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DEVELOPMENT OF CORNER CLOCK LEARNING MEDIA TO IMPROVE ANGULAR MEASUREMENT SKILLS AND SPATIAL ABILITY OF SDN KEBAYUNAN STUDENTS DEPOK CITY

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ABSTRACT

Education is a continuous process that plays an important role in the development of students' cognitive abilities, including through mathematics learning in elementary school. One of the essential geometry materials that is still considered difficult by students is angle measurement. The low understanding of concepts and students' spatial abilities in the material is caused by the abstract nature of mathematics and the lack of use of concrete learning media. Therefore, this study aims to develop and test the validity, practicality, and effectiveness of *Corner Clock* learning media in improving the angular measurement ability and spatial ability of elementary school students. This research uses *a Research and Development (R&D) approach* with the ADDIE model, which includes the stages of analysis, design, development, implementation, and evaluation. The subject of the study is a third-grade student of SDN Kebayunan Depok City. Data was collected through tests of angular measurement ability and spatial ability, student response questionnaires, interviews, and documentation.

The results of the study show that the Corner Clock media is declared valid by experts, practical based on positive student responses, and effective in improving learning outcomes. The average pretest score of 60.29 increased to 81.79 in the posttest. In addition, the use of Corner Clock media is able to increase student involvement, help visualize corners concretely, and train spatial skills through manipulative activities. Thus, Corner Clock learning media is suitable for use as an alternative to mathematics learning media in angle measurement materials in elementary schools and has the potential to improve the quality of meaningful and contextual learning.

Keywords: learning media, Corner Clock, angle measurement, spatial ability, elementary school.

ABSTRACT

Education is a continuous process that plays an important role in developing students' cognitive abilities, including through mathematics learning in elementary schools. One of the essential geometry materials that is still considered difficult by students is angle measurement. Students' low conceptual understanding and spatial abilities in this material are caused by the abstract nature of mathematics and the minimal use of concrete learning media. Therefore, this study aims to develop and test the validity, practicality, and effectiveness of the Corner Clock learning media in improving elementary school students' angle measurement and spatial abilities. This study uses a Research and Development (R&D) approach with the ADDIE model, which includes the stages of analysis, design, development, implementation, and evaluation. The research subjects were third-grade students of SDN Kebayunan, Depok City. Data were collected through angle measurement and spatial ability tests, student response questionnaires, interviews, and documentation.

The research results showed that the Corner Clock media was deemed valid by experts, practical based on positive student responses, and effective in improving learning outcomes. The average pretest score of 60.29 increased to 81.79 in the posttest. Furthermore, the use of the Corner Clock media increased student engagement, facilitated concrete visualization of angles, and fostered spatial skills through manipulative activities. Thus, the Corner Clock media is suitable for use as an alternative mathematics learning medium for angle measurement in elementary schools and has the potential to improve the quality of meaningful and contextual learning.

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INTRODUCTION

"Education is a continuous effort (throughout life) that humans make in their lives," said Wulandari et al (2024). According to Mukrimatin et al (in Rahmalia & Safari, 2024) said "Mathematics, as one of the main subjects, contributes significantly to these efforts, having a very large contribution in the field of Education". Understanding mathematical concepts is not only a foundation, but also the key to developing even more complex skills that can be applied in the future (Rahmalia & Safari, 2024).

Student knowledge can be formed through understanding mathematical concepts so as to help develop knowledge at higher education levels (Imam et al, 2023). Math is considered a difficult subject by elementary school students. Many students consider mathematics to be a boring, difficult subject, many formulas are difficult and in the application of daily life are lacking. In fact, mathematics is an important subject and must be developed along with the development of science and technology (Wijayanti & Yanto, 2023)

According to research conducted by Adhiyah (2023), the use of learning media in the form of concrete objects allows students to see and manipulate objects directly, so that learning becomes more meaningful and helps students understand concepts not only through memorization but based on real experiences. The same thing is also explained by Fitriana et al. (2024) that concrete media can stimulate student activities and facilitate real understanding of material in the learning process.

One of the important materials in the elementary school mathematics curriculum is angle measurement, part of the geometry competency that requires students to understand the concept of angles, recognize the types of angles, and measure the size of angles appropriately using tools such as protractors. Sari's (2025) research explains that angular large material involves indicators of mathematical concepts that students need to master, including the ability to restate concepts, classify objects, and present correct representations of angles. Corner learning problems found in a case study by Astuti *et al.* (2023) shows that students often do not have a mature understanding of the concept of angle material, so this learning is still a challenge in elementary school classrooms. In addition, ethnomathematical exploration of angle types suggests that concrete recognition of angle types can be an important part of contextual and meaningful geometry learning for students.

According to Jean Piaget's theory of cognitive development, elementary school students are in the concrete operational stage, which is a phase where they learn more effectively through real experience and manipulation of concrete objects rather than just listening to verbal explanations or looking at abstract images from textbooks (Nuryati & Darsinah, 2021). Meta-analysis research shows that the use *of manipulatives* or real objects in mathematics learning significantly improves students' understanding of mathematical concepts at the elementary school level compared to traditional learning approaches that are more abstract in nature (Lacaba, 2025). This supports the statement that traditional teacher-centered learning styles tend to make students passive and less engaged in conceptual exploration, while learning that provides opportunities for students to interact directly with concepts according to their cognitive development will increase student participation and understanding (Dietrich & Evans, 2022).

"Spatial ability is the ability to visualize an object in space. In geometry learning". (Düsseldorf , et al , 2020) In addition, students' spatial abilities are the ability to understand, visualize, and manipulate objects in two- or three-dimensional spaces and have a major influence on the understanding of geometry concepts, including angular measurements in elementary school mathematics. Research in the field of mathematics

education shows that spatial abilities help students interpret geometric relationships and *mental representations of* the positions and shapes of objects, which are the basis for understanding angles and orientations in space (Dietrich & Evans, 2022).

Studies related to mathematics learning media show that learning abstract angular concepts will be easier for students to understand when accompanied by concrete media. Permatasari, Apriyani, and Fitriyana (2021) stated that angular clock props play an important role in concretizing the concept of angles so that students can more easily accept them, considering that the nature of abstract mathematics requires real representations for understanding (Permatasari, et al., 2021). The two hands were later manipulated into various angular shapes, where each movement of the clock formed an angle of 30 degrees. This medium is very effective in helping students understand the concept of angles and their size, because students can see firsthand how angles form and change along with clockwise movements (Cahyanti, 2025).

Mathematics education in elementary school plays an important role in shaping students' academic skills. Geometric material that includes angular measurements as well as the relationship of shapes and positions of objects in space is an important part of the elementary mathematics curriculum because it encourages students to understand spatial relationships and visual representations (Kuzle, 2023). Research shows that mathematical spatial ability contributes positively to the understanding of mathematical concepts, especially in geometry and measurement, where the skills of visualization and manipulation of spatial objects are the basis of students' understanding of shapes and angles (Nur Siyam *et al.*, 2024). Pre-observation carried out on students at SDN Kebayunan as seen from the test scores of 30 students in the angle measurement showed that 34% of the students were complete, namely 13 students. From this data, it is a challenge for students to understand and apply angle measurement meters.

Based on the results of the initial analysis of corner learning in elementary school, many students still have difficulty in understanding and measuring corners accurately and applying the concept in daily life, which is reflected in test scores that have not met the KKM. Research by Asror *et al.* (2025) shows that students' *pretest* scores for measuring and comparing angle materials are still below the standard of completeness, which is an average of 58.65, thus showing that there is significant room for improvement in mastery of angle material before learning is intervened. In addition, field observations also revealed that students still have difficulty understanding the concept of corners because learning lacks visual and manipulative media, as shown in Mayasari (2022) research that developed corner clock media (Mayasari et al., 2022).

Thanks to the visual and kinesthetic integration between the concepts of time and angle, the Corner Clock media has significant educational benefits. Through the activity of turning the clock, students not only visually observe the formation of angles, but also practice motor coordination that strengthens mental representation and spatial imagination. Research shows that the use of angle clock media helps students understand angular concepts concretely through manipulative and exploratory exercises, while encouraging the development of spatial thinking skills that play an important role in geometry learning (Permatasari et al., 2021). These findings are in line with international studies that state that physical manipulative-based mathematics learning and hands-on experience are effective in developing students' visual-spatial abilities (Cheng & Mix, 2020).

The Merdeka curriculum implemented in Indonesia encourages active, contextual, and student-centered learning, where teachers have the freedom to choose methods, media, and approaches that suit the needs of students to make learning more meaningful and

effective. Research shows that the application of the Independent Curriculum in mathematics learning is able to increase motivation, active student involvement, and understanding of concepts through a contextual and flexible learning approach (Turmuzi & Wahyuningsih, 2025). Research by Kero and Wawe (2024) shows that the use of contextual learning media that is relevant, engaging, and interactive has been proven to enable students in mathematics learning, thereby increasing their active participation and cognitive engagement.

Based on this description, the development of *Corner Clock learning media* is a strategic effort to improve the quality of mathematics learning in elementary schools, especially in angle measurement materials. Research on the development of manipulative media shows that the use of manipulative tools in geometry and measurement learning can significantly improve student learning outcomes, because these media help students access concepts that were previously abstract to become more concrete and easy to understand (Asmarani et al., 2025). In addition, learning media in the form of corner clocks has proven to be suitable for use and has the potential to improve elementary school mathematics learning outcomes (Permatasari et al., 2021).

A literature review also found that manipulative media in general is able to increase students' motivation, engagement, and understanding of geometry concepts, confirming the important role of concrete media in basic mathematics learning (Mailani et al., 2025). Furthermore, the development of interactive learning media shows that the use of well-designed media can support the improvement of students' spatial abilities, which plays an important role in understanding the relationship between space and form in geometry (Wahyuni et al., 2024). Therefore, this study focuses on the development of Corner Clock learning media to improve the angular measurement ability and spatial ability of SDN Kebayunan students.

RESEARCH METHODS

This research uses **a research and development (R&D) approach** with **the ADDIE model**. The procedure in this method is sometimes referred to as the R&D cycle, which includes the analysis of research findings related to the product to be developed, the manufacture of the product based on those findings, and revisions to correct the deficiencies found during the testing phase. This cycle continues in a more rigorous R&D program until test data shows that the product meets the specified behavioral goals (Slamet, 2022).

The location of this research is located at SDN Kebayunan which is located on Jalan Kebayunan-Leuwinanggung, Tapos Village, Tapos District, Depok City. The type of research used is research and development (R&D) with data obtained through tests, questionnaires, documentation, and interviews. The test is used by researchers to measure changes (improvements) in students' abilities quantitatively, both the angular measurement ability test and the students' spatial ability test. The questionnaire was used to find out the students' response after the trial to find out the practicality and attractiveness of the media. Documentation is used to collect supporting data that functions to strengthen research results related to the validity, practicality, and effectiveness of *Corner Clock learning media*

RESULTS AND DISCUSSION

The steps to use the Media *Corner Clock* are as follows: The teacher indicates a specific time (e.g., 9:00 a.m.), students turn the clock hand on the *Corner Clock* according to that time, students observe the formed angle and measure the magnitude of the angle (considering that

1 turn between the numbers is 30^0), and the student identifies the type of angle formed (e.g., 9:00 a.m. forms 90^0 or right angles).

The improvement in student learning outcomes can be seen from the comparison of pretest and posttest. The average pretest score of students is in the low category, which is 60.29. Meanwhile, the average posttest score has increased compared to the pretest score of 81.79. Comparison of pretest and posttest results showed a significant difference between students' abilities before and after the use of Corner Clock media. Based on the results of the learning implementation using Corner Clock media, students showed a positive response during the learning process. The positive response can be seen from the increased involvement of students in learning activities, especially when students are asked to manipulate the hands on the Corner Clock media to form a certain angle

CONCLUSION

From this study, it can be concluded that students can measure the size of the angle accurately and correctly by using *the Corner Clock media.* In addition, *Corner Clock media* is effective in improving the learning outcomes of grade 3 students in corner materials (evidenced by an increase in average grades and completion percentages). The increase in postest scores shows that learning with Corner Clock media has a positive impact on students' understanding of angle measurement.

Suggestions from the development of Corner clock learning media for teachers are recommended to use Corner Clock media as an alternative learning media to angle measurement materials. For schools, it is expected to support the use of innovative learning media such as Corner Clock by providing facilities and opportunities for teachers to develop and implement creative learning media in mathematics learning. For researchers, it is recommended to develop Corner Clock media on other mathematics materials or test it at different grade levels with a wider number of samples to obtain more comprehensive research results.

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