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The Effect of Using Physics Learning E-Modules Context-Based on Students Science Communication Skill in Optical Tools and Global Warming

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ABSTRACT

This research is motivated by the low ability of students' science communication, the cause of the low ability of students' science communication because the teaching materials used by teachers in schools are less effective and quite difficult to understand. This study aims to see the effect the use of context-based physics learning e-modules on optical instruments and global warming for class XI Senior high school. The subjects of this study were all students of class XI Natural Science Mathematics Senior High School. Sampling was carried out using simple random sampling technique, by selecting class XI Natural Science Mathematics 1 as the experimental class and XI Natural Science Mathematics 2 as the control class. The research instrument is a non-test in the form of an observation sheet of scientific communication skills. The data research technique used in hypothesis testing is the t-test. The results showed that the average science communication ability of the experimental class students was higher than that of the control class. The results of testing the assumptions using the t-test, obtained t count of 61.10 and t table with a significance level of 0.05 with a table value of 1.669. So it can be concluded that there is an effect of the use of context-based physics learning e-modules on students' science communication skills in the material of optical instruments and global warming class XI Senior High School

Keywords :*E-module, physics, optical instruments, global warming.*

I. INTRODUCTION

The use of data and communication technology in all aspects of life including in the education process is a characteristic of world growth in the 21st century. Schools are required to prepare students who have quality to be able to compete globally in facing the growth of the century [1]. The century we live in requires human resources (HR) to be ready to compete and adapt in the global era. In the 21st century, knowledge has an important role in human civilization.

Teaching materials are grouped according to methods and procedures for learning, namely printed teaching materials, listening teaching materials, and auditory teaching materials. In accordance with the development of the era, educational modules can be obtained not only in the form of novels, but also in the form of diaries, posts, electronic novels (e-books), as well as electronic material (e-modules) from the internet or other sources. This can make it easier for students to access different learning materials [2]. Based on predetermined characters, it is hoped that there will be teaching materials that can help teachers and students in the educational process. Educational modules, namely modules, are thought to be able to improve students' science communication skills in the educational process. Nowadays, materials can be converted into electronic forms known as E-modules [3].

E-module is a form of innovation in the development of teaching materials in the form of soft files that can be opened and read by students anytime, anywhere [4]. Not only that, the e-module displays anything that can be read via a computer in a novel format that is presented electronically [5]. E-modules can help students better

master the lesson modules and also provide opportunities for students to become competent, explain and excel [6].

The research team from the Physics Department of Faculty of Mathematics and Natural Sciences Padang State University, chaired by Dr. Desnita, M.Si has improved the context-based physics learning e-module. The e-module contains activities that students want to do related to learning modules that have been integrated with learning videos using the CTL learning model. This e-module has been tested for validation and practicality, from the two tests this product was declared valid and practical so that it is suitable for use as a media and physics teaching material for class XI [7].

Physics lessons require teaching materials in the form of e-modules, because physics seems to have abstract concepts and is not easily related to everyday life in human life. Therefore, educators need to be creative in creating and improving the learning environment so that students can show more interest in learning and understanding the material [8]. One of the physics materials is Optical Instruments and Global Warming in class XI even semester which is the 2013 Curriculum teaching material. This material is one of the subjects that must be taught to students. In the optical instrument module and global warming requires appropriate science communication to produce a more interesting educational process, build students' knowledge in a structured manner in the optical instrument module and global warming. The hope is that the material that students understand fits in with the theory put forward by experts so as to build good science communication in the ongoing educational process.

Based on the demands of the 21st century according to Urwani [9] it is said that after understanding the concept, the ability that is considered important is the ability to communicate, the ability to communicate is used as a tool in the process of sharing data, information, ideas or comments between 2 or more people. Communication skills are considered as the main construct in education, communication in education is used as material for creating, processing, developing and expanding knowledge about the learning process which emphasizes active student interaction. One of the communications that can be tried to help students get the concept is science communication.

In learning, communication is a process of interaction in the process of observation, research and decision making. Students' communication skills to find concepts and theories can be developed through a learning process that uses different learning models or methods [10]. Communication skills are defined not only as interactions between teachers and students, but also as the process of making information or results of observations or experiments so that others can recognize and understand them. Through communication skills, students can easily convey various things about learning material, students who do not speak well in educational activities can cause educational activities received to be less than optimal. This is in line with the statement [11]which shows that there is a significant relationship between students' communication skills and learning activities. Based on this subject, more emphasis is placed on communication skills in the teaching and learning process. Through communication activities, students can obtain clear and accurate data or convey information orally and in writing from or to other people.

In physics education, the ability to communicate science in the education process is an implementation of 2013. When students' scientific communication skills are not optimal, it can be said that these students can implement the 2013 curriculum [12]When students' science communication skills are already lacking, it will be difficult to create a scientific feel in class because the bond from teacher to student and from one student to another student will be difficult to realize and difficult to achieve learning goals due to the low level of communication science students.

In the case of optical devices and global warming, context-based physics learning e-modules are used which have the advantages of being able to make learning discover their own knowledge. Furthermore, education becomes more meaningful and concrete, namely students are required to be able to recognize the relationship between learning experiences at school and life [13].

Based on interviews conducted by physics teachers at Senior High School, information was obtained that the reason for the learning module was made was because many students did not have textbooks provided at school, the teaching materials or modules used only contained material summaries, examples of problems and application of concepts in life and then sent via school e-learning or sent to social media groups.

This raises the communication skills of students there are good and some are lacking. One aspect that causes a lack of student science communication is the method used by educators in the physics learning process which is still ineffective, educators dominate students more and ultimately this causes students to be passive in class and any problems given cannot be solved properly, which what teachers do tends to be passive in class and every problem given cannot be solved properly what teachers do tends to present material using the lecture

method, giving practice questions, so they rarely express their opinions, answer teacher questions, offer to explain student knowledge related to the material what the teacher said.

Students' science communication skills are included in the less category, which can be seen from: 1) students pay less attention during learning, are passive, bored, and sleepy; 2) students rarely ask questions in class; 3) students rarely stop and never show their opinion; 4) students rarely encounter a problem and then solve it; 5) students tend to show less individuality and interest in friends; 6) Students see physics only as a computational subject, certainly not a science whose results can develop useful technology for life. So to improve students' science communication skills, teachers are required to create a learning process that does not only require students to receive, remember and memorize material.

According to what has been described above, the researcher is interested in raising this research with the title The Effect of Using Context-Based Physics Learning E-module on Students' Science Communication Ability on Optical Instruments Material and Global Warming for Class XI *Senior High School.*

II. METHOD

This research is a quasi-experimental design with a non-equivalent control group design [14]. Explaining that this experiment is the development of a true experiment which has the uniqueness of this experiment having a control team, but not all of it can function to control external variables that affect the implementation of the experiment.

Table.1 *Non-Equivalent Control Group Design*

Group	***Pretest***	***Treatment***	***Posttest***
Experiment	O_1	X_1	O_2
Control	O_3	X_0	O_4

(Source: Ref [14])

Information :

O_1 = Pretest (initial test) before being given treatment in both groups (experimental and control).
O_2 = Post-test performed for both groups after treatment.
X_1 = Experimental group treatment, namely the use of context-based e-modules for teaching physics.
X_0 = Treatment received by the special control group with package inserts.

Based on the table above, in this study there was a sample group before the pre-test was carried out which aims to determine the initial state of the sample. After processing, a post-test was carried out on the samples. The results of the pretest and posttest are compared to determine which treatment results are more accurate [14]. This research was carried out in the Physics subject in Even Semester 2022/2023 with a research population of class XI natural science mathematics at Senior High School. The total number of students is 169 which are divided into 5 classes.

The sampling method was carried out using a simple random sampling technique. So that class XI natural science mathematics 1 and XI natural science mathematics 2 were selected as samples in this research. The data collection method was tried using an instrument to assess students' scientific communication abilities using observation sheets. There are also variables in this study including independent variables, dependent variables and control variables. The independent variable in this research is the use of context-based physics learning e-modules. The dependent variable in this research is students' science communication skills. After that, the control variables in this study were approaches, learning models and textbooks.

The type of information used in this research is quantitative data. Quantitative data is an assessment of students' scientific communication abilities in the form of numbers. Sources of information in this study were students of class XI natural science mathematics senior high school with randomly selected classes as the study sample. The tool used in this research is a research tool for students' communication skills in the form of an observation sheet with the table below.

Table.2 *Observation Sheet Grid*

No	Indicator	Item Number	Amount
1	Verbal Communication	1, 2, 3	3

2	Social Maturity	4, 5, 6, 7	4
3	Emotional maturity	8, 9, 10	3
4	Intellectual Maturity	11, 12, 13, 14	4
	Amount		14

The first step in data analysis is to calculate the value of students' science communication abilities. Calculations can be done using the following formula:

$$Nilai = \frac{Skor\ mentah}{Skor\ maksimum\ ideal} \times 100$$

The results of these calculations are interpreted according to the following criteria:

Table.3 *Value Interpretation*

Grade	Predicate	Criteria
>85	A	Very good
75-84	B	Good
65-84	C	Enough
55-64	D	Less
<55	E	Very less

(Source: Ref [15])

The data will then be tested through analysis of data requirements to determine the statistical test to be used. This research uses parametric statistics, namely the normality test and homogeneity test. In this research, the method used in the normality test is the liliefors test. After the normality test, the next is the homogeneity test which aims to identify 2 groups of homogeneous data. Homogeneity test is needed for inferential in comparative test. In this research using Fisher's test (*Test* F) and for the final test, namely hypothesis testing. The hypothesis test used in this study is the t-test. In this study, the mean that was compared was the mean pretest data with the mean posttest data. [16].

III. RESULTS AND DISCUSSION

Results

After being given treatment, students' scientific processing abilities increased in each indicator as shown in the following figure:

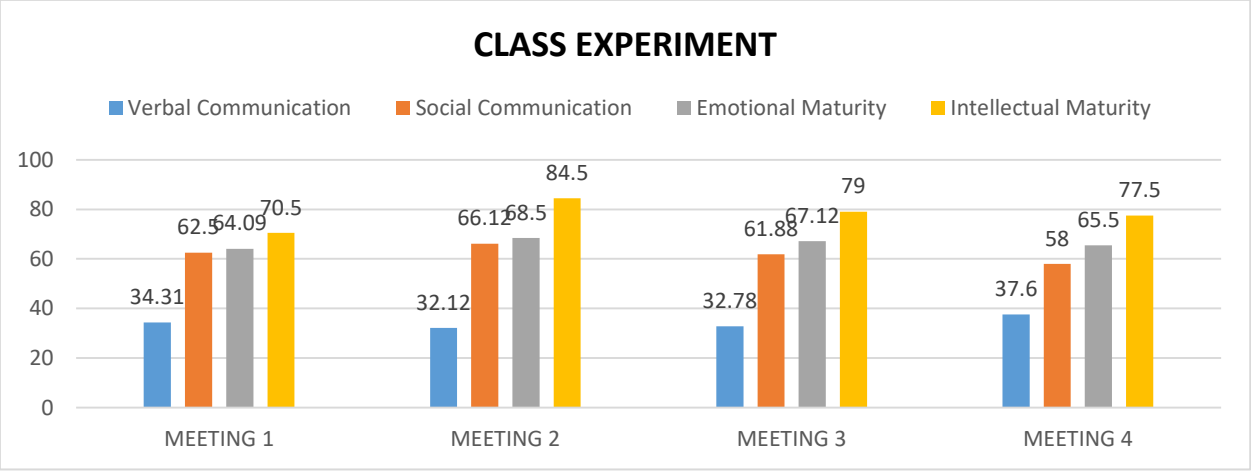

Figure 2. Final Score of Students' Science Communication Ability

From the graph above it can be seen that there are differences in the average values before and after being treated for each indicator of students' scientific communication abilities in the experimental class. It can be seen that at every meeting of the graph, every aspect observed has increased at every meeting. At the first meeting the

observed aspects obtained an average value of <55 with very poor criteria, at the second meeting the observed aspects obtained an average value ranging from 59-66 with less criteria, at the third meeting the observed aspects obtained an average value 64-68 with sufficient criteria, while at the last meeting it was seen on the observed aspects, the average value was 70-84 with good criteria. In the graph above, the diagrams in blue, orange, gray and yellow are the average values of oral communication, social maturity, emotional maturity and intellectual maturity.

Communication ability data obtained from measurements as stated above were analyzed using the normality test, homogeneity test and hypothesis testing. The normality test for the value of communication ability before treatment obtained a Lo value of 0.12471 and a Lt of 0.15435. Because Lo < Lt, the value of communication ability before treatment is stated to be normally distributed. Furthermore, a normality test was carried out for the value of communication ability after treatment and obtained a Lo value of 0.12376 and a Lt of 0.15435. Because Lo < Lt, the value of communication ability after treatment was declared normally distributed, then a homogeneity test was carried out between the two data groups. The homogeneity test was carried out to obtain Fh values of 1.79 and Ft of 1.80. Because Fh < Ft, the two data groups are said to be homogeneous. The final step is to test the hypothesis. In this study, the hypothesis test was carried out using the t-test. From the t-test, it was found that the year was 61.10 and the t was 1.669. Because th > tt then H_O is rejected and Ha is accepted. Thus, it can be concluded that there is a positive influence on the use of context-based physics learning e-modules on students' science communication abilities on students' science communication abilities.

Discussion

The results obtained were also supported by the results of observations in the two sample classes that the use of e-modules in the learning process could improve students' science communication skills in the learning process compared to using the physics learning modules or textbooks that had been provided.

The student learning process using e-modules is better than the student learning process using learning modules as well as textbooks [17]. This happened because during the learning process in the experimental class a lot of students were trained in their understanding by working on the problems in the e-module, the learning atmosphere created was more conducive because students focused on the material in the context-based physics learning e-module. This is also supported by the observation sheet, in each indicator of students' scientific communication skills in the learning process which gets a very good category. This means that students are more active when learning to use context-based physics learning e-modules.

In addition, when studying using e-modules students feel more interested and motivated than learning using physics learning modules or textbooks. This happens because in the e-module there are videos of observations related to everyday life that support learning and make students interested in reading them, while in the learning modules or textbooks only contain writing and not many pictures or videos explaining the material. Textbooks and learning modules are usually dominated by long writing, so that students have difficulty understanding the material and are lazy to read it. If you look at the research process, students are very motivated during learning to use the electronic physics module because the electronic module can display text, color, sound, sound, video, animation and images.

The use of e-modules can improve students' cognitive abilities, where in the context-based physics learning e-module there are practice questions [18]. This means that with practice questions related to everyday life related to the material being taught, students become accustomed to solving problems related to the material they have learned and hone students' analytical skills by involving the process of breaking down material into parts. In addition, data on students' science communication skills were obtained from observations carried out at each meeting. Science communication skills are only seen in optical instruments and global warming. This study examines the effect of using context-based physics learning e-modules on students' science communication skills. Post-research students' science communication skills were higher than pre-treatment communication skills related to optical instruments and global warming. This is because the use of e-modules in context-based physics learning has several advantages over previous learning that did not use e-modules for context-based physics learning. The role of context-based physics e-module on students' science communication skills can be reviewed during learning. At the initial meeting, the researcher gave a link to the physics learning e-module on optical devices about eyes and glasses to motivate students [19].

Overall learning using the context-based physics learning e-module can improve students' science communication skills. That is, it can be said that the e-module has several advantages. First, this e-module is presented on the basis of a context that requires students to play an active role in the learning process and this student activity can improve students' science communication skills in the physics learning process. Second, this e-module does not only contain material, assignments and exercises. However, there are videos that will make it easier for students to remember and understand the material through depicting concepts related to everyday life.

Third, there are questions before the material is presented, this can stimulate students to construct their own understanding of the material they are studying. Fourth, there are examples of questions and practice questions in the e-module, enabling students to solve problems related to the material they have learned. Fifth, education is more efficient, because learning materials are arranged according to academic level [20].

Context-based physics learning e-module besides having several advantages also has several weaknesses. First, the e-module in operation requires electrical energy to turn on computers and cellphones, if there is a power cut, the learning process will be hampered. Second, the limited number of computers and cellphones used in schools has caused some students to bring their own cellphones so that learning can run in a conducive manner. Third, the e-module has technical weaknesses in the learning process. Fourth, the context-based physics learning E-module used is learning that utilizes technology. So to access the context-based physics learning E-module, an internet network is needed. However, at the time the research was taking place, the network was in a poor condition in the research area. This causes the video playback duration to be longer. To play a video that is about 10 minutes long it may take up to 15 minutes. This resulted in the time allocation that had been prepared in the lesson plan could not be achieved. Apart from these weaknesses, overall the context-based physics learning e-module can improve students' science communication skills and obtain positive responses from students in the learning process [21].

IV. CONCLUSION

The results of the observation sheet for students' science communication skills in the research classes increased significantly, where the use of e-modules in the experimental class increased students' science communication skills compared to the use of modules or textbooks in the control class. Based on the conclusions that have been obtained in the research, the author suggests that teachers and students can use context-based physics learning e-modules as an alternative effort to improve students' science communication skills in physics learning.

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