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the Effect of Using a Contextual-Based Physics e-Module on Improving Students' Understanding of Concepts in Class X Measurement Material

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ABSTRACT

Understanding concepts is an individual's ability to understand the meaning of concepts, situations and facts that they know. Class X students' understanding of concepts at State High School 1 Kampung Dalam needs attention, because students' conceptual understanding is still relatively low. This is because the learning that has been developed has not been adapted to students' needs, namely teaching materials, resulting in student learning outcomes not reaching the expected results. One of the teaching materials that can improve students' understanding of physics learning material is E-Module. This research aims to determine the effect of using the Contextually Based Physics E-Module on Students' Understanding of Concepts. To achieve the goal, the Quasi Experiment method was applied with a Posttest-Only Control Design. The data in this research is in the form of students' understanding of the measurement material, collected through a test instrument, which consists of 7 indicators and is translated into 30 questions. Data analysis used the T test at a significance level of 5%. Based on data analysis, a t-count value of 3,638 was obtained. The threshold value at degrees of freedom is 62 and the significance level is 1.670. Based on the results obtained, it can be concluded that there is an influence of the E-Module on students' understanding of concepts.

Keywords :*E-module; contextual; understanding concepts.*

I. INTRODUCTION

Improving the quality of education is very important to develop quality human resources who have the knowledge, abilities and mindset needed to advance mastery of the fields of science and technology [1]. A key goal of the learning process is for students to develop strong capabilities in grasping and comprehending ideas and principles [2].

Understanding concepts is an individual's ability to find an abstract idea to clarify an object which is generally expressed in terms expressed in examples and non-examples so that someone can understand it[3]. [4] also defines concept understanding as the process that allows a person to correctly understand an abstract concept or idea, which allows them to classify objects or events. Understanding of this concept is obtained through the learning process [5].

Concept understanding is a student's ability to master a concept or material which is reflected in the cognitive aspect. By understanding a concept, students are able to identify, explain, describe, compare, differentiate, classify, provide examples and contrast, conclude, and convey an object again using their own language, while being aware of the processes involved [6]. There are 7 indicators that can be developed at the level of the cognitive process of understanding, including interpreting, exemplifying, inferring, comparing and explaining [7]. Meanwhile, Bloom states that understanding concepts is the ability to capture understandings such as being able to express material presented in a form that is more understandable, being able to provide interpretations and being able to apply them [8].

Students' ability to understand concepts regarding facts and events is the result of students' personal learning and experiences. In science, the ability to understand concepts is one of the key indicators for achieving

success in learning. One of the problems that often arises in science learning is students' low understanding of concepts [9]. Physics.

The use of learning models that are not suitable for the material being taught is one of the factors that can influence low mastery of physics concepts [10]. On the other hand, low concept mastery is also caused by students' difficulties in understanding physics concepts which tend to be abstract [7]. Meanwhile, according to [11] in this modern era, the majority of teachers teach using conventional teaching methods, with teacher-centered teaching and still using the lecture method.

Another factor that causes low understanding of physics learning concepts is that the learning carried out by students so far still separates students' formal knowledge from students' daily experiences, so that students assume that physics lessons have no connection with their daily lives. Physics learning is more popular, so physics learning cannot be separated from students' daily experiences and environment [12].

If students have not mastered the basic skills in understanding concepts, then the expected learning objectives cannot be achieved and it is certain that students will experience difficulties in designing solutions and implementing problem-solving plans. However, on the other hand, by understanding concepts, students will be able to relate and solve problems armed with basic abilities through concepts they already understand [13]. Understanding concepts allows students to improve intellectual abilities in solving problems and creating meaningful learning [8].

Based on the results of an interview with one of the teachers, the learning teaching materials used by teachers at State High School 1 V Koto Kampung Dalam are textbooks. The use of textbooks in learning does not attract students' attention, because most of the textbooks contain quite long words and formulas. Using textbooks alone is not able to make students understand the learning due to the lack of explanations of the material, examples of problems and application of concepts in life, which can make students understand and understand the concepts better.

Based on the results of students' conceptual understanding, the answer sheets for each question were analyzed for six indicators of conceptual understanding. The results of the analysis for each indicator of conceptual understanding were added up, then averaged, and the result was 43.96, this shows that students' conceptual understanding is still low. The cause of students' low conceptual understanding is because the learning teaching materials used by teachers at school are less effective and quite difficult to understand so they have not honed students' conceptual understanding.

From this explanation, the solution provided by researchers is to improve the learning process by using contextual-based E-module teaching materials in schools so that students can more easily understand the material well and are able to apply it in everyday life. This is done so that the learning process is more effective, interesting and not boring, students are also more active in learning, so tools are needed such as learning teaching materials that can increase students' understanding of concepts.

Several studies have been conducted to improve high school students' understanding of physics concepts. In general, this meta-analysis article refers to several articles related to various learning models that contribute to increasing students' understanding of concepts. Several groups of learning models include discovery learning models, inquiry learning models, cooperative learning models, direct instruction learning models, and problem-based learning models. These five groups of models are the most commonly used in the learning process and are considered to have a positive impact on learning, including increasing students' understanding of concepts [11].

In today's modern era, a contextual-based learning approach is very important, because this approach encourages students to relate lesson material to real life situations. So that the Physics E-module can be developed well, it is necessary to apply a directed and structured method or model [14]. The contextual-based physics e-module contains explanations about physics material related to everyday life which is presented in the form of pictures, videos, animations so that students are able to understand the pictures first after that students can analyze the pictures and determine formulas so students can analyze the problem or concept relationships or can work on problems easily [15].

According to [16], the advantage of e-modules with a contextual approach is their ability to present material in an interesting way, because it is equipped with learning media such as images and videos that are appropriate to the topic. This helps students understand and observe material, especially regarding single objects and mixtures around them. Apart from that, this approach can also encourage students to be active and motivated in the learning process. Therefore, the use of e-modules with a contextual approach is interesting in the context of physics learning.

Based on the background presented, the researcher is interested in carrying out research with the title "The Effect of Using Contextually Based Physics E-modules on Increasing Students' Understanding of Concepts in Class X Measurement Material at State High School 1 V Koto Kampung Dalam".

II. METHOD

The type of research used in this research is quasi experimental research. The research design used was a posttest-only control design. In this design there are two groups, each selected randomly (R). The first group was given treatment (X) and the other group was not. The group that is treated is called the experimental group and the group that is not treated is called the control group.

The population in this study were all students in class X Science at State High School 1 V Koto Kampung Dalam who were registered in the 2023/2024 academic year, consisting of 4 classes.

Table 1. Research Population

No	Class	Number of Students	Understanding of Concepts
1	X MIPA 4	32	39.219
2	X MIPA 5	32	49.844
3	X MIPA 6	32	49.219
4	X MIPA 7	33	37.576

Meanwhile, the sample in this study consisted of two classes, namely the experimental class and the control class. The sampling technique in this research was Purposive Cluster Sampling. Sampling in this way is based on a characteristic in a population that has a relationship so that it can be used to achieve research objectives Sampling from several population classes that have a normal distribution and also has a homogeneous variance, and has the same or close average conceptual understanding scores to obtain sample classes, namely classes XE5 and XE6. Where the experimental class in this research is X.E5, while the control class is X.E6.

In this research, primary data is data collected directly by researchers from students' final test results to obtain student concept understanding scores from the experimental class with 25 students and the control class with 25 students. After the researcher gave treatment to the two sample classes of class X students at State High School V Koto Kampung Dalam. Meanwhile, secondary data is data obtained from teachers before the researchers conducted the research in the form of daily test scores for understanding concepts of class X students at State High Schoo1 V Koto Kampung Dalam.

The instrument tested was a concept mastery test in the form of 30 multiple choice questions, which had been explained in terms of 6 indicators of concept understanding, namely interpreting, giving examples, grouping, drawing inferences, comparing and explaining. A test that is considered good as a measuring tool must meet several requirements, namely validity, reliability, level of difficulty and distinguishability. In this research, the test was given after the discovery learning model was applied. Previously, the test will undergo testing to determine whether the test is feasible or not. This test involves a validity test, reliability test, difficulty level test, and different power test.

In this research, to measure validity, we use a form of product moment correlation using rough numbers, namely :

$$r\,xy = \frac{N\Sigma XY - (X)(Y)}{\sqrt{\{N\Sigma X^2 - \Sigma X^2\}\{N\Sigma Y^2 - \Sigma Y^2}} \qquad (1)$$

Information :

r_{xy} = Correlation ceofficient between variavels x and y
$\sum XY$ = The amount of increase between X and Y
$\sum X$ = Total question scores
$\sum Y$ = The total score of the questions

Of the forty questions created in this research, thirty questions were classified as valid and were used in this research.

After the validity test is carried out, it is continued with the reliability test. According to Festiyed (2017) Reliability is the level of stability of the results of two measurements of the same thing. In this research to calculate Reliability using Kuder-Richardson (KR-20) with the equation :

:

$$r_{11} = \left(\frac{k}{k-1}\right)\left(\frac{s^2-\Sigma pq}{s^2}\right) \quad (2)$$

Keterangan :
r_{11} = reliability using the KR-20 equation
p = the proportion of test takers who answered correctly
q = the proportion of test takers who answered incorrectly (q=1-p)
∑ pq = the amount of increase between p and q
k = lots of questions
S = standard deviation

Of the thirty questions used, after testing the level of reliability of the questions, the r_{11} value was obtained as high as the reliability category. Reliability details are presented in the appendix. Based on the results of the validity test and reliability test, it can be said that the instrument used in this research meets the requirements as a research instrument, because it has been proven to be valid and reliable.

The data obtained in this research involves several analytical stages. First, a prerequisite analysis test was conducted using tests for normality and homogeneity. Second, a pre-test data analysis was performed to assess the equivalence of initial abilities between the experimental and control groups before treatment, with testing conducted using an independent two-sample t-test. Subsequently, post-test data analysis was carried out using the Paired Samples T Test to identify differences in outcomes before and after treatment. Furthermore, the post-test scores of the participants were subjected to hypothesis testing using the t-test to compare these post-test results. These stages reflect a comprehensive approach to examining and interpreting the research data [17].

Data collection techniques in this study used normality, homogeneity and t tests (hypothesis tests. This normality test aims to see whether the samples in the experimental class and control class come from a normally distributed population or not. The t test is carried out if two samples are normally distributed and both samples have homogeneous variances. The t test equation is:

$$\frac{X1-X2}{S\sqrt{\frac{1}{n_1}+\frac{1}{n_2}}} \quad (3)$$

$$S^2 = \frac{(n_1-1)S_1^2+(n_2-1)S_2^2}{n_1+n_1-2} \quad (4)$$

Information :
$\bar{x_1}$ = average value of the experimental class
$\bar{x_2}$ = class control average value
S_1^2 = experimental class standard deviation
S_2^2 = standar deviasi kelas ontrol
n_1 = control class standard devistion
n_2 = number of control group students
S = combined standard deviation

Kriteria pengujian adalah terima H_0, jika =

$$t_{1-\frac{1}{2}\propto} < t < t_{1-\frac{1}{2}\propto} \quad (5)$$

Where $t_{1-\frac{1}{2}\alpha}$ is obtained from the t distribution list with dk = (n_2=n_2-2)
And odds $(1-\frac{1}{2}\alpha)$. For other values of t H_0 is rejected.

III. RESULTS AND DISCUSSION

The data obtained from this research is related to understanding the concept of measurement material in Physics subjects. The experimental group received treatment in the form of using a contextual-based E-module containing non-interactive digital learning material that could be accessed using a gadget device. Meanwhile, the control group used textbooks provided by subject teachers along with video content from YouTube as learning aids.

The use of concept understanding tests aims to assess students' understanding of the material that has been taught after they have participated in the learning process. This test is given in the form of a written test consisting of 30 multiple choice questions, both before and after students take part in the lesson. The aim is to determine the extent of increased understanding of concepts experienced by students after participating in

learning activities [18]. The data from observations of experimental and control class students' conceptual understanding is presented in table 1 below.

Table 2. Understanding of Concepts in Experimental and Control Classes

Parameter	Experiment	Control
Max Score	87,00	80,00
Min Score	70,00	64,00
Mean	79,00	75,13
Std Defisiency	4,36	4,16

Based on table 2, it can be seen the value of understanding the concept of the sample class (experimental and control) after the treatment. It is known that the experimental class's conceptual understanding is higher than the control class. The highest score for the experimental class was 87.00, and the highest score for the control class was 80.00. Meanwhile, the lowest score for the experimental class was 70.00 and the lowest score for the control class was 64.00. The average or mean value of the experimental class is 79.00 and the average value of the control class is 64.00. The standard deficiency value for the experimental class is 4.36 and the control class is 4.16. The difference between the two sample classes is due to the contextually based E-Module having an influence on students' understanding of physics concepts.

After measuring the ability to understand concepts for the two sample groups, the results are presented as Figure 1 below

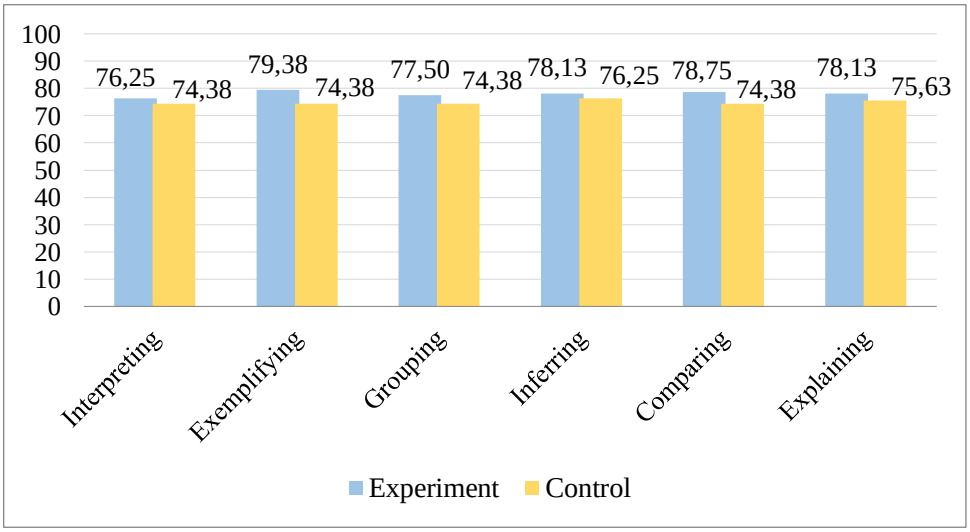

Figure 1. Graph of Concept Understanding Indicator Scores for Experimental and Control Classes

Based on the data seen in Figure 1 above, it can be seen that all indicators of conceptual understanding, the experimental class has a higher average score than the control class. The indicator score interpreting the experimental class is 76.25 and the indicator score interpreting the control class is 74.38. The indicator score gives an example of the experimental class of 79.38 and the indicator score gives an example of the control class of 74.38. The indicator score that groups the experimental class is 77.50 and the indicator score that groups the control class is 74.38. The indicator score for drawing inferences for the control class is 78.13 and the score for the indicator for drawing inferences for the control class is 76.25. The indicator score comparing the experimental class is 78.75 and the indicator score comparing the control class is 74.38. Meanwhile, the explaining indicator score for the experimental class is 78.13 and the explaining indicator score for the control class is 75.63. This shows that the indicators of research success have been achieved.

he results of the normality test on the two data samples from the research sample are presented in the following table:

Table 3. Posttest Normality Test Results

Class	**N**	α	L_t	L_h	**Keterangan**
X MIPA 5	32	0.05	0.157	0.128	Information
X MIPA 6	32		0.157	0.121	

Based on table 3, it can be seen that the Lt > Lh value is at a significant level of 0.05 for both sample classes. This shows that each sample class has a normal distribution. Meanwhile, the results of the homogeneity test for the two research samples are presented in the table below:

Tabel 4. Posttest Homogeneity Test Results

Class	N	$\bar{X}$	S	S^2	F_t	F_h	Dk	Information
Experiment	32	79	4.36	18.97	1.822	0.914	31	Homogen
Control	32	75.13	4.16	17.34			31	

Based on table 4 provided, it can be seen that the Fh value (the statistical value of the homogeneity of variance test) is smaller than the Ft value (critical value) for both sample classes. This shows that the sample class has a homogeneous variance..

After carrying out normality and homogeneity tests, it can be seen that the two samples are normally distributed and homogeneous. Then proceed with carrying out the T test. The results of the similarity test of two averages from two groups of sample class data are documented in the following table.

Table 5. Results of the Test of Similarity of Two Sample Means

Class	N	$\bar{X}$	S	S^2	Tt	Th
Experiment	32	79	4.36	18.97	1.67	3.638
Control	32	75.13	4.16	17.34		

Based on the hypothesis test results listed in Table 5, it can be concluded that the th value (test value) is greater than the critical value in the table. Therefore, the research hypothesis is accepted at a significance level of 5%. Thus, it can be concluded that the use of contextually based E-modules has a significant influence on the understanding of the concepts of class X students at State High School 1 V Koto Kampung Dalam.

Based on the results of research data analysis, it can be seen that the ability to understand concepts as a whole, as well as according to concept understanding, shows that the concept understanding score for the experimental class is higher than the control class. This shows that the use of contextually based E-modules in experimental classes may have a positive impact on the development of students' conceptual understanding compared to control classes that use different teaching materials [19]. These results could be an indication of the potential benefits of the learning approach used in the experiment.

The test results show that understanding of the concept of measurement material in the experimental class which uses contextual-based E-modules is higher than in the control class which uses textbooks from subject teachers and video media from YouTube as supporting measurement material. This difference may be due to the contextually based advantages of E-modules including ease of access, a higher level of interactivity, and the ability to combine various types of media, such as audio, video, animation, as well as internet links, which can enhance the student learning experience.

According to [20] states that electronic modules (E-modules) and e-books are almost similar in terms of digital form . The main difference lies in the content of the two. According to the Encyclopedia Britannica Ultimate Reference Suite, an e-book is a digital file containing text and images suitable for electronic distribution and displayed on a monitor screen with a display similar to a printed book. E-books are usually used for reading or publishing purposes [21].

On the other hand, an E-module or electronic module is a module in digital form consisting of text, images, or both, and contains digital electronics material accompanied by simulations that can be used in the learning process. E-modules are specifically designed to help students understand specific material by providing guides, assignments, exercises, and additional resources that can enhance the learning experience. E-modules focus more on educational contexts and interactive learning [22].

Another opinion says that E-modules can be used in various locations to increase learning effectiveness, as explained by [23]. E-modules provide flexibility in accessing learning materials, allowing students to study anywhere according to their convenience [24]. Apart from that, E-modules also support expanding student contributions in the learning system, especially in understanding concepts [25]. This means E-modules can help students be more actively involved in the learning process and provide additional resources that allow them to delve further into the subject matter. E-modules also allow the use of various media, such as text, images, audio, video, and simulations, to support deeper understanding and learning [26], so that students don't get bored just looking at writing [27]. Apart from that, it can be used via laptop, tablet and cellphone [28].

Based on the component of understanding the concept of measurement material in physics subjects, there is a score obtained for each indicator. In the experimental class, of the six indicators of conceptual understanding, all components achieved scores above 75, in the good category, with respective scores, namely interpreting 76.25, giving examples 79.38, grouping 77.50, drawing inferences 78, 13 compares 78.75, and explains 78.13. Meanwhile, in the control class, of the six indicators of understanding the concept of measurement material in physics subjects, each indicator also achieved a score above 70 in the good category, and the score for each was interpreting 74.38, giving an example of 74.38 , grouping 74.38, drawing inferences 76.25, comparing 74.38, and explaining 75.63.

These results indicate that students in the experimental class achieved a good level of understanding in various aspects of understanding the concept of measurement material in physics subjects. This high score illustrates strong understanding and application of various indicators of conceptual understanding, which can be caused by the use of contextually based E-modules in physics learning. The contextual-based E-module facilitates students to easily comprehend complex ideas and generate responses to challenging problems. These skills are valuable as they allow individuals to discover various solutions to diverse challenges through deliberate thinking and abstract reasoning [29]. Furthermore, according to research conducted by [30], E-modules have a significant impact on students' conceptual understanding due to their highly contextual design, facilitating easy comprehension for students.

These results are also strengthened through hypothesis analysis with the t test at a significance level of 5%. The results of this test show that tcount (test value) is 3.6379 while ttable (critical value) is 1.6998. Because tcount is outside the H0 rejection area, the alternative hypothesis H1 is accepted at a significance level of 0.05. In other words, these results show that there is a significant influence from the use of contextually based E-modules on increasing students' conceptual understanding in class X measurement material at State High School 1 V Koto Kampung Dalam.

This study has limitations in its implementation, primarily due to constraints associated with the content that can be taught using the contextual-based E-module in physics education. Currently, the module only covers measurement topics.

IV. CONCLUTION

Based on the research results, it can be concluded that the use of contextually based E-modules has an effect on increasing students' understanding of concepts in class X measurement material at State High School 1 V Koto Kampung Dalam. This shows that the E-module with a contextual approach is effective in helping students understand concepts related to measurement in learning. These results emphasize the benefits of using digital technology in the learning process. Recommendations for further research consider a wider application of research materials rather than just being limited to fluid materials only. Additionally, consider the use of other technologies that might support learning, such as simulation software, brave learning platforms, or other interactive learning tools.

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