The Influence of Concept Attainment Models on Students’ Conceptual Understanding

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Abstract. The purpose of this study was to determine the effect of applying the Concept Attainment model on students' conceptual understanding. The type of research used is quasi-experimental design with Pretest-Posttest Control Group using saturated sampling technique and obtained by class XI IPA2 as an experimental class and class XI IPA1 as a control class. The instrument used to collect data in this study is using multiple-choice tests with a reasonable number of 14 questions. Hypothesis testing is done by t-test statistic technique to test the mean difference of students' concept comprehension scores with significance (α = 0.05) with testing criteria if \( t_{\text{count}} < t_{\text{table}} \) then \( H_0 \) is accepted, and if \( t_{\text{count}} \geq t_{\text{table}} \) \( H_0 \) is rejected. Based on the results of the conceptual understanding hypothesis test of the control class and experimental class, it appears that \( t_{\text{count}} > t_{\text{table}} \), namely 14.71> 2.015 so that the null hypothesis \( (H_0) \) is rejected and the alternative hypothesis \( (H_1) \) is accepted. With the acceptance of \( H_1 \) in testing the hypothesis, it can be concluded that this study can test the validity of the hypothesis that there is a significant effect of using the Concept Attainment model on the understanding of the concept of class XI students on the fluid material.

1. Introduction

Education is an effort that is systematic, planned, and sustainable, of course, seeks to optimally achieve educational goals both from the most concrete level as the goal of the short-term learning process and at the most abstract and general level.[1]

The purpose of physics is how students can understand the principles and concepts of physics, and students are expected to be able to have knowledge skills and an attitude of confidence. We must know the purpose of physics learning because mastery of concepts is an important goal in learning physics. Understanding of concepts can be interpreted as the ability of students to understand and understand a concept and interpret a material well. Understanding of concepts is included in one of the aspects of learning outcomes that are measured, namely aspects of understanding, we can conclude that the lack of understanding of the concepts of students can influence the learning outcomes.[2]

The formation of understanding concepts can help educators connect and transfer knowledge in a deeply organized way. [3] Understanding concepts are the ability to understand meaning such as being able to express material that is presented into a more understood form, able to interpret,
and able to apply it. Understanding the concept is very necessary for students who have experienced the learning process. [4] Learning activities carried out in schools should be made fun so that students can learn well so that optimal learning outcomes are obtained. Learning activities involving students will make students better understand the learning material delivered by educators so that the learning experience applied to students must be student-centered (student-centered).[5]

Likewise with the process of learning science must be oriented to students, where students no longer play a passive role just learning by listening to and recording explanations from educators only, but emphasizing on direct learning experience independently. The role of educators is no longer a source of learning but as a facilitator, directing students to carry out the learning process through a series of concrete activities that build students' knowledge. [6]

In the process of implementing physics learning research at SMAN 1 Adiluwih, it still has not achieved maximum results, especially in class XI students. This is alleged because students have difficulty understanding the concepts of physics. The difficulty to understand the physics concepts experienced by students is not only because of the material presented, but students are less involved in the teaching and learning process. Although educators have tried as much as possible to design teaching and learning activities in various ways so that students can be active, it turns out that only a few students can be active, while others are only passive to take lessons and receive material delivered by educators.

From the above events, of course, this can lead to not achieving a goal of the teaching and learning process. And if the goal of the teaching and learning process is not achieved, it will lead to a lack of understanding of the concept of the students. With a lack of understanding of concepts in students will lead to low learning outcomes of students.

Thus, increasing the understanding of the concepts of students in physics learning is, of course, much that must be considered, one of which is in determining the learning model. Therefore, researchers chose the Concept Attainment model as the chosen model to be able to help improve students' understanding of concepts. This model is intended to teach certain concepts by comparing examples containing concepts and those that do not contain concepts.[7] Previous research conducted by Amit Kumar stated that the Concept Attainment Model was superior and effective in terms of understanding students' physics concepts compared to Traditional Methods.[8]

Concept Attainment learning model is a process to look for traits and traits that can be used to distinguish between the right and inappropriate examples of the material being studied. This model is a model used to provide new ideas in the teaching and learning process. The application of the Concept Attainment model can be used as a way to get concepts that will and are being studied through questions presented by educators when the teaching and learning process is in progress. [9] Joyce and Weil (2009) suggest that CAM consists of 3 phases, namely: presentation of data and identification of concepts, testing of concept achievement, and analysis of thinking strategies.[10] The expectation of this model is how the teaching and learning goals can work well.

Based on the description above, the purpose of this research was to determine the effect of the Concept Attainment Model on Class XI students' understanding of the fluid material.

2. Research and Methods
The population in this study were all students of class XI Science at SMA Negeri 1 Adiluwih Pringsewu in the odd semester of 2018/2019 Academic Year consisting of two classes totaling 46 students. The sampling technique in this study uses Saturated Sampling techniques. And the two classes were sampled in this study with class XI IPA1 as the control class using Discovery Learning learning model and XI IPA2 as an experimental class using Concept Attainment learning
model. This study includes a quasi-experimental study. The instrument test includes a validity test, reliability test, difficulty level test, different power test, and deception effect test. While the test data analysis techniques in the form of normality test, homogeneous test, N-Gain test, hypothesis testing that is t-test and N-Gain test.

The instrument used to measure concept understanding is using a test that is in the form of a Two-Tier Multiple Choice, this assessment is done twice, at the time of the pretest (before applying the Concept Attainment model) and posttest (After the Concept Attainment model is applied).

A two-tier Multiple Choice is a form of multiple choice questions that have two levels. The first level is multiple choice and the second level is the reason for the answer at the first level. The following are the criteria for answers to students conceptual understanding, on the Two-Tier Multiple Choice.[11]

| Table 1. Possible Patterns of Student Answers and Their Categories Using Two-Tier Multiple Choice [12] |
|--------------------------------------------------|-----------------|-----------------|
| The pattern of Student Answers                   | Understanding Level Category | Score |
| Correct Answer - Correct Reason                  | Understanding (M)                       | 3     |
| Correct Answer - the Wrong reason                | Misconception (Mi-1)                   | 2     |
| Correct Answer - Reasons not filled               | Understanding Some (MS-1)               | 2     |
| Wrong Answer - the Right Reason                   | Misconception (Mi-2)                   | 1     |
| Wrong Answer - the Wrong reason                   | Don't understand (TM-1)                | 0     |
| Wrong Answer - Reason not filled                   | Don't understand (TM-2)                | 0     |
| Not answering core tests and reasons              | Don't understand (TM-3)                | 0     |

3. Results and Discussion

Table 2 below is the data of the average score of the students' pretest both the pretest and the control class experimental values, namely:

| Table 2. Results of Pretest Value Data Understanding the Concept of Control Classes and Experiment Class |
|--------------------------------------------------|-----------------|-----------------|
| Class                                            | Average value   |
| Control                                          | 37,70           |
| Experiment                                       | 37,50           |

We can see from the data table above, that the average value of the experimental class pretest (XI IPA₂) is 37.50 and the control class (XI IPA₁) is 37.70. We can conclude that the experimental class is of lower value if we compare it with the value of the control class.
Table 3. Posttest Result Data Understanding the Concept of Control Classes and Experiment Class

| Class   | Average value |
|---------|---------------|
| Control | 51.87         |
| Experiment | 78.63       |

The results of the data in the table above show that the average posttest value of the experimental class (XI IPA\(^2\)) is 78.63 and the control class (XI IPA\(^1\)) is 51.87. We can conclude that the experimental class is of greater value if we compare it with the value of the control class.

**N-Gain test**

If we want to analyze the categories of a conceptual understanding test then use normalized N-gain values, these values can be obtained from the posttest value minus the pretest value then divided by the maximum value minus the pretest value. The following is the data from the N-Gain calculation:

Table 4. Data on N-gain Results Understanding the Concept of Control Classes and Experiment Class

| Class   | N-Gain | Category |
|---------|--------|----------|
| Control | 0.2245 | Low      |
| Experiment | 0.6572 | Medium  |

The data above shows that the acquisition value of the experimental class N-Gain (XI IPA\(^2\)) is 0.6572 and the control class (XI IPA\(^1\)) is 0.2245. We can conclude that the value of N-Gain from the experimental class is higher with the criteria being medium, while the control class is low.

Graph 1. Obtaining N-Gain Understanding Concept Score Experiment and Control Classes
Normality test

This test is the goal so that we can see the data is normal or not. The normality test in this study is by using the liliefors test ($\alpha = 0.05$).

![Table 5. Pretest and Posttest Normality Test Results Data Understanding of Student Concepts](image)

| Statistic test | Experiment Pretest | Posttest | Control Pretest | Posttest |
|----------------|-------------------|----------|----------------|----------|
| $N$            | 22                | 22       | 24             | 24       |
| $\bar{x}$      | 37.5              | 78.63    | 37.70          | 51.84    |
| SD             | 4.818120          | 6.758031 | 4.885463       | 4.376940 |
| $L_h$          | 0.16556           | 0.17318  | 0.1686         | 0.15428  |
| $L_t$          | 0.180             | 0.180    | 0.176          | 0.176    |

Conclusion

It can be seen in the table above that the $L$-count pretest experimental class shows the results of 0.16556 and the posttest value shows the results of 0.17318 and the $L$-table value is 0.180. So it is in accordance with the criteria that if the $L_{\text{count}} \leq L_{\text{table}}$ indicates that the experimental class the data is normally distributed. Whereas the pretest count in the control class shows a value of 0.1686 and the posttest value shows the results of 0.15428 and the $L$-table value is 0.176. Then according to the criteria that if the large $L$ count $\leq L_{\text{table}}$ shows that the control class data is normally distributed. We can conclude that all data in this study are normally distributed.

Homogeneity Test

This homogeneous test is carried out after normality is carried out. Homogeneous test in this study is using the Fisher test ($\alpha = 0.05$).

![Table 6. Homogeneous Test Result Data Understanding the Concept of Students](image)

| Statistic test | Pretest Control | Pretest Experiment | Posttest Control | Posttest Experiment |
|----------------|----------------|--------------------|-----------------|-------------------|
| $SD^2$         | 22,8732        | 22,1590            | 22,2222         | 43,5950           |
| $F_{\text{hitung}}$ | 1.0322        |                     | 1.9617          |
| $F_{\text{table}}$    | 2.0283         |                     | 2.0283          |

We can see in table 6 the results of the pretest calculation of the experimental class and the control showed the results of 1.0322 with a large $F_{\text{table}}$ value of 2.0283. So according to the criterion that if the $F_{\text{count}} \leq F_{\text{table}}$ indicates that the pretest data has a homogeneous distribution. Then for the post-test $F_{\text{count}}$, the experimental and control classes showed the results of 1.9617 and the $F_{\text{table}}$ value was 2.0283. So it is in accordance with the criteria that if the $F_{\text{count}} \leq F_{\text{table}}$ shows that the posttest value of the experimental and control classes is homogeneous. We can conclude that the experimental class and control class data are all homogeneous.
Hypothesis Testing

After the prerequisite test is completed and all data regarding understanding the concept is normally distributed and homogeneous. Then the next test is the t-test.

**Table 7. Data on Concept Understanding T-Test Results**

| Klas | N | Mean | SD | T-table | T-count | Conclusion |
|------|---|------|----|---------|---------|------------|
| K    | 2 | 53.33| 4.81| 4.81    | 80      | There is influence |
| 4    |   | 33   | 34 | 2.0     | 14      |             |
| E    | 2 | 78.63| 6.75| 15      | 71      | influence |
| 2    |   | 63   | 80 |         |         |            |

We can see in table 7 that the results of the count in the experimental class and the control class show the results worth 14.71 and the value of the T-table is 2.015. Then according to the criteria that if it is large $T_h > T_t$, then reject $H_0$ and $H_1$ are accepted. So we can take the conclusion on the results of the t-test that there is the influence of the CA model on students' conceptual understanding.

**Results of Learning Implementation Using the Concept Attainment Model**

Adiluwih State High School 1 is a place used as research. And the sample is class XI IPA as the experimental class and class XI IPA as the control class, the implementation of learning at the time of research is using the Concept Attainment Model. The model consists of three learning syntax, namely: presentation of data and identification of concepts, testing of concept achievement, and analysis of thinking strategies.[13] This model is observed during the teaching and learning activities. And to assess whether or not this model is running during learning, there are observers who observe and judge. The one who acted as the observer was the class XI physics teaching staff. At the time of research, the teaching and learning process was scheduled and carried out 4 times.

At the first meeting, the aim was to carry out the pretest and begin to see students' conceptual understanding of the fluid material. During the teaching and learning process, the educator begins by saying hello, then reading the prayer and checking the attendance of students. After carrying out the above activities, it is time for researchers to do apperception and convey the objectives of the learning to be carried out.

When the above activities have been carried out, then the researcher enters the stages of the Concept Attainment model, the researcher begins by delivering an introduction to the material about static and dynamic fluid, then students are asked to classify images which are examples of static and dynamic fluids. The next step is to use the CA Model stages as follows:

**a. Stage of Presenting Data and Concept Identification**

At this stage students are presented with examples in the form of pictures in everyday life, then students are asked to group the images into the static fluid or dynamic fluid.

Furthermore, students are asked to explain from each picture that has been presented. At this stage, educators want to see students from their initial knowledge. Then educators give a video and explain the material related to examples of static and dynamic fluids. Before the
second stage, then the teaching staff asks students to ask which material they have not understood.

b. **Testing Concept Achievement Phase**

At this stage, educators divide students into four groups. And each group will be given a Student Worksheet by educators. At the time of the experiment, educators have the goal that students are expected to be able to participate in learning activities actively in the problem-solving process and can solve the problem properly.

c. **Thinking Strategy Analysis**

At this stage educators test hypotheses and experimental results from students regarding practicum activities that have been carried out.

In this activity, students explain the results of the experiment and educators can directly assess how much the understanding of the concept. The next activity was the closing activity which ended with the activity to conclude the results of the learning activities and say hello.

The stages above lasted for four meetings in accordance with the sub material conveyed by the teaching staff, and at the last meeting the teaching staff gave posttest as an evaluation of learning and saw students' conceptual understanding after using the Concept Attainment model.

Judging from the results of the research and the posttest results that the use of this model can improve students' understanding of concepts. This is in line with the research conducted by Desi Kholifah which stated that the Concept Attainment model can improve the understanding of concepts and students' interest in learning with very good categories compared to conventional learning models [14]. The research conducted by O.K Praveen stated that the Concept Attainment model as a teaching model was more effective than traditional methods in encouraging the efficiency of conceptual learning in social sciences [15-17]

In table 8 below is the data of the results of the activity of the researcher using the Concept Attainment model at the first, second, and fourth meetings, among others:

| Meeting          | Percentage |
|------------------|------------|
| First Meeting    | 94%        |
| Second Meeting   | 96%        |
| Third Meeting    | 98%        |
| Fourth Meeting   | 100%       |
Graph 2. Implementation of the Concept Attainment Model

Based on the graph above, we can see that there are four meetings in the learning activities using the Concept Attainment model with a percentage that is at the first meeting 94%, at the second meeting 96%, at the third meeting 98% which means the activities are almost entirely well done at the fourth meeting, which is 100%, it means that the learning activities using the Concept Attainment model are all well implemented.

4. Conclusion

Based on the results of the study it can be concluded that the Concept Attainment Model can improve students' conceptual understanding of the fluid material. This is shown from the results of the independent sample t-test posttest test that $t_{\text{count}} = 14.71$ and $t_{\text{table}} = 2.015$ so that $t_{\text{count}} > t_{\text{table}}$ (14.71 > 2.015) then H1 is accepted, thus it can be concluded that there is an influence of Concept Attainment model on concept understanding learners.

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