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Application of E-Module to Identify Students' Science Process Skills in the Practicum of Refraction on Prisms

Aprilita Ekasari[1], Maulidinah[2]
[1,2]Department Physics Education, Universitas Masumus, Papua Selatan, Indonesia

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ABSTRAK

Research Objectives: The objective of this research is to determine the level of science process skills of Physics Education students at the University of Masumus in the practice of habituation in basic physics prisms towards the use of e-modules.

Methodology: This research is a descriptive research type. The approach used in this research is a quantitative approach. The implementation of this research was conducted in October 2019. The number of samples in this study were all 2018 physics education students, totaling 40 people. This study used a sampling technique, namely total sampling.

Main Findings: The results of research conducted by researchers, it is known. In the Science Process Skills Research of Physics Education Students at the University of Masumus in the prism refraction practicum using the e-module, the results were very good, this can be seen from the percentage results for each indicator. the use of e-modules can increase the level of student process skills in carrying out practicum activities.

Novelty/Originality of Research: Novelty in research is in the form of analyzing the science process skills possessed by physics education students at the University Masumus.

Corresponding Author:
Aprilita Ekasari,
Physics Education, Universitas Masumus, Papua Selatan, Indonesia,
Jl. Kamizaun Mopah Lama, Rimba Jaya, Kec. Merauke, Kabupaten Merauke, Papua 99611, Indonesia
Email: aprlitia_eka936@gmail.com

1. INTRODUCTION

Education is a process of improving the quality of life, as well as acquiring and inculcating skills carried out by students. Education is an effort to provide certain knowledge, insight, skills and expertise to humans to develop their talents and personality [1]. This requires education to continue to be developed continuously in accordance with the times [2][3]. Education is the most powerful weapon that can be used to change the world [4][5]. The aim of education in Indonesia is to increase human resources who are faithful, pious, virtuous, disciplined, responsible, and have high intellectual intelligence [6]. Learning is not just a series of transferring knowledge from educators to learners which is rigid in nature [7][8]. In education in Indonesia itself, there are several levels, one of which is the senior high school level [9][10]. Senior High School is a level of education that must be taken by students before continuing to higher education. In senior high school education studies various sciences, one of which is studying physics.

Physics is one of the compulsory subjects for students at the senior high school level. Physics is learning with science that discusses something that is in nature [11]. Physics is one of the subjects that discuss real phenomena and symptoms. Physics learning that races on concepts requires a high understanding [12][13]. Physics is a branch of science that has its uniqueness and characteristics [14][15].

Physics is seen as a process and a product, so that the learning strategies or methods used must be effective and efficient [16][17]. Physics plays an important role in explaining various phenomena that occur in the universe [18][19]. Physics has become one of the subjects related to science education [20][21]. Physics lessons related to practical activities.

Practicum activities will form science process skills in students. Science process skills are skills that need to be instilled in practice, and are owned by students [22][23]. Science process skills are thinking skills that are used to create knowledge, solve problems and formulate results [24]. Students' science process skills can be seen from practicum activities that lead to concepts in learning and applying science [25].

Science process skills are tools students use to investigate the world around them and to construct science concepts [26][27]. Science process skills are skills that involve cognitive or intellectual, manual, social, mental and physical aspects that serve as necessary tools for effective learning, problem solving, and individual and group development [28][29]. So from the above research it can be concluded that science process skills are a set of complex abilities commonly used by scientists in conducting scientific investigations into a series of learning processes.

Science process skills are divided into two groups, namely basic and integrated science process skills [30]. Basic science process skills include observation, classification, measuring, predication, communication and concluding [31]. Whereas integrated science process skills include identifying variables, compiling data tables, making graphs, obtaining and processing data, describing relationships between variables, identifying variables operationally, making hypotheses, analyzing experiments, designing investigations, and conducting experiments [32]. From the above understanding shows that with process skills, students try to find and develop cognitive and psychomotor abilities.

Students' Science Process Skills can be applied through information and communication technology. Information and communication technology (ICT) has a very large influence on efforts to develop students' skills in the learning process. "Education in the present very much requires the use of technology to improve the competence of increasing human resources" [33]. Along with the development of ICT, especially the internet, the opportunities for implementing e-learning are very large. "By using e-learning, students will become more motivated in learning" [33]. The application of e-learning focuses on requiring students to be independent in learning, so the development of priority learning tools is e-modules (electronic-modules)[34]. E-module is an ICT-based module, E-module has its own advantages compared to printed modules. E-module has interactive properties that make it easier, can display/load images, audio, video and animation and is equipped with formative tests/quizzes that can be used as feedback. in helping users. The way that can be done to train students' science process skills is by getting them used to solving as an approach to learning physics [35].

In this study the researchers conducted research on basic Science Process skills and integrated them on observation indicators, measuring, analyzing investigations, and conducting experiments on prism refraction material, prism refraction is basic physics practicum material II which is being studied by Jambi University physics education students semester 2 class of 2018. Basic Physics II is one of the compulsory Physics subjects in the Physics education study program at Jambi University [36]. Refraction of light can occur in prisms, among other things applied to the working principle of a device, namely a spectrometer in the form of an optical device used to observe and measure the angle of deviation of incident light due to refraction and dispersion [37]. According to "The development of such scientific concepts will support subsequent capabilities such as creativity, critical thinking skills, and greater accuracy or abilities, where such abilities are often used in everyday life"[38]. "The development of such scientific concepts will support subsequent capabilities such as creativity, critical thinking skills, and greater accuracy or abilities, where such abilities are often used in everyday life"[39]. Basic physics practicum that uses E-modules really helps educators in creating students' science process skills, e-modules are developed to develop students' individual abilities in investigating objects, symptoms, and problems where educators act as facilitators and commentators on the problems raised. faced by students in determining work procedures, data analysis, and drawing conclusions. Because in the developed e-module there are various science activities that students can do individually.

The purpose of this study was to determine the level of science process skills of Physics Education students at Musamus University in the Habitation practicum on the prism of basic physics II on the use of e-modules. It is hoped that through this research basic references will be obtained in the use of e-modules both in practicum and in learning and can improve students' science skills.

2. RESEARCH METHOD

This research is a type of descriptive research. Descriptive research is research that is intended to collect information about the status of a symptom according to what it was at the time the research was conducted. The approach used in this research is a quantitative approach. The implementation of this research was conducted in October 2019. The research population taken was physics education students from the Physics Education Study Program, Faculty of Teacher Training and Education, Musamus University class of 2018, who took basic

physics course 2. The research sample was all physics education students class of 2018 who totaling 40 people. This study used a sampling technique, namely total sampling [40]. In the total sampling technique, the more samples used, the smaller the error rate.

The instrument used in this study was a validated science process skills observation sheet. What was observed in this study were the process skills possessed by students when carrying out practicum activities at the Physics Education Laboratory at Musamus University using e-module-based guides. This observation was assisted by 25 observers. .Science process skills in observation are divided into two categories, namely basic science process skills and integrated science process skills. The basic process skills observed are the indicators of observation, measuring. The integrated process skills observed are analyzing investigations and conducting experiments [25]. The acquired science process skills data were analyzed using descriptive statistics. To determine students' mastery of science process skills consists of 4 criteria as shown in Table

Table 1. Intervals for mastering basic science process skills in observing and measuring

	Interval	Category		Interval	Category
Observation	5.00 – 8.75	Very Not Good	Measurement	1.00-1.75	Very Not Good
	8.76 – 12.50	Not good		1.76-2.50	Not good
	12.51 – 16.25	Good		2.51-3.25	Good
	16.26 – 20.00	Very good		3.26-4.00	Very good

Table 2. Interval of mastery of integrated science process skills Analyzing experiments and conducting experiments

	Interval	Category		Interval	Category
Analyze experiments	4.00 – 7.00	Very Not Good	Do an experiment	9.00-14.75	Very Not Good
	7.10 – 10.00	Not good		14.76-20.50	Not good
	10.10 – 13.00	Good		20.51-26.25	Good
	13.10 – 16.00	Very good		26.26-32.00	Very good

3. RESULTS AND DISCUSSION

Mobile Learning is something close to physics education students. However, the use of mobile learning in practicum based on practicum manuals is expected to provide new experiences for physics education students. Shafila Sahnaz, Harlita, (2018), states that the use of e-modules can improve communication between students and practicum instructors, students can obtain learning resources, study materials and gain new learning experiences. In this study I will identify the level of science process skills of Musamus University Physics Education students in the prism refraction practicum using an e-module based practicum guide. This media provides various features that can help users to get teaching materials quickly and easily and provide effective assessment instruments because e-modules can be accessed by anyone, anytime and anywhere but still pay attention to aspects of science process skills [42].

There are 2 indicators of basic science process skills used in this study. The results of the 2 indicators of students' basic science process skills can be seen in the following table:

Table 3. Description of Basic Science Process Skills On Observation And Measuring Indicators In Basic Physics Practicum Ii On Prism Refraction Material

Classification			%	Mean	Median	Min	Max
Indicator	Interval	Category					
Observation	5.00-8.75	Very Not Good	12.5	14.37	16.00	5.00	20.00
	8.76-12.50	Not good	17.5				
	12.51-16.25	Good	32.5				
	16.26-20.00	Very good	37.5				
Total			100.0				
Measurement	1.00-1.75	Very Not Good	10.0	3.02	3.00	1.00	4.00
	1.76-2.50	Not good	17.50				
	2.51-3.25	Good	32.5				
	3.26-4.00	Very good	40.0				
Total			100.0				

Table 3. shows that the indicators for observing and measuring indicators are included in the very good category with a percentage of 37.5% and 40.0% respectively. There are 2 indicators of integrated science process skills used in this study. The results of 2 indicators of students' integrated science process skills can be seen in the following table:

Table 4. Description of Integrated Science Process Skills On Indicators Of Analyzing Experiments And Conducting Experiments In Basic Physics Practicum II On Refraction Of Prisms.

Klasifikasi			%	Mean	Median	Min	Max
Indicator	Interval	Category					
Analyze experiments	4.00-7.00	Very Not Good	10.0	12.3	12.00	4.00	16.00
	7.10-10.00	Not good	15.0				
	10.10-13.00	Good	40.0				
	13.10-16.00	Very good	35.0				
Total			100.0				
Experiment	9.00-14.75	Very Not Good	12.5	24,75	26,5	9.00	34.00
	14.76-20.50	Not good	17.5				
	20.51-26.25	Good	25.0				
	26.26-32.00	Very good	45.0				
Total			100.0				

Table 4 shows that the experimental indicators are included in the good category with a percentage of 40.0% and the indicators conducting experiments are included in the very good category with a percentage of 45.0%.

Based on the results of the research, it was found that Physics Education students at Musamus University were in the very good category when doing practicum on refraction material on prisms using a mix of practicum based on Electronic Modules. "Process skills are student learning outcomes because science process skills emphasize learning processes, activities, creativity, values and also student attitudes that will be applied in everyday life."[43]. In this study, 2 indicators were used to assess basic science process skills, namely observing and measuring while evaluating integrated science process skills using 2 indicators, namely analyzing experiments and conducting experiments.

On the observation skills indicator, 37.5% of the 96 students were classified as very good at making observations. It is based on the use of e-module based guides. The observing indicator (observation) is visible when students observe to collect data about observations of refraction in prisms. Students make observations to find facts related to the practicum material. For example, students observe the tools and materials used in the experiment, students observe the path of light on a prism, students observe the angle of incidence and the angle of refraction of light on a prism. Sahnaz, Harlita, & Ramli (2018), states that "Observation skills are skills in identifying differences and similarities in an object". Observation activities are useful for fulfilling curiosity. From the observation process students can make tables to describe the results and explain them in graphs. Mastery of observation skills has a good impact on students, where students can connect direct experience with the theory that students know. This is in line with research that has been done. The use of e-modules can improve students' science process skills [33].

In the measurement skills indicator, 40.0% of the 96 students were classified as very good at measuring. In the measurement indicator in the refraction experiment on a prism, it can be seen when students are able to measure the angle of incidence 1 with the angle of refraction 1 (i_1 and r_1) and the angle of incidence 2 with the angle of refraction 2 (i_2 and r_2) using an arc for (i_1≥45 °) with skilled and precise procedures, this proves that student skills are measurable when students are able to measure objects according to measurement standards.

Integrated science process skills namely analyzing experiments and conducting experiments. The ability to observe is the most basic skill that supports the mastery of the next skill. When students make observations and analyze the results of observations, students will find patterns that can predict conditions that have not occurred or have been observed. In the experimental analysis skills indicator, 40.0% of the 96 students were classified as good in conducting experimental analysis. The indicator for analyzing the experiment in the refraction experiment of the prism can be seen when students are able to analyze the tools used in the prism refraction experiment. In the experiment skill indicator, 45.0% of the 96 students belonged to the very good category in conducting the experiment. The indicator of conducting an experiment in the refraction practicum of prisms can be seen when students are able to prepare tools according to the purpose of the experiment, students are able to place prisms on graph paper , students are able to insert a needle at an angle of i±45°, i≤45°, i≥45° from the normal line, students are able to insert a Q needle in line with the P needle in terms of the opposite side of the prism, students are able to insert R and S needles in line with the P needle and Q is on the right side of the prism, students are able to connect points from Q, P, R, S, students are able to extend the PQ and RS lines with apparent, students are able to determine the angle deviation (D) and students are able to determine the incident ray (i_1, i_2), ray bias(r_1,r_2).

So the research that has been done shows that very good results are obtained because this is supported by the use of practicum guidelines in the form of e-modules. E-module can improve students' scientific process skills [45]. By using the e-module students are able to carry out laboratory activities independently, students can make experimental data with good practical results. Students write down the measurement results in the table

according to the experimental data obtained during the practicum, students are able to make a repetition of measurements table based on the number of experiments carried out, and students can determine the label/table title that corresponds to each experimental column. students are skilled in observing, measuring, analyzing experiments and conducting experiments. The scientific attitude possessed by students is very influential in practicum activities, this can help students in obtaining knowledge independently here, not only cognitive abilities are prioritized but also psychomotor and affective abilities [46].

4. CONCLUSION

In the Science Process Skills Research of Physics Education Students at Musamus University, the results of the percentage of each indicator. In each indicator students are able to carry out experiments skillfully and correctly, for example, students are skilled in observing, measuring, analyzing experiments and conducting experiments. So the use of e-modules can increase the level of student process skills in carrying out practicum activities and e-modules really help educators in creating students' science process skills, e-modules are developed to develop students' individual abilities in investigating objects, symptoms, and problems problems where educators act as facilitators and commentators on problems faced by students in determining work procedures, data analysis, and drawing conclusions. Because in the developed e-module there are various science activities that students can do individually.

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