



Improving Mathematical Concept Understanding Ability of Junior High School Students with Conceptual Understanding Procedures Learning Model

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ABSTRACT

Keywords:

Conceptual Understanding Procedures (CUPs); Learning Model; Mathematical Concept Understanding Ability.

Understanding concept material is the basic material for someone to solve problems. The importance of understanding concepts because it is useful in learning, thinking, reading and communicating. This study was conducted to analyze the improvement of mathematical concept understanding ability of experimental class students after using the CUPs learning model. This research was conducted in class VIII Junior high school with 30 experimental class students as research subjects. This research design uses one group ptest-posttest design. Data collection techniques used include observation, interviews and tests. Initial data analysis used normality test, homogeneity test, and mean similarity test. Meanwhile, the final data analysis used Paired Sample T-test and N-gain test. The results showed that the mathematical concept understanding ability of experimental class students increased after using the CUPs learning model with an average N-gain value of 0.63 in the moderate category. Based on the results of the study, it can be concluded that the CUPs learning model is able to provide an increase in students' mathematical concept understanding ability.



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A. INTRODUCTION

Wahyudi in Rahayuni dkk. (2020) said that education is guidance conveyed by educators to students to achieve goals in order to complete the tasks given without expecting the help of others. Mathematics is needed in everyday life to explain the actual situation so that problems can be solved. A successful learning process is when students can understand the subject matter delivered by the teacher and get the expected learning outcomes. One of the efforts to improve the quality of education in schools is to improve the learning process. Various new concepts and insights about the learning process have emerged and developed along with the rapid development of science and technology. Teachers who play a strategic position in the development of human resources are required to keep abreast of the development of new insights in the world of teaching.

NCTM in Mayasari & Habeahan (2021) stated that understanding concept material is the basic material for someone to solve problems. Depdiknas in Yulianty (2019) stated that understanding concept is one of the mathematical skills or skills that are expected to be achieved in learning mathematics, namely by showing understanding of the mathematical concepts they learn, explaining the relationship between concepts and applying concepts or algorithms flexibly,

accurately, efficiently, and precisely in problem solving. Nasution in Haris (2019) suggests the importance of understanding concepts because it is useful in learning, thinking, reading and communicating. The ability to understand mathematical concepts is a very important ability in learning mathematics because one's mastery of many concepts gives influence in better problem solving. Problems solving requires rules which are based on concepts (Haris, 2019). With this concept understanding, students not only know, know and memorize material, but students will be able to re-express the concepts that have been learned in a form that is easier to understand and be able to apply them. Sunnardi in Farida & Renaldo (2021) stated that after understanding, students are able to explain the relationship between concepts, apply concepts, and solve problems. Understanding of mathematical concepts has a positive influence on problem solving. Hartati in Farida & Renaldo (2021) said that the higher the student's ability to understand mathematical concepts, the student will better to understand, solve, and describe the solution to the given problem. Boaler in Mills (2019) states that conceptual understanding is more than just knowing separate facts and strategies. Students must understand the relationships between mathematical ideas and have the ability to transfer their knowledge into new situations and apply it to new contexts. The emphasis on conceptual understanding has demanded a change in teaching style for many teachers, with a shift from more traditional models that focus on students' proficiencies in reproducing existing solution methods and strategies, to models that encourage students to construct meaningful mathematical concepts for themselves.

Conceptual understanding will lead students to learn math actively and build on previous knowledge and experience (Kusumadewi dkk., 2020). The characteristics of understanding mathematical concepts according to Kartika in Yanti dkk. (2019) can be formulated through learning strategies, the application of simple calculations, the use of symbols to present concepts, and converting one form to another such as fractions in learning mathematical concepts. Therefore, the characteristic of understanding mathematical concepts is that there are mathematical concepts because of an idea that is widely accepted in the study of educational science where students must understand the sciences that cover the learning domain they are teaching.

Researchers made observations by giving tests to determine the level of students' mathematical concept understanding abilities on December 14, 2022 at Junior high school. The initial test was given to 30 students in class VIII. Based on the data obtained, in question number 1 with an indicator of restating a concept, it is known that as many as 15 (50%) students are able to restate the concept of multiplication. A total of 13 (43%) students were less precise in restating the concept of multiplication and the remaining 2 (7%) students were still unable. In question number 2 with the indicator of classifying objects, it is known that as many as 1 (3%) student is able to classify objects based on the properties of multiplication. A total of 4 (13%) students were less precise in classifying objects based on the properties of multiplication and the remaining 25 (84%) students were still unable. In question number 3 with the indicator of applying concepts, it is known that as many as 3 (10%) students are able to apply the concept of multiplication and the remaining 27 (90%) students are still unable to apply the concept of multiplication.

In question number 4 with the indicator of giving examples and non-examples according to the concept, it is known that as many as 8 (27%) students are less precise in giving examples and non-examples according to the concept of multiplication and the remaining 22 (73%) students are still unable to give examples and non-examples according to the concept of multiplication. In question number 5 with the indicator of presenting concepts in various representations, it is known that as many as 1 (3%) student is less precise in presenting the concept of multiplication

in various representations and the remaining 29 (97%) students are still unable. In question number 6 with the indicator of linking various mathematical concepts, it is known that as many as 1 (3%) student is able to link the concept of flat area with multiplication. A total of 3 (10%) students were less precise in linking the concept of flat area with multiplication and the remaining 26 (87%) students were still unable.

Based on the results of interviews conducted by researchers with one of the mathematics teachers of Junior high school, information was obtained that there are still many students who do not understand the concept, this is indicated by students who can only do problems that are similar to the examples given by the teacher. However, when the teacher gives different types of problems, students will find it difficult to solve them. The results of research by Suraji, Maimunah, and Saragih in Utami dkk. (2020) which show that students' understanding of mathematical concepts is still low, especially in applying everyday life also support that students' mathematical concept understanding abilities are still low. During learning, students are encouraged to be active but there are still students who are less active in class so that sometimes the teacher dominates learning. Mettes in Fuadi dkk. (2016) stated that the unsatisfactory way and results of students' mathematics learning were due to students learning mathematics only copying and recording problem solving from the teacher, while according to Slettenhaar in Fuadi dkk. (2016) mathematics learning that does not involve active learning students results in a lack of emphasis on student understanding because students only receive teacher explanations. The learning model is one of the things that can be applied to improve the quality of education. The same learning method that is routinely done almost every day and there is no variation will be able to bring up boredom in students and can further damage students' interest in learning. If this continues, the basic competencies and learning indicators will not be achieved.

One of the learning models that can be used is the Conceptual Understanding Procedures (CUPs) model. The CUPs model is a learning model that invites students to conclude the material they have learned themselves. Gunstone in Multazam (2020) states that CUPs is a learning model consisting of a series of learning activities that aim to help improve students' concept understanding. According to Gunstone in Safitri (2020) the CUPs model is composed of stages in learning activities and aims to support understanding of concepts that are considered difficult by students. CUPs has three phases, namely the individual work phase, group work phase and group results presentation phase (Haris, 2019). In the first phase, students are individually confronted with mathematical problems and observe the problems before discussing with their groupmates, so that students will be stimulated to build their own knowledge first. In the second phase, students are grouped according to triplet groups to practice expressing their respective opinions from the observations of the previous phase and discussing the problems given. The third phase, class discussion by means of each group presenting the results of the discussion, after listening to the results of each group's problems that expand students' knowledge of the given problem, students are assisted by the teacher to draw conclusions together. From these three phases, students get the opportunity to develop their mathematical concept understanding skills because the stages/phases of the CUPs model can teach students to get used to building their understanding and solving problems independently. That way, students' concept understanding skills will be trained.

The conceptual understanding procedures (CUPs) learning model is one of the learning models that is considered effective, because in the implementation of learning by using the CUPs learning model students are divided into small groups of three people (triplets) formed heterogeneously, taking into account the ability of students and discussion materials given to

students. According to Gita et al in Harahap & Lubis (2022) the teacher acts more as a facilitator, helping to activate these students in the formation of knowledge. The advantages of the Conceptual Understanding Procedures (CUPs) learning model according to Pasaribu in Pertiwi, (2017), including: (1) students better understand the concepts taught because they themselves try to find the concept; (2) knowledge is embedded based on the schemes that students have gone through so that learning is more meaningful; and (3) students can feel the benefits of learning because the problems solved are related to real life. This research was conducted to analyze the improvement of students' mathematical concept understanding ability after using the Conceptual Understanding Procedures learning model.

B. METHODS

This research uses quantitative research quasi-experimental method. The design used in this research is the one group pretest-posttest design. In this design the groups were randomly selected. Before the research was conducted, both groups were given a pretest or initial test to find out the initial situation. During the research, the experimental group was treated with the Conceptual Understanding Procedures (CUPs) model. Furthermore, at the end of the study, the experimental class was given a posttest or final test to see how the results were. Population is a generalization area consisting of objects or subjects that have certain qualities and characteristics that are applied by researchers to study and then draw conclusions (Sugiyono, 2019). The population in this study were VIII grade students at Junior high school, Kota District, Kudus Regency, Central Java. With a total of 265 students. The sample is part of the number and characteristics possessed by the population (Sugiyono, 2019). Sampling is done by simple random sampling. In simple random sampling, the population is considered homogeneous, so the sample can be taken randomly. The sample in this study was 30 students of class VIII-C as the experimental class. The data analysis technique used is the Paired Sample T-test to determine the difference in students' concept understanding ability before and after using the Conceptual Understanding Procedures learning model and the N-Gain test to determine the improvement in students' concept understanding ability after using the Conceptual Understanding Procedures learning model.

C. RESULT AND DISCUSSION

1. Normality Test

The normality test using the Kolmogorov-Smirnov test with SPSS program obtained the following results, as shown in Table 1.

Table 1. Tests of Normality

| No | Data | Sig |
|----|-----------|-------|
| 1 | Pre-test | 0.060 |
| 2 | Post-test | 0.144 |

Based on the table above, it can be seen that the significance level of the pre-test data is $0.060 > 0,05$ so it can be concluded that H_0 is accepted, which means that the experimental class pre-test data is normally distributed. Furthermore, the significance level of the post-test data is $0.144 > 0.05$ so it can be concluded that H_0 is accepted, which means that the experimental class post-test data is normally distributed.

2. Homogeneity Test

Homogeneity test using homogeneous test of two variances with SPSS program obtained the following results, as shown in Table 2.

Table 2. Tests of Homogeneity

| No | Data | Sig |
|----|------------------------|-------|
| 1 | Pre-test* Post-test | 0.071 |

Based on the table above, it can be seen that the significance level of the pre-test and post-test data is $0.071 > 0.05$ so it can be concluded that H_0 is accepted which means that the experimental and control class post-test data is homogeneous.

3. Paired Sample T-test

Paired Sample T-test test with SPSS program to determine whether there are experimental class students before and after using the CUPs model. The following are the results of the tests that have been carried out, as shown in Table 3.

Table 3. Tests of Homogeneity

| No | Data | Sig |
|----|------------------------|-------|
| 1 | Pre-test* Post-test | 0,010 |

Based on the table above, it can be seen that the significance level is $0.010 < 0.05$ so it can be concluded that H_0 is rejected and H_1 is accepted, which means that students' concept understanding ability after using the CUPs model is higher than before. It can be concluded that the students' concept understanding ability in the experimental class is higher after being given the CUPs learning model in other words the CUPs learning model has an influence on students' concept understanding ability.

4. N-Gain Test

N-gain test with Microsoft Excel program to determine whether there is an increase in the ability to understand the mathematical concepts of experimental class students after using the CUPs learning model, as shown in Table 4.

Table 4. Tests of N-Gain

| No | N-Gain Skor | Interpretation | Number of Students | Percentage (%) |
|----|------------------------------|----------------|--------------------|----------------|
| 1 | $-1,00 \leq N - Gain < 0,00$ | Decrease | 0 | 0 |
| 2 | $N - Gain = 0,00$ | Fixed | 0 | 0 |
| 3 | $0,00 \leq N - Gain < 0,30$ | Low | 2 | 6,67 |
| 4 | $0,30 \leq N - Gain < 0,70$ | Medium | 16 | 53,33 |
| 5 | $0,70 \leq N - Gain < 1,00$ | High | 12 | 40 |

Based on the table, it is shown that none of the students experienced a decrease in grades, none of the students whose grades remained fixed, there were 2 students with a percentage of 6.67% experienced an increase in the low category, 16 students with a percentage of 53.33% experienced an increase in the medium category and 12 students with a percentage of 40%

experienced an increase in the high category. This means that there is an increase in students' mathematical concept understanding ability after applying the CUPs learning model.

The increase in students' mathematical concept understanding ability is influenced by learning with the CUPs model which has a positive impact on students' concept understanding because the teacher provides opportunities for students to construct their own understanding first, then exchange ideas and consider existing answers to choose the most appropriate answer. In line with research conducted by Kriswinarso et al. (2023) with the results of research showing that students' mathematical concept understanding abilities after using the Conceptual Understanding Procedures (CUPs) learning model are better than before. Another opinion Fahrudin et al. (2018) stated that students' mathematical concept understanding ability after using the right learning model is better than before. Thus, the Conceptual Understanding Procedures (CUPs) learning model is one of the effective learning models to improve students' mathematical concept understanding skills. With this model, students are more active and have a good understanding of mathematical concepts so that students are able to solve the given mathematical problems. The results of this study are supported by the research of Jehadus et al. (2020) which shows that the mathematical understanding ability of students who used the CUPs learning model is better than the mathematical concept understanding ability of students who used the direct learning model. This can be proven by previous research conducted by Saadah et al., (2021) that the CUPs learning model is able to influence students' mathematical concept understanding ability. This research is in line with research conducted by Sari et al. (2022) that the ability to understand the mathematical concepts of students who use the Conceptual Understanding Procedures (CUPs) learning model is better than the ability to understand the mathematical concepts of students who use the expository learning model. In addition, according to Putri et al. (2020), the Conceptual Understanding Procedures learning model is better than the conventional learning model because the CUPs model has the advantage of providing opportunities for students to build their own knowledge before discussing with their groupmates.

In this study, the ability to understand mathematical concepts was analyzed through the results of the pre-test and post-test. Each question includes indicators of the ability to understand mathematical concepts used in the study, namely; (1) Restate a concept; (2) Classify objects according to certain properties/characteristics and concepts that are owned appropriately; (3) Apply concepts; (4) Provide examples and not examples; (5) Present concepts in various representations; and (6) Relate various mathematical concepts to everyday problems. The average pre-test result was 46.40 while the average post-test result was 80.13. In another study conducted by Ardianti et al. (2019) showed that students' mathematical concept understanding ability increased after using the right learning model. One of the right learning models is the Conceptual Understanding Procedures (CUPs) learning model. With this model, students are more active and have a good understanding of mathematical concepts so that students are able to solve the given math problems. This can be proven from research conducted by Putri et al. (2020) that the model can be an alternative to improve students' mathematical concept understanding ability because the CUPs model encourages students to find their own concepts. Another opinion from Salsabila (2019) states that the CUPs model is a learning model designed to help students' concept understanding abilities, because in the CUPs learning model students are assigned to read, observe, experiment or ask questions so that they are able to construct concept understanding individually. Arfiani et al., (2020) states that teacher should be more optimal in class management using learning models so that learning can fulfill what is wanted to be achieved. The use of the right learning model affects the ability to understand mathematical concepts because in the

learning process students are active and do not feel bored. In addition, student-centered learning by trying to find concepts using their own way so that students more easily remember the concepts that have been learned. It can be concluded that the Conceptual Understanding Procedures (CUPs) learning model is proven to improve students' mathematical concept understanding ability.

D. CONCLUSION AND SUGGESTIONS

Based on the results of research that has been carried out on "Improving Mathematical Concept Understanding Ability of Junior High School Students with Conceptual Understanding Procedures (CUPs) Learning Model" in VIII class of Junior high school, it can be concluded that: (1) there is a difference in the ability to understand mathematical concepts before and after using the Conceptual Understanding Procedures (CUPs) learning model with a significance value of $0.010 < 0.05$ so that H_0 is rejected and H_1 is accepted; and (2) an increase in the ability to understand mathematical concepts of 0.63 with a moderate category after using the Conceptual Understanding Procedures (CUPs) learning model.

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