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Application of learning models conceptual understanding procedures by using experimental methods on understanding physics concepts of students

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Abstract. This study was True Experimental Research aimed to know : (1) Understanding the concept of physics concept of education by using Conceptual Understanding Procedures Models Using The Experimental Methods and Konvensional Models, (2) To Improving the understanding of the concept of students physics in X MIA 1 and X MIA 2 and (3) The difference in understanding the concept of the student taught to use Conceptual Understanding Procedures Models Using The Experimental Methods and not to use Conceptual Understanding Procedures Models Using The Experimental Methods. The Population in this Research is an X class in Muhammadiyah High School of Limbung there are 60 people divided into two classes that X MIA 1 and X MIA 2 Class. The sample of this research was taken randomly with the random sampling technique as many as two-class are X MIA 1 and X MIA 2. The Instruments of Research used the instruments of understanding the concept of physics in the dual form is 35 number of multiple-choice that meet valid criteria. From the research that has been done can be concluded : (1) Understanding of the concept of a well-taught concept of education by using Conceptual Understanding Procedures (CUPs) Models Using The Experimental Methods are in the middle category, (2) Understanding of the concept of a well-taught concept of education by using Conventional Models are in a Low category, (3) There's a difference in understanding the concept of the student taught to use Conceptual Understanding Procedures (CUPs) Models Using The Experimental Methods and not to use Conceptual Understanding Procedures Models Using The Experimental Methods.

1. Introduction

Education in this 21st era is where knowledge experiences tremendous improvement and requires rapidly competition. It must a guarantee that each student has the skills to learn and innovate, using technology, and information media, as well as readiness, to be able to work and survive using these skills.

Three reasons make education is not by the circumstances. Firstly, students are not adults in mini form, but they are developing organisms. Secondly, the explosion of science resulted in the tendency of anyone not to be able to master every branch of science. Remarkably, the development of this period makes the thing that had not been imagined, will be a reality. And last reason, the latest discoveries, especially in the field of psychology has resulted in the emergence of a new understanding of the concept of human behavior change[1].

The Ministry of Education and Culture of the Republic of Indonesia has adopted at least three of 21st-century education concepts, especially in developing a new curriculum for elementary schools (SD), junior high schools (SMP), high schools (SMA), and vocational high schools (SMK). According



to Trilling and Fadel, the three concepts are 1) 21st-century skills and knowledge; (2) scientific approach; (3) authentic assessment [2].

Indonesian minister of education regulation number 16 of 2007 dated May 4, 2007, which contains standards for academic qualifications and teacher competency, Physics subject teacher education in SMA/MA, Vocational/MAK must have the ability to understand all things that will be taught and in the realm of the laboratory, that is skilled in using tools, work principles and practical activities [3].

The result of the observation that has been done in SMA Muhammadiyah Limbung by conducting interviews with teacher subject and direct observation of the class, it is known that the understanding of physics concept for X Class relatively low. This obtained based on the daily test result that has been carried out by previous students and the direct experience of researchers during the observation activities. In Physical Learning particularly, the student must be taught according to physical characteristics through direct measurement, the use of experimental methods, demonstrations and the elaboration of formulas[4]. Therefore, to achieve the educational goals of the 21st century and overcome problems that arise in schools, a learning model urgently needed that is able to improve students' understanding of concepts and is supported by skills in conducting the learning process. Research by applying the learning model Conceptual Understanding Procedures by using the experimental method on physics learning has been examined previously which shows there are differences in understanding the concepts between the two classes tested using the model and which are tested with different models [5].

Based on the description, the researcher tried to do research on "Application of the Conceptual Understanding Procedures learning model by using the Experimental Method to Understanding the Physics Concept of Students".

2. Literature Review

2.1. *Understanding Of Concept*

Understanding comes from the base word "understand" in the Indonesian language dictionary interpreted to be true. Someone who understands with a case, when he understands well and be able to explain it again[6]. Learning concepts is the activity of recognizing the same traits and being found in various objects or events, and then treating objects or events, due to the existence of these same properties [7]. In line with this, Purwanto reveals that understanding concepts is the level of ability that students are expected to be able to understand concepts and facts that are known, and can explain in their own words according to their knowledge, by not changing the meaning [8].

According to Bloom, learning outcomes in the form of understanding are divided into three categories, namely, understanding translations is translating languages or terms. Understanding interpretation is connecting the parts of an event, distinguishing the principal from the non-principal. An understanding of extrapolation, namely the ability to see implicit meanings, can make assumptions about the consequences of an event [9].

Based on the opinions of several sources above, it can be concluded that students are said to be able to understand a concept when he can retell a material or information obtained with his own language so that people around him are able to grasp the understanding of the explanation.

2.2. *Learning Conceptual Understanding Procedures (CUPs)*

Conceptual Understanding Procedures (CUPs) model was developed using a constructivism approach where the learning model is based on the belief that students can build an understanding of their own concepts by expanding or modifying the experiences of students so that participants students are able to instill attitudes to be able to draw conclusions on the material being studied [10].

CUPs have three learning phases of CUPs, the individual work phase, the group work phase, and the presentation phase of the results of group work [11]. The first phase begins with the presentation of a simple demonstration by the teacher to foster the focus of learners. The second phase is the group work phase, students work in groups in experimental activities and continue with group discussion

activities, students discuss the results of group experiment activities and work on group worksheets. In the third phase, each group presents the results of the discussion, the teacher acts as a facilitator and evaluates the results of group work [12].

Learning begins with a simple demonstration to gather information on the initial concepts of each student. After the teacher completes the demonstration, students are given an individual worksheet. Students are directed to fill individual worksheets and are given the freedom to argue. Information was obtained about understanding students' initial concepts of material from students' answers.

2.3. Experimental Method

The experimental methods are a way of teaching where the students will experiment on something, observe the process, and write the result of the experiment then the results of the observation are submitted to the front of the class and evaluated by the teacher [13].

In line with that, the experimental methods also is a method or way in which the teacher and students work together on an exercise or experiment to determine the effect or effect of an action. In essence, the experimental learning model aims to prove to students the real truth of applicable legal theories, and students get answers directly from the experiments conducted [14].

The advantages of the experimental method are that the attention of students will be fully focused on children who conduct demonstrations or experiments, providing practical experiences that can form strong memories and skills because they play a direct role in practical activities. But using the experimental method, there are several things that must be considered beforehand with the result that the implementation is more efficient, videlicet preparation and implementation takes a long time.

The technical implementation of the experimental learning model begins with explaining the learning objectives to be studied, explaining about the learning model that will be implemented, discussing first the issues that are significant to be raised and will be displayed, before the teacher sets out the necessary tools what variables must be controlled, and after the experiment is done the teacher must collect reports, process activities, and conduct tests to test students' understanding.

3. Method

The research design used in this study was True-Experimental Design with The Posttest-Only Control Design. The design of this study uses The Posttest-Only Control Group Design with a scheme like a table 1.

Table 1. Randomized Subjects, Posttest-Only Control Group Design

Class	Independent Variable	Posttest
Eksperimen	X	Y_2
Kontrol	-	Y_2

Where :

- X : Treatment by applying the learning model Conceptual Understanding Procedure (CUPs) with the experimental method
- Y_2 : Posttest in the experimental and control classes [15]

This research was conducted in the X class of Muhammadiyah Limbung High School in the odd semester of 2018. The sample in this study was the same as the total population of the study which was 60 people divided into 2 parts, each of which had 30 people in one class X MIA at Muhammadiyah High School Limbung. The sampling technique used in this study is the Simple Random Sampling technique to determine the class to be the Control Class and Experimental Class. Where class X MIA 1 is the Control Class and X MIA 2 is the Experiment class.

There were two groups randomly selected, were to determine the experimental class and the control class each group was given a posttest. The experimental class was treated by applying the CUPs learning model with the experimental method while the control class was treated by applying

the conventional learning model to the lecture method question and answer. The analysis used is descriptive analysis and inferential analysis. But it begins with an analysis of learning devices by 2 experts.

4. Result

The results of the validation analysis using the Gregory test are shown in the following table which shows that all devices in the study are feasible to use.

Table 2. Results of Validation Analysis by Gregory Test

Numb.	Instruments	R	Result
1	RPP	1.0	Feasible to Use
2	LKPD	1.0	Feasible to Use
3	INSTRUMEN	1.0	Feasible to Use

This descriptive statistical analysis discusses the results of the research conducted using 30 multiple-choice tests.

Table 3. Statistics on Understanding Concepts Score of Students in Class X MIA Muhammadiyah SMA Limbung

Statistic	Statistic Value	
	Eksperimen	Control
Subject	30	30
Standard Deviation	4.340	3.740
Variance	18.830	13.960
Highest score	27	23
Lowest score	12	8
Data range	15	15
Amount of interval classes	6	6
Interval class length	2	2
Average score	19.000	13.900
Minimum score	0	0
Ideal score	35	35

Based on the table 3. shows that there are differences with the results of the conceptual understanding test between the experimental class and the control with differences as far as 4 scores. If the score results of understanding the concepts of students in class X MIA 2 (Experimental Class) and class X MIA 1 (Control Class) Muhammadiyah Limbung High School are categorized on a scale of five, the following results will be obtained;

Table 4. Frequency Distribution and Result Score Categorization of Understanding Physics Concepts Students in Experimental Classes and Control Classes

Numb.	Statistik	Categorized	<i>(fi)</i>	
			Experimen	Control
1	29 - 35	Very high	0	0
2	22 - 28	High	11	1
3	15 - 21	Medium	14	15
4	8 - 14	Low	5	14
5	0 - 7	Very Low	0	0
Total			31	30

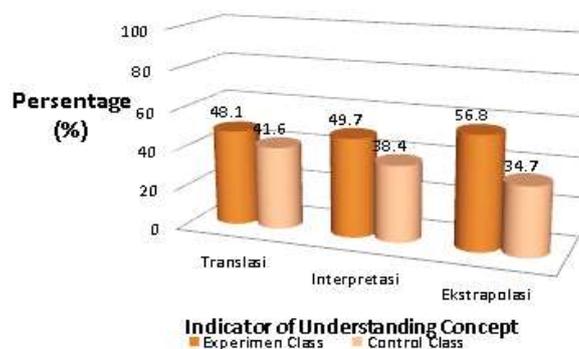


Figure 1. Percentage diagram for each indicator of understanding physics concepts in the experimental and control classes

In accordance with the Table 4. and Figure 1. it shows clearly that the results of the physics concept understanding test of the experimental class students were in the high category while the results of concept understanding test of the control class students were in the moderate category and that the average student with the highest percentage to answer correctly in the experimental class was able to answer well the questions included in the extrapolation indicator but vice versa in the control class have difficulties in answering questions which are included in the indicators of understanding extrapolation. This is because understanding extrapolation is the ability to give an idea of something based on related events in the data.

Furthermore, the inferential statistical analysis results include the Normality Test to determine the normal distribution of research data which results in a value of χ^2 count < value of 2 tables of data so that the data from the understanding of physics concepts of students come from populations that are normally distributed.

Table 5. Frequency Distribution and Result Score Categorization Understanding Physics Concepts Students in Experimental Classes and Control Classes

Class	χ^2 count	χ^2 table	Result
Experimen	2,882	7,810	Normal
Control	1,182	7,810	Normal

The equality of variance tests to find out whether or not the population variants are used. The results of the analysis obtained indicate that the value of the $F_{count} < F_{table}$ is $1.480 < 1.850$, then the group has a homogeneous variance.

After the normality test is done, then to test the existing hypothesis used two-party t-test.

Table 6. Hypothesis Test Results

t_{count}	t_{table}	Result
4,876	2,021	H_0 ditolak

According to table 6. It reveal that the price of t_{count} obtained is in the rejection area, with a real level of $\alpha = 0.05$. Thus H_0 is rejected and the H_1 hypothesis is accepted. This means that there are differences in understanding of students' concepts that are applied and not applied by using a model of learning Conceptual Understanding Procedures (CUPs) with experimental methods in improving students' understanding of concepts.

5. Discussion

This research is intended to find out how much the understanding of physics concepts increases in the XIA class of MIA students at Muhammadiyah SMA Limbung by applying the learning model Conceptual Understanding Procedures (CUPs) with the experimental method.

Based on the analysis that has been done using descriptive and inferential analysis, the results obtained in the descriptive analysis show that the comparison of students' scores on the understanding of physics concepts applied to the Conceptual Understanding Procedures (CUPs) learning model with the medium categorization while the conceptual comprehension score results in Physics of students who applied conventional learning belongs to the low categorization. This is because students in the learning process have great enthusiasm in the phase where they conduct experiments and conduct discussions at the end of the lesson to convey and draw conclusions from the experiments carried out and build collaboration in answering the questions that exist in the LKPD.

The results of the next analysis are inferential analysis, showing that the two classes are from populations that are normally and homogeneously distributed and the average population score results of the understanding of physics concept tests of class X MIA 2 students are not the same as the average population score results of physics concept understanding tests students of class X MIA 1. This indicates that by learning physics the learning model Conceptual Understanding Procedures (CUPs) with the experimental method is one of the effective physics learning used to achieve an understanding of physics concepts especially in indicators of understanding extrapolation.

6. Conclusion

Based on the research data obtained in this study, it can be concluded that understanding the concepts of physics of students who applied the Conceptual Understanding Procedures (CUPs) model using the experimental method is indicated by the percentage of the average posttest results (final test) in the medium category.

7. References

- [1] Fathurrohman, M. Model-Model Pembelajaran Inovatif. Jogjakarta: Ar-Ruzz Media. Yogyakarta: Ar-Ruzz Media, 2015
- [2] Laura. 99 Cara Mengajar dalam Kelas. Bandung: Alfabet., 2014
- [3] Sudibyo, B. Peraturan Menteri Pendidikan Nasional Republik Indonesia Nomor 16 Tahun 2007. Jakarta: Sinar Grafika, 2007.
- [4] Subekti, Y., & Ariswan, A. Jurnal Inovasi Pendidikan IPA, 2 (2): 252-261, 2016
- [5] Lakuntu, Jein Kristina, I Komang Wherdiana dan Muslimin. Penerapan Model Pembelajaran Conceptual Understanding Procedures Menggunakan Metode Eksperimen terhadap Pemahaman Konsep Hukum Newton pada Pesertadidik Kelas X SMA Negeri 1 Palu. Jurnal Pendidikan Fisika Tadulako (JPFT), 2017.
- [6] Khaerani, R. Penerapan Pembelajaran Kooperatif melalui pendekatan inkuiri terbimbing dalam meningkatkan keterampilan proses dan pemahaman konsep fisika pada siswa SMP Negeri 5 Watampone Kabupaten Bone. Universitas Negeri Makassar, 2010

- [7] Winatasaputra, S. U., dkk. Teori Belajar dan Pembelajaran. Jakarta: Universitas Terbuka, 2007.
- [8] Purwanto. Evaluasi Hasil Belajar. Yogyakarta: Pustaka Pelajar, 2011.
- [9] Sagala, S. Konsep dan Makna Pembelajaran. Bandung: Alfabeta, 2014.
- [10] Ibrahim, Kosim, &Gunawan. Pengaruh Model Pembelajaran Conceptual Understanding Procedures (Cups) Berbantuan Lkpd Terhadap Kemampuan Procedures (Cups) Berbantuan Lkpd Terhadap, III(July), 1–23, 2017.
- [11] Gunstone, R., McKittrick, B., & Mulhall, P. Structured cognitive discussions in senior high school physics: Student and teacher perceptions. *Research in Science Education*, 29(4), 527–546, 1999.
- [12] Gunstone, Dick., McKittrick, Brian., &Milhall, Pam. CUP - A Procedure for Developing Conceptual Understanding. *Prosiding PEEL Conference*. Australia: Monash University, 2009.
- [13] Putra, S.R. Desain Belajar Mengajar Kreatif Berbasis Sains. Yogyakarta: PT Diva Press, 2013.
- [14] Kurniasih, I. dan B. S. Ragam Pengembangan Model Pembelajaran Untuk Meningkatkan Profesionalitas Guru, 2017.
- [15] Ary, D., Jacob, L. C., Chris, S., &Razavieh, A. *Introduction to Research in Education* Eight Edition. Wadsworth, 2010.