 girls. This class was selected based on the low level of student engagement and motivation, which impacts low mathematics learning outcomes.

The research object is the aspect that is the primary focus of the study. The objective of this study is to improve mathematics learning outcomes through the use of images for angle measurement among fourth-grade students at Kaliabu Public Elementary School, Magelang Regency.

2.3. Research Procedures

This research procedure was implemented through two cycles, each consisting of two learning activities. Each cycle in this classroom action research includes four main stages: planning, action implementation, observation, and reflection [41], [42]. Prior to implementing cycle I, the researcher first conducted a pre-action by carrying out the learning process as usual without implementing any specific actions. This pre-action aimed to determine the initial conditions and students' mathematics learning outcomes before the implementation of the action using visual media.

The action planning stage began by identifying problems that arose during the fourth-grade mathematics learning process. Next, the researcher defined the material to be taught, determined data collection techniques and tools, and developed a Lesson Plan that outlined a series of learning activities using visual media. At this stage, the researcher also prepared teaching aids, visual media, and other supporting materials to be used during the learning process.

The action implementation stage was carried out by implementing the lesson according to the previously prepared Lesson Plan. The teacher began the lesson with introductory activities, such as greeting students, leading prayer, taking attendance, relating students' experiences to the material to be learned, and conveying the learning objectives [43], [44]. In the main activity, the teacher delivered the material on angle measurement through lectures, demonstrations using visual media, and a question-and-answer session. Students are actively involved in experimenting with drawing media at the front of the class, measuring angles using non-standard and standard units, and determining angle types, such as a quarter turn, half turn, full turn, and right angles in the cardinal directions. The learning activity concludes with a reinforcement of the material, a joint conclusion, the provision of evaluation questions, a discussion of the evaluation results, and a closing session.

The observation phase was conducted concurrently with the implementation of the action. Observations were conducted to obtain data regarding the mathematics learning process using visual media. Observations were conducted based on a previously prepared observation sheet, which covered teacher and student activities, the classroom atmosphere, the use of learning media, and any obstacles encountered during the learning process [45], [46].

The reflection phase was conducted after the implementation of the action and observations. The data obtained were analyzed to assess the impact of the actions taken on the student learning process and outcomes [47], [48]. The reflection results were used as a basis for determining the continuation of the action in the next cycle. If the expected results were not achieved, improvements and repetition of the action in the next cycle were made by adjusting the learning strategy to optimally improve students' mathematics learning outcomes. A brief overview of the research procedure can be seen in the diagram below:

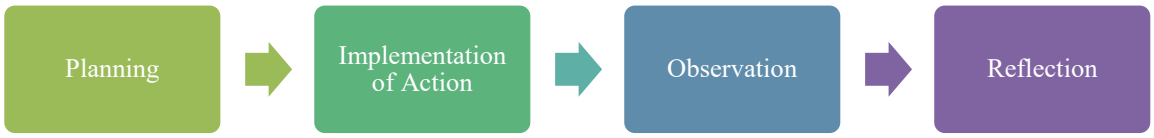

Figure 1. Research Procedure

2.4. Data Collection Techniques

The data collection technique in this study was carried out to obtain the necessary information regarding the process and outcomes of students' mathematics learning [49], [50]. Data collection techniques are methods used by researchers to collect abstract data that cannot be observed directly, but can be realized through research instruments [51], [52]. In this study, data collection was carried out using an instrument in the form of a limited essay test designed according to the indicators of mathematics learning, specifically the material on angle measurement. This test was used to measure student learning outcomes individually and as a class. In addition, additional data can be obtained through observations of student activities during the learning process to support the analysis of learning outcomes and student activeness in using image media.

2.5. Research Instruments

A research instrument is a tool or facility used by researchers to collect data to facilitate and achieve success, meaning it is more accurate, complete, and systematic, making it easier to process [53], [54]. Data collection in this study was conducted using tests. Tests are a set of stimuli given to a person with the intention of eliciting answers that reflect the skills, knowledge, intelligence, abilities, or talents possessed by an individual or group. Tests are used to measure students' learning outcomes in mathematics learning using learning media. In conducting the tests, researchers used test questions as instruments.

The test questions used in this study were in essay or limited description form, where each question addressed specific issues or had certain limitations, in terms of: 1) its scope, 2) the perspective from which it was

answered, 3) the indicators, and the answers were directed to specific aspects. The test questions contained many items that would measure variables. The variable or object in this study was student learning outcomes in mathematics learning using visual media. The following is a grid for the mathematics learning outcomes test using image media for fourth grade students at Kaliabu State Elementary School, Magelang with the main material of Angle Measurement.

Table 1. Mathematics Learning Outcomes Test Grid

No	Topic	Indicator	Cognitive Level	Number of Items
1.	Angle Measurement	• Measuring the size of angles using non-standard units and standard units	C3	3
		• Determine the size of the angle of one turn, half turn and quarter turn	C2	8
		• Recognize right angles in the cardinal directions	C1	5
		• Using the four cardinal directions	C3	4
Total Number of Questions				20

2.6. Data Analysis Methods

Data analysis is the process of organizing and sorting data into patterns, categories, and basic descriptive units so that themes can be identified and working hypotheses can be formulated as suggested by the data [55], [56]. The research data were analyzed using quantitative descriptive data analysis using percentage techniques, which provide an overview of the application of image media in mathematics lessons. To calculate the percentage of learning completion achieved by students, the following formula is used:

$$P = \frac{\sum Students\ who\ have\ completed\ their\ studies}{\sum Students}\ x\ 100\%$$

Researchers also analyzed and described how the process and results of learning mathematics using image media in cycle 1 and cycle 2. If there is an increase in student learning outcomes in mathematics learning as known through test results, it means the hypothesis is proven.

2.7. Criteria for Action Success

This Classroom Action Research is said to be successful if the fourth grade students of Kaliabu State Elementary School, Magelang Regency achieve the Minimum Completion Criteria of at least 75%.

3. RESULTS AND DISCUSSION

The implementation of this research is in the form of classroom action research, which is carried out in two cycles, where each cycle is carried out in two meetings (two actions), to obtain initial data, pre-action activities (pre-cycle) are carried out first as follows.

3.1. Pre-Action (Pre-Cycle)

Before commencing the research in Cycle I, a pre-action was conducted to obtain baseline data on the mathematics scores of fourth-grade students at Kaliabu State Elementary School before the research activities were implemented. The topic covered angle measurement, with a focus on the subtopic of measuring angles using non-standard units.

In the pre-action, the researcher employed a lecture and question-and-answer method. At this stage, no visual media was used, so the learning process took place without any specific actions. Before beginning the material, the teacher conducted an apperception session by asking students to list the number of angles in objects around them. Next, the teacher explained the material through a lecture, followed by a question-and-answer session between the teacher and students regarding the material just presented. Although the teacher gave students the opportunity to ask questions, no questions were raised. The learning activity concluded with a joint conclusion between the teacher and students, the administration of an essay evaluation, a discussion of the evaluation results, the delivery of a message and impression by the teacher, and a closing greeting.

Based on the pre-action data, it can be concluded that only 6 students, or 25% of the 24 fourth-grade students, had achieved the success criteria, with scores equal to or above the Minimum Completion Criteria of 70.00. Meanwhile, 18 students, or 75%, failed to meet the success criteria because their scores were below the Minimum Completion Criteria. Therefore, the percentage of students achieving the Minimum Completion Criteria in the pre-action phase was still relatively low and insignificant. Therefore, efforts are needed to improve student learning outcomes to better meet the Minimum Completion Criteria target of 70.00.

3.2. Cycle I

To improve the learning outcomes of fourth-grade students at Kaliabu State Elementary School in mathematics, a visual learning model was used. The hypothesis of this study is that visual learning can improve mathematics learning outcomes in fourth-grade students at Kaliabu State Elementary School.

In the first meeting of Cycle I, most students forgot to bring their rulers, disrupting learning because they borrowed rulers from friends who were using them. In the next meeting, students who did not bring rulers were instructed to purchase them before class. Based on data from the first cycle, 12 students, or 50%, met the success criteria with scores equal to or higher than the minimum completion score of 70. Another 12 students, or 50%, did not meet the success criteria because their scores were still below the minimum completion score. Thus, only half of the 24 fourth-grade students met the success criteria in the first cycle. This result is still considered low and insignificant because it does not reach the minimum target of 75% of students meeting the minimum completion score. Therefore, further efforts are needed to improve student learning outcomes. In other words, in cycle I, only 50% of the 24 fourth-grade students achieved the success criteria. Of course, the evaluation results still show a figure that is not significant enough and is still low because not 75% of the scores meet the expected Minimum Completion Criteria of 70.00 (seventy point zero), so the students' learning outcomes need to be improved.

3.3. Cycle II

An action plan was prepared to continue the material in Cycle I. The material studied in Cycle II was Angle Measurement. Overall research results in Cycle II showed an improvement in student learning outcomes, as seen through student tests administered at the end of each meeting. Increased student engagement and enthusiasm were also evident in the learning activities. This indicates a positive response from students to participating in mathematics learning using visual media.

Based on data from the second cycle, 20 students, or 83.3%, obtained scores equal to or higher than the minimum passing grade of 70. Meanwhile, 4 (16.6%) did not achieve the success criteria because their scores were still below the minimum passing grade. Thus, in the second cycle, 83.3% of the 24 fourth-grade students achieved the success criteria. The study was terminated in the second cycle because the results achieved met the target, with more than 75% of students achieving scores in accordance with the expected minimum passing grade of 70. The following is a diagram of the percentage of students achieving the Minimum Passing Criteria between cycles of fourth-grade students at Kaliabu Public Elementary School, Magelang Regency, in the mathematics learning process on angle measurement:

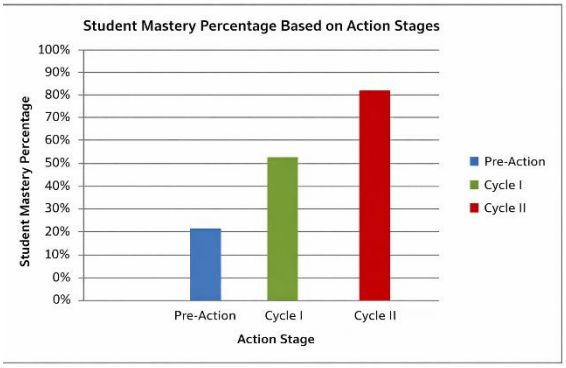

Figure 2. Percentage Diagram of Minimum Student Completion Criteria Between Cycles

Based on the implementation of classroom action research, a pattern of improvement in student learning outcomes was observed from the pre-action phase to the second cycle. In the pre-action phase, learning was still conventional, using lecture and question-and-answer methods without the use of engaging learning media. This resulted in relatively low student engagement, resulting in most students failing to achieve the Minimum Completion Criteria. This aligns with previous research findings, which showed that the pure lecture method tends to decrease student motivation and participation in mathematics learning.

The application of visual media in the first cycle began to have a positive effect on the teaching and learning process. The visual media served as visual aids that facilitated the understanding of the concept of angle measurement. Despite technical obstacles, such as a lack of student equipment, the implementation of this media increased student engagement in learning [57], [58]. This indicates that appropriate learning media can enhance student interaction with the material, which in turn impacts learning outcomes.

In the second cycle, the application of visual media consistently demonstrated significant improvements. Students were more active, enthusiastic, and responsive to learning activities. This supports the principles of

constructivist learning, where students learn through direct experience and visual representations of concepts being studied. These results also align with research findings that emphasize that visual media enhance learning appeal and help students understand abstract mathematical concepts.

Overall, this study shows that the use of visual media as part of a mathematics learning strategy can improve students' skills in measuring angles and increase the percentage of students achieving the Minimum Completion Criteria. Furthermore, the increase in student engagement and enthusiasm also indicates that learning media not only facilitates understanding of the material but also fosters higher learning motivation [57], [59].

This research aligns with various previous findings showing that the use of visual media in mathematics learning can improve student learning outcomes [14], [60]. Visual media and teaching aids can facilitate student understanding of abstract concepts, increase student engagement, and improve academic achievement [34], [61]. Conventional learning without media tends to decrease student learning motivation, so the implementation of interactive learning media is an effective strategy for improving learning success. Therefore, the results of this study are consistent with previous empirical evidence supporting the use of visual media as a means to improve student understanding and skills.

This research has had a positive impact in several aspects. First, academically, the use of visual media can improve students' understanding of the material on measuring angles and increase the percentage of students achieving the Minimum Completion Criteria. Second, psychologically, this learning media increases students' enthusiasm, activeness, and motivation to learn, making the learning process more enjoyable and interactive. Third, for teachers, this study provides practical evidence that the use of instructional media can be an effective strategy for improving the quality of mathematics learning in the classroom.

Despite showing positive results, this study has several limitations. First, the limited number of subjects in one class makes it difficult to generalize the results to the entire elementary school student population. Second, technical constraints, such as the availability of angle measuring tools, which not all students had, impacted the smoothness of learning in the initial cycle. Third, this study only assessed angle measurement as a single topic, so it cannot yet confirm the effectiveness of image media on other mathematics topics. These limitations should be considered for future research to expand the sample size, expand the material, and optimize learning resources.

4. CONCLUSION

Learning using picture media with teachers attaching pictures on the whiteboard in explaining the material can improve the learning outcomes of fourth grade students of Kaliabu State Elementary School, Magelang Regency in mathematics. This is proven by an increase in the percentage of students' Minimum Completion Criteria classically. In the pre-action, the percentage of students' Minimum Completion Criteria classically was 25%. In cycle I, the percentage of students' Minimum Completion Criteria classically was 50%, which means an increase of 25% from pre-action. While in cycle II, the percentage of students' Minimum Completion Criteria classically was 83.3%, which means an increase of 33.3% from cycle I where the percentage has reached the desired target, namely the minimum Minimum Completion Criteria for fourth grade students of Kaliabu State Elementary School, Magelang Regency classically is 75%. Further research is recommended to examine the use of visual media combined with digital technology or other innovative learning models to determine optimal effectiveness on mathematics learning outcomes. Furthermore, further research can be conducted at different grade levels, subjects, or with different student characteristics to test the consistency and generalizability of this study's findings.

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