PILLAR OF PHYSICS EDUCATION
Vol. 15 (1), 2022, page.xx-xx
DOI :xxxxxxxxxxxxxx
ISSN (Print) : 2337-9618
ISSN (Online) : 2684-8880

The Influence of the Use of Concept Map in the Conceptual Understanding Procedures (Cups) Learning Model on Physics Learning Outcomes for Class XI SMAN 1 2x11 Enam Lingkung

Dian Mutya[1], Gusnedi[*1], Amali Putra[2], Letmi Dwiridal[3]

[1*123] *Department of Physics, Universitas Negeri Padang, Jl. Prof. Dr. Hamka Air Tawar Padang 25131, Indonesia*
Corresponding author. Email:dianmutya84@gmail.com

ABSTRACT

Learning that takes place in educational units requires strategies to achieve learning objectives. Learning outcomes indicate the attainment of learning goals. The learning outcomes of students in physics subjects at SMAN 1 2x11 Enam Lingkung class XI Science still have not reached the minimum learning completeness set by the school. This fact is related to students' low motivation and interest in learning and the learning model that has been determined has not been implemented optimally and is not in accordance with the students' character. One of the ways to overcome this problem is to apply the Conceptual Understanding Procedures (CUPs) learning model accompanied by making concept maps. This study aims to determine whether there is a significant influence from the use of concept maps in the Conceptual Understanding Procedures (CUPs) learning model on physics learning outcomes for class XI SMAN 1 2x11 Enam Lingkung.

The sort of inquire about carried out was Quasy Experimental Design with a Posttest Only Control Design.. The research results are based on an analysis of the similarity test of two means using the t test. At a significance level of 0.05, t_{count} = 2,14 greater than t_{table} = 1,67, leading to the acceptance of the H_i accepted. Thus, it is determined that there is a significant influence from the use of concept maps in the Conceptual Understanding Procedures (CUPs) learning model on physics learning outcomes for class XI SMAN 1 2x11 Enam Lingkung.

Keywords : Conceptual Understanding Procedures (CUPs); concept maps; learning outcomes.

I. INTRODUCTION

Education is an important aspect that is a benchmark for whether a country is progressing or not [1]. As one of the important aspects of a country, Indonesia makes education part of national development as an effort to enhance the level of welfare of human life [2]. The implementation of education must conform to established process standards. Standard learning processes should be held in an interactive, inspiring, joyful, challenging, propelling students so they are able to take an interest actively, and providing sufficient space for initiative, creativity and independence in accordance with the students' ability, interests and physical and psychological improvement [3].

Education is able to be described as a planned, orderly and systematic effort to involve students in order to realize learning that is useful for developing the abilities and potential that exist within students in terms of attitudes, knowledge, and also skills in a better direction, which is needed by the students and their environment. The potential possessed by students can be increased through experience. Experience can be created due to effective interaction between students and their environment [4].

Education has a dynamic nature, namely adapting to current developments with developments in science and technology [2]. Currently the world is entering the 21st century, where in the 21st century there are three core educational subjects, include Life and Career Skills, Learning and Innovation Skills, and Information, Media, and Technology Skills. On the subject of Learning and Innovations Skills, there are four skills needed in the 21st

century, made up of critical thinking, collaboration, communication and creativity, which are commonly known as 4C skills [5]. These subjects and skills are skills that are closely related to real life [6].

In connection with the needs needed in the 21st century within the field of education, efforts are needed so that the Indonesian State can meet these demands. One aspect that is the basis for the development of the world of education is curriculum policy [7]. The curriculum must be developed periodically and continuously in line with developments in science and technology [8]. The curriculum needs to be designed and refined in order to enhance the quality of education and make strides the quality of human resources [7]. This is an effort made by the government in arrange to progress national education, namely by improving the curriculum [9].

The revised edition of the 2013 curriculum is a refinement of the curriculum by the government which has been adapted to current developments. In its application, the revised edition of the 2013 curriculum demand teaching staff to be able to integrate four important things in learning, including 21st century skills, namely 4C skills. The requirement of the 2013 revised edition of the curriculum require that learning models, approaches to learning, learning strategies, learning methods and learning techniques must be designed in such a way that they can make students active in learning [10]. Based on this, teaching staff need to adapt the models, approaches, strategies, methods and techniques that will be used in learning so that students can participate actively during learning in order to grow and improve the abilities they need in the 21st century.

Based on initial observations carried out by researchers at SMAN 1 2x11 Enam Lingkung, it is known that students' readability in learning physics is still comparatively low. Students think that physics lessons are lessons that require them to memorize many formulas. As a result of this assumption, students quickly become bored when studying physics material. Apart from that, student participation during classroom learning is still relatively low. This low participation can be recognized during question and answer activities or during discussions. Students who actively ask questions or give opinions are the same students and the responses that students give tend to focus on the textbooks used during learning. The impact of these conditions is that students have inconvenience understanding the subject matter, which results in the learning outcomes obtained by students still not being optimal. The learning outcomes of students who have not been maximized in physics subjects can be described from the average score of the final exam of first semester in class XI Science, with details of the scores for each class as follows.

Table 1. Average Score in the First Semester Final Exam at SMAN 1 2x11 Enam Lingkung

Class	Highest Score	Lowest Score	Average Score in the First Semester Final Exam of Physics Subject	Standard of Minimum Completeness
XI Science 1	90	30	46,93	76
XI Science 2	84	18	43,86	
XI Science 3	85	20	40,69	
XI Science 4	65	17	53,70	

Appropriate to table 1, average final assessment score for first semester for physics subjects in each class has not reached the standard of minimum completeness by the school concerned, namely 76.

Apart from factors originating from within the learner, there are other factors that determine learning outcomes, namely factors originating from outside the learner [11]. This is related to the models and methods that educators use in learning. In accordance with observations that researchers have carried out at SMAN 1 2x11 Enam Lingkung, it is known that the learning activities designed and implemented by the physics subject teacher in class XI Science use a scientific approach through the discovery learning model. However, in practice, not all learning activities are carried out in accordance with the steps in the discovery learning model. Apart from that, the learning model applied by educators is still not appropriate to the characteristics of the students. During learning, students still shows indicators of motivation and interest in learning that are still low. As a result of low learning motivation, students become less confident in their abilities and students tend to only rely on their study group colleagues in problem solving, discussion and question and answer activities. The low interest in learning of students can be seen from students who still do not carry out the instructions given by the teacher properly during learning and the lack of attention of students when educators provide explanations regarding the material being studied. Furthermore, the large number of students means that the discovery learning model cannot be applied optimally in classroom learning. Some of these conditions can be factors causing learning activities that have not been able to enhance students' motivation and interest in learning to study independently, whether studying individually or in groups. This affects student learning outcomes which are not yet optimal.

The solution chosen in this research is in line with the problems described above, namely choosing and implementing a learning model that is able to motivate students to learn independently and increase students'

interest in learning. The Conceptual Understanding Procedures (CUPs) model can be used in an effort to make students active during learning which has the potential to improve student learning outcomes. This is because in its implementation, the CUPs model has steps that encourage students to be able to convey and develop the ideas they have [12]. The use of the CUPs model not only makes students active individually but also actively involved in groups to make learning and learning more meaningful which can increase enthusiasm and interest in learning among students [13]. This is related to the urgency of implementing the CUPs model where individuals are encouraged to be active and have responsibility for achieving a shared understanding of a group [14].

The Conceptual Understanding Procedures (CUPs) learning model is a cooperative learning development and was developed based on a constructivist approach [15]. This makes the values of cooperative learning and the active role of students an important part of the CUPs model. In connection with the constructivism approach, it is believed that the understanding possessed by students is constructed by expanding existing knowledge. The CUPs learning model is created for the purpose of improve students' ability to understand science concepts [16]. The CUPs model has three phases in its implementation, including: 1) Individual phase, where students are trained to be able to express opinions after making observations; 2) Group work phase, where students exchange ideas with their colleagues in group discussions in order to obtain the correct answer to the problem; 3) Presentation phase, namely the phase where educators carry out a study of students' understanding in terms of the group answers presented [17].

Apart from using the CUPs model in learning, implementing learning that is able to direct students to build their own knowledge in discovering a concept in the subject matter can also be a solution. Concept maps can act as a method for organizing concepts possessed by students. Making concept maps can improve students' ability to understand, thinking ability and creativity [18]. The application of concept maps in physics learning will also increase students' creative thinking abilities and increase students' high-level thinking abilities [19].

The concept map method is a method of taking comprehensive notes on one page [20]. Presentation using concept maps is an effort to present a summary of concepts that explains the relationships between concepts so that the material can be studied thoroughly and comprehensively. In a concept map, information is mapped into branches of thought in various creative imaginations. Thus, a concept map can be defined as a learning method that is created by mapping several concepts in the form of branches, where each branch is related to form a hierarchy. The concept map produced by students becomes an illustration of what students have understood in learning [21]. Thus, concept maps can be used as an assessment of students' understanding [22].

Organizing concepts using concept maps can be integrated into the Conceptual Understanding Procedures (CUPs) learning model, where students' understanding of concepts can support learning outcomes. In connection with this, it is hoped that the application of the CUPs learning model accompanied by concept maps can improve student learning outcomes. The aim of the research is to determine the significant influence of the use of concept maps in the Conceptual Understanding Procedures (CUPs) learning model on physics learning outcomes for class XI SMAN 1 2x11 Enam Lingkung.

II. METHOD

The experimental method is the research technique utilized in this study. The form of experimental design applied is Quasy Experimental Design, which is a form of design that was born due to the difficulty of carrying out True Experimental Design. Quasy Experimental Design includes a control group, but this group cannot control all external variables that have the potential to influence the implementation of experimental research [23]. This study applied Posttest Only Control Design, with the research design implemented below.

Table 2. Table 2. Posttest Research Design Only Control Design

Group	Treatment	Posttest
Experimental	X	O_2
Control	-	O_4

Source: (Ref: [23])

In this study, the population determined was students in class XI Science at SMA Negeri 1 2x11 Enam Lingkung who were registered in the 2021/2022 academic year. The number of students for the four science program classes is 131 students. The research method used was Cluster Random Sampling following this procedure:

a. Collecting value data from the final assessment results of semester 1 in the physics subject class XI Science SMAN 1 2x11 Enam Lingkung 2021/2022 academic year.

b. Analyze the results of the first semester final exam.
c. Taking research samples randomly using a lottery system.
d. Carry out a normality test to determine whether the sample class has a normal or non-normal distribution. The results for the sample class normality test are summarized in table below.

Table 3. Results of the Sample Class Normality Test

Class	N	α	L_0	L_t	Result
XI Science 1	33	0.05	0.14	0.15	Normal
XI Science 3	33	0.05	0.14	0.15	Normal

In table 3, it is found that $L_o < L_t$ for each sample class. Based on L_o dan L_t in the table, it is evident that the sample for the study is sourced from a population that follows a normal distribution.

e. Accomplish a homogeneity test to determine whether each sample class has a homogeneous or inhomogeneous variance. The findings from the homogeneity test for each sample class can be outlined in table 4.

Table 4. Results of the Sample Class Homogeneity Test

Class	N	S	S^2	F_h	F_t	Result
XI Science 1	33	13,32	177,49	1,11	1.80	Homogeneous
XI Science 3	33	14,82	219,71			

As reported by table 4, it is found that $F_h < F_t$ which indicates that the research sample class has homogeneous variance.

f. Carry out a test of equality of two means to find out whether each class of research samples has the same initial ability or not. According to the results of the normality test and homogeneity test, it is acknowledge that the research sample class comes from a population that has a normal distribution and homogeneous variance, therefore the t test is applied to test the equality of two means. The results of the t test calculation are outlined in table 5.

Table 5. Calculation Results for the Test of Equality of Two Means

Class	N	$\bar{x}$	S	t_{table}	t_{count}
XI Science 1	33	46,93	13,32	2,00	1,80
XI Science 3	33	40,69	14,82		

Based on the calculation results, it is obtained $t_{count} = 1,80$, while for the value of t_{tabel} at a real level $\alpha = 0,05$ and dk = 64, we get the size $t_{table} = 2,00$. H_o acceptance criteria if $t_{count} < t_{table}$ or $t_{count} < 2,00$. Because $t_{count} < t_{table}$, $1,80 < 2,00$ then H_o accepted. Thus, the research sample class has the same initial abilities.

g. Select the experimental and control classes randomly and identified XI Science 1 will be the group that receives the experiment, while XI Science 3 will serve as the comparison group.

In this research there are three variables, including; independent variables, namely concept maps, dependent variables, namely student learning outcomes, and control variables, namely learning models, lesson materials, amount of learning time, and teaching staff. The procedures in this research are outlined divided into three stages, namely the preparation, implementation and completion stages. The implementation stage is the stage for determining the research location and schedule, preparing a research permit, determining the research population and assigning sample classes to the research, designing learning tools that are designed based on the annual program and semester program, which includes the syllabus, lesson plan, work sheets, and media learning, as well as making a grid for trial questions and compiling guided trial test questions on the grid predefined grid. At the implementation stage, researchers carry out learning on predetermined samples, carry out trials of test questions, and analyze the results of trials of test questions. The results of trying out test questions in other classes that are not samples are then analyzed to determine the quality of the test questions. Analysis carried out on the results of trial test questions, namely: validity, reliability, level of difficulty, and differentiability. Meanwhile, at the completion stage, the researcher conducted a final test (posttest) in the experimental class and control class, collected and processed test result data on cognitive aspects, analyzed test result data on cognitive aspects through statistical tests, requested a certificate of having carried out research at school, and compiled research report.

The data obtained in this research are learning results for the cognitive aspects of students. Learning outcome data for the cognitive domain was obtained using written test techniques carried out upon completion of the learning process on the research sample. The instrument used in this research was a written test. Before the test instrument is used as an evaluation tool, validity, level of difficulty, reliability, and distinguishing power are first tested [24].

After the research data is obtained, normality tests, homogeneity tests and hypothesis tests are carried out. The purpose of the normality test is to determine if the research data follows a normal distribution. The homogeneity test was conducted in order to determine the variance of the data. Meanwhile, hypothesis testing is carried out to ensure whether or not there is an influence between the variables in the research. The t test was ultilized in this study due to the normal distribution and homogeneous variance of the research data.

III. RESULTS AND DISCUSSION

The research was carried out at SMAN 1 2x11 Enam Lingkung in two sample classes, including the experimental class, namely class XI science 1 and the control class, namely XI science 3. The experimental class was treated by applying the Conceptual Understanding Procedures (CUPs) model accompanied by a concept map. The control class was given treatment using the CUPs learning model with the material studied by students in this study, namely sound waves, light waves, and optical instruments. The information gathered in this study included student learning result in the subject of knowledge, which were acquired through a written exam at the conclusion of the learning activity.

Data on learning outcomes for aspects of students' knowledge were obtained from the final test (posttest) in the experimental class and control class at the end of the research. Researchers utilized a written test tool consisting 40 multiple choice questions. Based on the results of the learning outcomes test, test scores are obtained which are processed to answer the proposed hypothesis. Table 6 presents the test scores of student learning outcomes in both the experimental and control classes.

Tabel 6. Distribution of Student Learning Results Test Scores in the Experimental Class and Control Class

Test Score	Frequency of Students in Experimental Class	Frequency of Students in Control Class
55-59	0	1
60-64	0	0
65-69	2	3
70-74	2	3
75-79	4	10
80-84	15	10
85-89	10	6

Table 6 indicates for the same value interval in the experimental class and control class, there are different frequency numbers of students who get scores in certain intervals. In the smallest score interval, namely 55-59, there were no students in the experimental class who got a score in that range, while in the control class there was one student who had a score in the 55-59 interval. The test scores for students' learning outcomes in the largest interval were 85-89, in the experimental class there were 10 students who obtained scores in that interval, while in the control class there were six students who achieved scores in that interval. According to table 6, it can also be seen that many students in the experimental class obtained test scores on student learning outcomes at large intervals compared to students in the control class. Many students' test scores at small intervals are obtained by students in the control class. This illustrates that the average test score for students' learning outcomes in the experimental class is higher than the average learning outcomes for students in the control class.

Student test scores on knowledge competency are differentiated between the experimental class and the control class. A description of the research data for the experimental class and control class are summarized in table 7.

Table 7. Experimental Class and Control Class Knowledge Competency Data at SMAN 1 2x11 Enam Lingkung

Class	N	Score		$\bar{x}$	S^2	S
		Highest	Lowest			
Experimental	33	87,5	65	80,68	31,74	5,63
Control	33	87,5	55	77,34	48,41	6,95

Table 7 shows the average values ($\bar{x}$), standard deviation (S), and data variance (S^2) aspects of students' knowledge for the experimental class and control class obtained statistically. According to table 7, it can be seen the experimental class has a higher average value for the knowledge aspect compared to the control class.

The first data analysis was carried out based on the posttest results, namely the normality test. The normality test used is the Lilliefors test. The normality test was carried out to ensure that the sample class used in the research came from a normally distributed population. The normality test obtained is the value L_o and L_t at a real level of 0.05 are summarized in table 8.

Table 8. Results of the Normality Test for Knowledge Aspects of the Experimental Class and Control Class

Class	N	α	L_o	L_t	Result
Experimental	33	0,05	0,13	0,15	Normal
Control	33	0,05	0,10	0,15	Normal

Table 8 shows that the sample class in the study has a value $L_o = 0,13$ and $L_t = 0,10$ which indicates that $L_o < L_t$ at a significance level of 0,05. This shows that the data for each sample class in the knowledge aspect comes from a normally distributed population.

The stage after carrying out the normality test is to carry out a homogeneity test using the F test. The purpose of homogeneity test is to determine if the sample class is from a population with homogeneous variance or not. The results of statistical calculations for each sample class for the homogeneity test obtained the following results.

Table 9. Results of Homogeneity Test of Knowledge Aspects of Experimental Class and Control Class

Class	N	S	S^2	F_h	F_t	Information
Experimental	33	5,63	31,74	1,23	1,80	Homogeneous
Control	33	6,95	48,41			

From the homogeneity test results for each sample class in table 9, it was found that F_h = 1,23 and F_t with a real level of 0,05 $dk_{numerator}$ 32 and $dk_{denumerator}$ 32 is 1,80. Based on F_h and F_t, then the data in both sample classes are declared to come from a population that has homogeneous variance.

The normality test and homogeneity test that have been carried out on the sample classes show that the results of both sample classes are normally distributed and have homogeneous variances. After obtaining the results of the normality test and homogeneity test, a t test statistic was used to conduct a comparison test in order to test the research hypothesis. Table 10 displays the findings of the comparasion test by using t test.

Table 10. Comparison of Experimental Class and Control Class Knowledge Aspects through t Test

Class	N	$\bar{x}$	S^2	t_{count}	t_{table}
Experimental	33	80,68	31,74	2,14	1,67
Control	33	77,34	48,41		

Table 10 shows that the reception area of H_o with a significance level of 0,05 untuk $t_{count} < t_{1-\alpha}$ with degrees of freedom $dk = (n_1 - n_2) - 2$ so that $t_{0,95:64}$ = 1,67. Because the t_{count} = 2,14 is outside the reception area of H_o then H_i accepted.

Based on statistical analysis, in general it can be seen that the application of the Conceptual Understanding Procedures (CUPs) model can help enhance student achievements in the area of acquiring knowledge. The enhance in student learning outcomes can be seen in the average score obtained in the first semester final exam in physics subjects, and then a comparison is made with the average score of the posttest results carried out at the end of the study. In the experimental class, the average student score before being treated with the application of the CUPs model accompanied by a concept map was 46.93 and after being given the treatment the average student score increased to 80.68. Meanwhile, in the control class, the average student score before being given treatment using the CUPs model was 40.69 and after being given the treatment the average student score increased to 77.34. The research results obtained strengthen the results of other researchers who stated that student learning outcomes increase when learning applies the CUPs learning model [25]. This is because in the CUPs model, students get the same opportunity to succeed in learning activities.

The implementation of the Conceptual Understanding Procedures (CUPs) learning model not only influences student learning outcomes in general, but also influences student activities during class learning. When learning by implementing CUPs learning model, students appear to make more effort to understand the material being studied in order to be able to answer individual worksheets that they have to work on individually. The stage of answering worksheets individually is the first step in the core activities of learning using the CUPs model. In this step, students are required to have the capability to build and organize the information obtained so that students have a basis for thinking that will be expressed or discussed at the group discussion stage. Thus, the learning stages in the CUPs model can also attract students' attention which can increase students' motivation in learning [26].

The group discussion stage or group work phase is a stage carried out after students have initial knowledge individually. In the group work phase, students will express opinions to each other according to the knowledge they already have. After the group agrees to determine the answer to the question given, each group will display their answer in front of the class. Groups that have answers that are relatively different from other groups and groups that have answers that can represent the group's answers in general will communicate the outcome of the discussion in front of the teacher and all the students. At this stage, the ascendancy of the Conceptual Understanding Procedures (CUPs) model can be seen. Students who initially felt less confident in the answers to the questions given will feel more confident because they feel that the answers obtained and displayed are a group agreement. Because of this, if the answers that students give are not correct, students will feel that the error does not only come from them personally but is the result of inappropriate discussions in the triplet group. Furthermore, students do not feel afraid to express their opinion at the next meeting because they do not feel individually blamed if they give an answer that is not correct. Each group has the same opportunity to respond to the discussion results that have been presented. Thus, applying the CUPs model to learning can make students active in discussion and question and answer activities.

The concept map in this research was used in the second stages and third stages of the learning steps using the CUPs model. At the group discussion stage, students in groups not only answer the questions on the group worksheet but also discuss how to map the concept of the material they have studied. After the concept map in the second stage is completed, then in the third stage of learning with the CUPs model, students will communicate the concept map they created in front of the class and then the other groups are given the opportunity to provide arguments for the concept map presented. By using concept maps, educators can find out how students organize the knowledge they have. By using concept maps, educators can find out how students organize the knowledge they have. Furthermore, through concept maps educators can also understand how students learn [20].

The research results obtained according to the research objective are that there is a significant influence from the use of concept maps in the Conceptual Understanding Procedures (CUPs) learning model on physics learning outcomes for class XI SMAN 1 2x11 Enam Lingkung. The research results obtained were proven by the results of hypothesis testing using the t test. In the research sample class with a significance level of 0,05 is t_{count} = 2,14 where the calculated price of t is greater than the price t_{table} which is 1,67. Based on the tcount and ttable values obtained, it can be stated that H_i accepted and H_o rejected. Thus, the Conceptual Understanding Procedures (CUPs) model will be better used during learning accompanied by the concept map method. This proves that concept maps can be used as a support in cooperative learning [20].

The study results obtained are in accordance with the results of other studies by other researchers. The Conceptual Understanding Procedures (CUPs) learning model can help improve student learning outcomes in helping students understand concepts that students find difficult [25]. Apart from that, making concept maps can increase students' learning outcomes and can also increase motivation and interest in learning [27].

The use of concept maps in the Conceptual Understanding Procedures (CUPs) learning model has shortcomings when applied during research. The CUPs model takes a relatively long time, either in organizing students in individual study, group study, and during class discussion sessions. The effort that researchers made to reduce the impact of the shortcomings of the CUPs model was to divide students into triplet groups before learning began.

IV. CONCLUSION

Based on the calculation of student learning outcomes in the realm of knowledge and then testing the hypothesis using the t test, it was found that hypothesis H_o was denied while H_i was approved. Thus, it can be concluded that there is a significant influence from the use of concept maps in the Conceptual Understanding Procedures (CUPs) learning model on physics learning outcomes for class XI SMAN 1 2x11 Enam Lingkung.

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