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Concept Attainment Model for Enhancing Conceptual Understanding in Seventh-Grade Students at Junior High School

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Abstract

This research aims to describe the implementation of the Concept Attainment Model in teaching conceptual understanding of quadrilaterals, specifically parallelograms and rectangles. This research uses a qualitative approach with the type of classroom action research. This study was conducted through two cycles of classroom action research. Each cycle consisted of planning, acting, observing, and reflecting stages. The research subjects were 22 students from grade VII. Data collection techniques included observation, concept understanding tests, and interviews. The research results showed that the test scores in cycle 1 and cycle 2 were 67.8 and 78.68, with an increase of 10.88, and the average percentage of students who met the Minimum Mastery Criteria in Cycle 2 was 77.27%. The teacher's success rate in conducting activities in cycle 1 and cycle 2 was 59.54% and 79.54%, respectively, indicating a 20% improvement. Meanwhile, the percentage of students' activity observation results in cycle 1 and cycle 2 was 59.58% and 78.75%, respectively, showing a 19.78% improvement.

Keywords: concept attainment model, conceptual understanding, parallelograms and rectangles

Introduction

In learning mathematics, the ability to understand concepts is necessary for students to solve mathematical problems and apply them in daily life (Utari & Gustiningsi, 2021). According to Bartell (in Radiusman, 2020), conceptual understanding is the most fundamental foundation in learning mathematics. Mastering concepts will ease students in solving mathematical problems.

Students face various challenges in learning mathematics. One of them is the assumption that mathematics is a difficult subject, leading to a reluctance to study it (Nursalam in Laily et al., 2019). This is in line with Purwitasari et al.'s research (2019) stating that mathematics is considered difficult to understand, boring, and contains complex concepts, causing students to neglect how to construct their understanding. Consequently, students become passive in learning, leading to decreased interaction intensity and a decline in understanding mathematical concepts.

The low understanding of students in mathematical concepts can be caused by several factors, such as the selection of teaching methods or strategies, students' passive attitudes during learning, and insufficient ways of understanding mathematical concepts (Amintoko, 2020). In general, Lynch and Waters (in Putri, 2017) suggest that one of the causes of low concept understanding among students is their failure to engage in comprehension during the learning process. Instead, they tend to memorize without forming an understanding of the material they are learning. Students may not learn mathematics based on core concepts, and teachers may not provide adequate explanations of the topics taught. However, conceptual understanding is a fundamental skill that students must possess to solve mathematical problems and apply them in everyday life.

The challenges faced during learning can be minimized by providing constructive conceptual understanding to students, allowing them to grasp the essence, meaning, and application of

mathematics as a whole. According to Arikunto (in Siahaan & Sihotang, 2023), understanding can be defined as students' abilities to infer, differentiate, expand, conclude, provide examples, and rephrase a concept. Meanwhile, a concept is an individual or group's linear thinking that includes principles, theories, and laws used as references to explain and predict (Sagala, 2010). Therefore, improving mathematical conceptual understanding is necessary through the learning process. One alternative to enhance conceptual understanding in mathematics is by implementing changes and improvements in the planning and execution of teaching.

The students' ability to understand concepts can be maximized if they are actively, intuitively, and applicative engaged in learning activities. Enthusiasm arises when teachers provide students with opportunities to discover, formulate, and conclude the concepts of a subject (Andriliani, et al., 2022). This can be achieved when teachers select teaching models that suit the students' needs and conditions. One such model that can be used is the Concept Attainment Model.

According to Joyce, Weil, and Calhoun (in Yensy, 2020), teaching with the Concept Attainment Model students in discovering concepts through three stages. The first stage involves presenting examples and non-examples to students. In the second stage, students accurately identify related examples and non-examples, and then add examples they provide. Finally, in the third stage, students analyse the ideas obtained in the previous stages and conclude them into a concept.

The three stages for achieving conceptual understanding through the Concept Attainment Model are supported by research conducted by Winarti et al. (2022) which states that the use of the Concept Attainment Model significantly influences the conceptual understanding of fourth-grade students, with an average score increase from 46.4 to 70. This finding is further supported by the research conducted by Mustika & Sutriana (2018) on two eighth-grade classes (VIII-1 and VIII-2), dividing them into a control group and an experimental group using the Concept Attainment Model. The results showed a difference in the average scores of the two sample groups, with the experimental group scoring higher in the understanding test for the topics of rectangular prisms and cubes, with an average score of 80.35. Thus, it can be concluded that the implementation of the Concept Attainment Model has a positive impact on students' conceptual understanding.

The initial observation at MTs Al-Hidayah Karangploso indicated that students lacked the ability to express and present mathematical concepts in various ways and understand their differences. This was because students tended to memorize formulas without knowing their application to problems and the basic concepts behind those formulas. Additionally, the classroom observation revealed that students were not actively engaged in the learning process, leading to weak conceptual construction. Students also hesitated to express opinions and lacked collaboration in group work. Moreover, their conceptual understanding was inadequate in terms of stating definitions, examples, and properties in easily understandable language related to the material being taught.

Based on the challenges and issues identified at MTs Al-Hidayah Karangploso, Malang, it can be concluded that students' conceptual understanding is still relatively low. Therefore, this research was conducted with the aim of describing the implementation of the Concept Attainment Model to improve students' conceptual understanding and determine the categories of students' conceptual understanding at MTs Al-Hidayah Karangploso, specifically in the topics of parallelograms and rectangles.

Materials and Method

This research uses a qualitative approach with the type of research used, namely Classroom Action Research. Classroom action research is carried out in an effort to improve the learning process in the classroom by teachers based on the results of reflection on the actions given. This classroom action research was conducted at MTs Al-Hidayah, Donowarih, Malang. The subjects of this research were 22 students from class VII B MTs Al-Hidayah. The research followed Kemmis and Mc Taggart's model, which consists of interconnected components: plan, act and observe, reflect, and revised plan.

Data analysis was performed through data reduction, data presentation, and drawing conclusions. Data were obtained from teacher observation sheets, student observation sheets, interview sheets, and final tests of cycle. The average student score is determined using the following formula.

$$\bar{x} = \frac{\sum x}{N}$$

The average score percentage is determined using the following formula.

$$AS = \frac{\sum score}{\sum maximum\ score} \times 100\%$$

The success criteria can be seen in Table 1.

Table 1. Success Criteria

Success Percentage	Level of Success
$80\% < AS \leq 100\%$	Very Good
$60\% < AS \leq 80\%$	Good
$40\% < AS \leq 60\%$	Passable
$20\% < AS \leq 40\%$	Scant
$0\% < AS \leq 20\%$	Very Less

The classroom action research would be repeated if it did not meet the following criteria: 1) teacher and student observation results are ≥ 75%, 2) minimum passing grade score (75) is ≥ 70% of the total number of students; and 3) average student response is ≥ 50%.

Results and Discussion

The research was conducted in 2 cycles as it already met the predetermined success criteria. The learning process was carried out in four stages: planning, acting, observing, and reflecting. The application of the Concept Attainment Model was carried out in three stages. The first stage involved presenting data and identifying concepts, where the students were given a shape to find concepts and visible properties. The students then compared the shape with information from other sources and discussed it within their groups to construct the concepts discovered. In Cycle 1, the students faced difficulties in stating properties and defining shapes based on concepts.

The second stage involved testing the achievement of concepts based on the analysed properties of shapes. The students determined formulas to find the area and perimeter of rectangles and applied these formulas to solve problems. Before applying the formulas to the problems, the students wrote down the concepts and their applications based on their understanding. The students' work in applying the discovered concepts can be seen in the following figure:

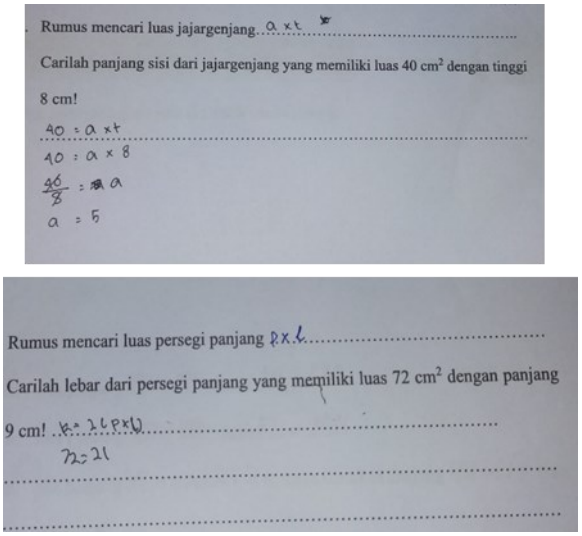

Figure 1. Results of Student Answers

The third stage is the analysis of thinking strategies, where the students present the concepts again by summarizing their understanding of the material learned. Based on the research results in Cycle 1, the students were not able to provide complete and accurate conclusions. However, in Cycle 2, there was an improvement in students' activity in expressing opinions and presenting more accurate conclusions. The results of the teacher activity observation, student activity observation, and post-test are presented as follows.

Cycle 1

Observation for teacher activities in Cycle 1 was conducted by Observer 1 (subject teacher) and Observer 2 (a peer student). The results of the teacher activity observation are presented in Table 2, and the results of the student activity observation are presented in Table 2 as follows:

Table 2. Results of Observation of Teacher Activity Cycle I

Teacher Activity	Maximum Score	Observer 1 Score	Observer 2 Score
Beginning	15	10	11
Core	85	47	49
End	10	6	8
Percentage	100%	57,27%	61,82%
Level of Success	Very good	Good	Good

Table 3. Results of Observation of Student Activity Cycle I

Teacher Activity	Maximum Score	Observer 1 Score	Observer 2 Score
Beginning	15	9	7
Core	90	56	53
End	15	9	9
Percentage	100%	61,66%	57,5%
Level of Success	Very good	Good	Good

The results of final tests of Cycle 1 is given to 22 students in grade VII-G in the form of five essay questions can be seen in the following Table 4 as follows:

Table 4. Results of Final Tests of Cycle 1

Total number of students	22
Highest score	83
Lowest score	38
Average score: 67.8	67,8
Number of students who passed	13
Percentage of passing students	59,1%

Based on Table 4, it is known that after the implementation of the action, 13 out of 22 students passed the test, resulting in a passing percentage of 59,1%. Since the set criteria for passing is more than 70%, it can be concluded that the students have not met the established criteria. Therefore, the action in Cycle 1 is considered incomplete and will be continued in Cycle 2.

Cycle 2

Observation for teacher activities in Cycle 2 was conducted by Observer I (subject teacher) and Observer 2 (a peer student). The results of the teacher activity observation can be seen in Table 5 and the results of the student activity observation can be seen in Table 6 as follows.

Table 5. Results of Observation of Teacher Activity Cycle 2

Teacher Activity	Maximum Score	Observer 1 Score	Observer 2 Score
Beginning	15	12	14
Core	85	65	68
End	10	8	7
Percentage	100%	77,27%	81,81%
Level of Success	Very good	Good	Good

Tabel 6. Results of Observation of Student Activity Cycle 2

Teacher Activity	Maximum Score	Observer 1 Score	Observer 2 Score
Beginning	15	12	13
Core	90	72	69
End	15	12	11
Percentage	100%	80%	77,5%
Level of Success	Very good	Good	Good

The results of final tests of Cycle 2 is given to 22 students in grade VII-G in the form of five essay questions can be seen in the following Table 7 as follows.

Table 7. Results of Final Tests of Cycle 2

Total number of students	22
Highest score	94
Lowest score	52
Average score: 67.8	78,68
Number of students who passed	17
Percentage of passing students	77,27%

Based on Table 7, it is known that 17 out of 22 students passed the post-test of Cycle 2, resulting in a passing percentage of 77,27%. According to the established success criteria, if the percentage of student scores is ≥ 70%, then Cycle 2 is considered successful accomplished.

A comparison is conducted to facilitate the understanding of the research results, which are presented in the form of bar graphs and line graphs for the data of teacher activity observation, student activity observation, and end-of-cycle test. Here is the breakdown of each data in Cycle 1 and Cycle 2.

a) Presentation of teacher activity observation data:

Observation data on teacher activity obtained in Cycle 1 and Cycle 2 are presented in Figure 2 below.

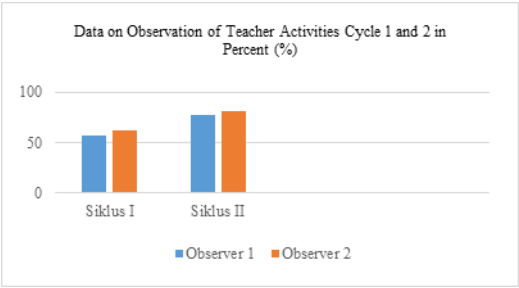

Figure 2. Bar Diagram of Teacher Activities Observation Data

In Cycle 1 and Cycle 2, there was an improvement in teacher activity in implement-

ing the Concept Attainment Model. The observation conducted by Observer I showed an increase in the percentage of teacher activity from 57,27% to 77,27%. Meanwhile, the observation by Observer 2 showed an increase from 61,82% to 81,81%. Based on the data obtained, it can be concluded that teacher activity improved by 20,01% and met the success criteria for action, which is a percentage ≥ 75%.

b) Presentation of student activity observation data:

Observation data on student activity obtained in Cycle 1 and Cycle 2 are presented in Figure 3 below.

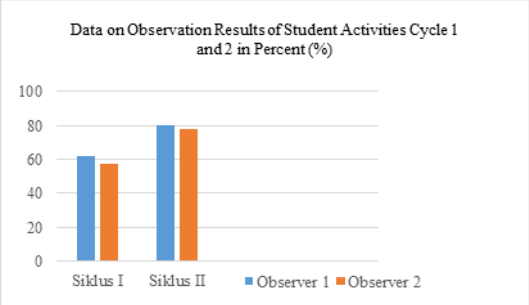

Figure 3. Bar Diagram of Student Activities Observation Data

In Cycle 1 and Cycle 2, there was an improvement in student activity during the learning process observed. Based on the observation by Observer I, there was an increase in the percentage of student activity from 61,66% to 80%. On the other hand, based on the observation by Observer 2, there was an increase from 57,5% to 77,5%. From the data obtained, it can be concluded that student activity improved by 20% and met the success criteria for action, which is a percentage ≥ 75%.

c) Presentation of final tests of cycle:

The data based on the posttest results of cycle for students can be seen in Figure 4 below.

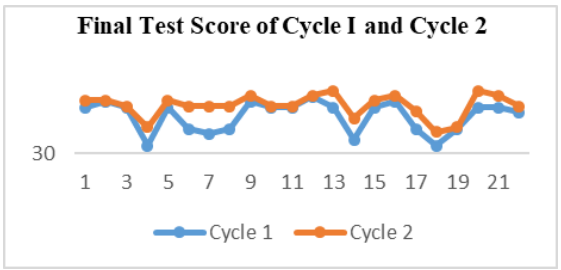

Figure 4. Line Graph of Final Test Cycle Scores

From Figure 4, it can be seen that the highest score in Cycle 1 was 88 and in Cycle 2, it was 94. In Cycle 1, 13 students achieved the Minimum Mastery Criteria (MMC), which is a minimum score of 75. In Cycle 2, this number increased to 17 students who met the MMC. Thus, the number of students meeting the MMC increased from Cycle 1 to Cycle 2.

Mathematics is a crucial subject in education at school, as it provides the foundation for students to understand information. A strong conceptual understanding, particularly in mathematics, is essential for students to excel in their studies (Patni et al., 2019). Low conceptual understanding can lead to misconceptions and requires special attention in the problem-solving process (Walida & Hasana, 2020).

The implementation of the Concept Attainment Model by the teacher resulted in positive outcomes, as seen in the students' engagement while working on the student worksheet. The use of student worksheet in the learning process sparked students' curiosity and led to more questions. In Cycle 1, less than half of the students responded and asked questions, but there was an improvement in Cycle 2. The increased engagement of students provided a deeper understanding of the presented concepts, resulting in better learning outcomes, indicating the significant role of student worksheet in the learning process (Razi et al., 2022).

Student responses to the Concept Attainment Model also improved from Cycle 1 to Cycle 2. Students expressed enjoyment and were more active during the learning process, particularly when focusing on basic concepts. This supports the notion that active learning strategies are more effective than conventional models (Utarni & Mulyatna, 2020). Furthermore, active learning strategies can motivate students to engage more effectively in learning mathematics (Fuqoha, 2018).

Learning took place through group work and discussions, and this process improved significantly in Cycle 2, following the reflection from Cycle 1. Group discussions allow students to actively participate and articulate their thoughts systematically in front of their peers (Herman, 2005). Group discussions also encourage students to collaborate in problem-solving, leading to deeper learning (Wayesa, 2020).

According to Anisensia, dkk. (2020), students' level of understanding can be known from the test results at the end of each cycle. Based on the results of the final tests of cycle, the students' conceptual understanding of mathematics improved after the implementation of the Concept Attainment Model. This finding is consistent with the results of previous research, which showed that applying the Concept Attainment Model improved the percentage of students' conceptual understanding from satisfactory in Cycle 1 to good in Cycle 2 and increased to excellent in Cycle 3 (Agustin & Yuliastuti, 2019). Similar improvements in students' test scores through the application of the Concept Attainment Model were also reported in other studies (Razi, 2022; Mulyani, 2022). The results of research conducted by Mulyani (2022) strengthen the results of this research because by applying the Concept Attainment Model (CAM) using fun book educational game tools, it can increase students' understanding.

Overall, the implementation of the Concept Attainment Model in mathematics classes contributed to better student engagement, improved conceptual understanding, and positive learning outcomes. The model proved to be an effective teaching approach for enhancing students' learning experiences and achievements in mathematics education.

Conclusion

The implementation of the Concept Attainment Model in the teaching process has proven effective in enhancing students' conceptual understanding. This improvement is evident in the achievement of success criteria observed in teacher and student activities, as well as the results of the end-of-cycle test. Learning through the Concept Attainment Model provides students with opportunities to enhance their problem-solving skills and knowledge, leading to long-lasting learning experiences and understanding.

Suggestion

The successful implementation of the Concept Attainment Model requires effective time management and classroom management. Therefore, careful planning of learning activities is necessary to utilize time more efficiently. Additionally, providing stimulating questions that encourage students to apply basic concepts in problem-solving would be beneficial.

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