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A Study of Student Science Process Skills: In Formal Change Practices

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ABSTRAK

Research Objectives: This study aims to describe students' science process skills in the transformation practicum using an m-module based manual.

Methodology: This study used a descriptive qualitative approach involving 40 physics education students at Jambi University. The sampling technique used is total sampling. The data collection instrument used the observation sheet of science process skills. The science process skills that are focused are basic science process skills, namely communication and measuring as well as integrated science process skills making graphs and describing relationships between variables.

Main Findings: The results of this research were Jambi university physics education students who had good science process skills, especially measurement skills, 65% of the 40 students were in the very good category. This is also influenced by the effective use of e-modules and m-modules that are attractive to students.

Novelty/Originality of Research: The effectiveness of the use of the m-module is seen in the good basic abilities of students in the practice of changing forms. Therefore, basic science process skills influence the development of integrated science process skills, where communication and measurement skills are part of basic science process skills.

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1. INTRODUCTION

Education is a continuous process that has the goal of providing better quality human resources. Educational goals will be achieved if the quality of education is achieved [1]. Education is an activity that aims to prepare students to become professional educators who have the task of guiding, training, building knowledge, skills, and habits in life [2]. Basically education is a conscious and planned effort in creating a learning atmosphere and learning process so that students actively develop their potential [3]. With education, it will change the way of thinking to be more active and more practical because with education it will change people who do not know to know and those who already know to understand and the good ones will lead a person to become a competent and innovative person and vice versa [4]. Recognizing the importance of education, one thing that needs to be improved is the learning system [5]. This improvement can be in the form of cognitive, affective or psychomotor [6].

In education in Indonesia, there are several levels of education, one of which is the tertiary level [7]. Higher education as a form of education is owned by various faculties, supported by the Teaching and Education Faculty (FKIP) [8]. One part of FKIP is a physics education study program which has the goal of creating graduates who also meet the Indonesian National Qualifications Framework (KKNI). The IQF explains that

learning outcomes are abilities acquired through internalization of knowledge, attitudes, skills, competencies, and work experience accumulation [9]. To achieve the goals of teacher education programs, educational academic programs must include important elements such as practicum experiences [10]. Practicum activities will go well if you master the process skills.

Process skills are a learning approach that refers to the growth and development of existing skills in students [11]. Science process skills have a very important role in the learning process, but in reality science process skills have not been optimally developed [12]. Science process skills contain components of basic and integrated process skills. Science process skills are divided into basic science process skills and integrated science process skills [13]. Basic science process skills can make students active while integrated science process skills are skills that see whether something can work and whether it can answer questions through experimentation [14]. Science process skills are skills that must be possessed by a physics student as a teacher candidate, process skills are skills acquired through basic skills [15].

Basic science process skills consist of observation, communication, classification, measurement, inference, and prediction skills. Meanwhile, integrated process skills consist of skills in identifying variables, creating data tables, creating graphs, describing relationships between variables, obtaining and processing data, investigative analysis, defining variables operationally, making hypotheses, designing investigations, and conducting experiments [16]. Science process skills, both basic science process skills and integrated science process skills, really need to be mastered by physics education students as prospective teachers [17]. As a support for the implementation of practicum, it is necessary for the efforts of educators, in this case lecturers in charge of courses, in preparing teaching materials in the form of guidelines or relevant practicum guides [18]. To support practicum, a manual media is needed which is based on aspects of science process skills. One of the efforts to improve students' science process skills in practicum is by making practicum guides that are able to improve students' science process skills [19].

As a learning tool used in learning activities, teaching materials such as practicum guides are needed to support the learning process at the tertiary education level [20]. The use of the practicum manual media is very helpful for students in practicing their science process skills. Learning media is growing along with technological developments in the current era of the industrial revolution 4.0. Technological advances can be utilized in the learning process both in developing learning tools and media [21]. The use of technology in learning is one of the handbooks for basic physics practicum II based on mobile learning [22]. Mobile learning is learning that can be done through the use of mobile devices [23]. E-learning is one of the things that can be used by lecturers in the learning process [24]. The use of technology as a learning instrument provides real experience to students and the results of the learning have a high level of validity [25]. Mobile-based learning media is currently the center of attention for educators [26]. The existence of trendy learning media can support the learning process [27]. In addition, students will find it easier to access guides simply by using gadgets or computers anywhere and anytime, thus enabling students to get direct feedback and master learning thoroughly [28].

Physics is a branch of natural science which has its own uniqueness and characteristics [29]. In addition, physics can incorporate abstract concepts and requires idealization through mathematical modeling [30]. In the physics learning process, students are required to be able to solve the problems given [31]. Problems that often occur in the physics learning process include the low ability of students to explain physics principles [32]. In the process of learning physics, besides carrying out cognitive and affective assessments, it is very necessary to also carry out psychomotor assessments [33]. Learning science is a process of experiencing and producing knowledge acquisition in the form of understanding concepts [34]. The material for changing forms in physics practicum aims to help students gain knowledge about the concept of changing forms independently so as to train students' skills. According to [35] the development of science process skills at the education level must continue to be done because in reality in the field there are still students and teachers who have not yet mastered the science process skills. This study aims to determine students' mastery of science process skills in the transformation practicum using the m-module-based guidebook in terms of 4 indicators namely 1) communication, 2) measuring, 3) graphing, 4) describing the relationship between variables.

2. RESEARCH METHOD

This research uses a quantitative approach with descriptive methods. Quantitative descriptive research can provide extensive information about an event [36]. The research was conducted in the physics education laboratory at Jambi University. Jambi university physics education students in 2018 regular class B who teach basic physics II courses are the research population. The research sample was 40 students of physics education at Jambi University in 2018 regular class B. This study used a sampling technique, namely total sampling. This technique is considered the most accurate technique and is free from the influence of sample errors [37], so it is very suitable for use in this study.

The data collection technique used was to observe students' science process skills using observation sheets. The indicators of science process skills observed in this study are limited, namely communication, measuring, graphing and describing the relationships between variables that students have when carrying out practicum activities in the physics education laboratory at Jambi University. This observation was assisted by 16 observers. The percentage of the data obtained was sought and then expressed in several categories including very bad, not good, good and very good and analyzed using descriptive statistics. Descriptive data analysis is useful for knowing the interactions between these variables by calculating the distribution of frequencies, averages, and standards [38].

Table 1. Categories of Student Science Process Skills

Interval	Category
25.00 – 43.75	Very not Good
43.76 – 62.50	Not Good
62.51 – 81.25	Good
81.26 – 100.00	Very Good

3. RESULTS AND DISCUSSION

The results of this study were obtained from the assessment of science process skills using observation sheets. The assessment aims to determine the extent to which the student's skill level is then used to make decisions [39]. Table 2 shows the results of the statistical description analysis on basic science process skills, namely communication skills with an average student score of 6.57 out of a maximum score of 8.00. With a value scale from 3.00 to 8.00 and a median of 6.00. In measuring skills, an average of 10.05 is obtained with a maximum value of 12.00 and a minimum value of 3.00 and a median value of 10.00.

Table 2. Statistical Description Analysis of Basic Science Process Skills

Indicator	Mean	Median	Min	Max
Communication	6.57	6.00	3.00	8.00
Measure	10.05	10.00	3.00	12.00

Observation results of two indicators of basic science process skills and two indicators of integrated science process skills are shown in Table 3 and Table 5.

Table 3. Basic Science Process Skills of Students in Practicum Activities for Change of Being

Classification			%
Indicator	Interval	Category	
Communication	2.00 – 3.50	Very not Good	2.5
	3.51 – 5.00	Not Good	0.0
	5.01 – 6.50	Good	50.0
	6.51 – 8.00	Very Good	47.5
Total			100.0
Measure	3.00 – 5.25	Very not Good	2.5
	5.26 – 7.50	Not Good	2.5
	7.51 – 9.75	Good	30.0
	9.76 – 12.00	Very Good	65.0
Total			100.0

The description of the results of the basic science process skills of physics education students at the University of Jambi on material changes in form is shown in Table 3 with two indicators of basic process skills that are focused on in this study, namely communication and measuring. The importance of basic science process skills for students, especially physics education students where the basic science process skills themselves are insights into the development of intellectual, social and physical skills derived from the fundamental abilities that already exist in students. Students must master basic science process skills first before integrated science process skills [40]. The results of the research on the basic science process skills of indicator students varied from very bad, not good, good, and very good categories.

On the communication skills indicator, about 50% of the 40 students were good at communicating and even 47.5% of students were in the very good category. This can be seen when students carry out experiments on changing forms in the laboratory asking one another. The things they discussed were about how to do experiments, how to use tools properly, why changes in the state of matter could occur and so on. In accordance

with what was stated [41] that learning science which is carried out using laboratory experimental methods can improve students' questioning skills scientifically.

Almost the same as the communication skills indicator, students are also very good at measuring skills, this can be seen from the high percentage of students who fall into the good and very good categories of 30% and 65%. Researchers saw that when the experiment was carried out, students looked very enthusiastic in measuring each material. Apart from being enthusiastic, these students also looked proficient in measuring. Another thing that also influences the acquisition of good grades is the effective use of m-module-based practicum manuals so that they can improve students' mastery of science process skills and make students more motivated to do practicum. M-module become one of the learning media that can motivate practical learning [42]. The next factor is because students have experience in carrying out practicum activities. Reference [43] says that practicum activities are very necessary in training students to carry out investigations such as planning, systematically, and developing science process skills. So it can be said that the mastery of basic science process skills using m-module-based guidebooks for Jambi university physics education students is included in the good category.

Table 4. Statistical Description Analysis of Integrated Science Process Skills

Indicator	Mean	Median	Min	Max
Creating Graphs	3.15	3.00	1.00	4.00
Describe the Relationship Between Variables	6.325	7.00	2.00	8.00

The results of the statistical description analysis on integrated science process skills are shown in Table 4, namely the skill of making graphs with an average student score of 3.15 out of a maximum score of 4.00. With the lowest value of 1.00 and the middle value of 3.00. In the skills of students describing the relationship between variables, an average of 6.325 is obtained with a maximum value of 8.00 and a minimum value of 2.00 and a median value of 7.00.

Table 5. Students' Integrated Science Process Skills in Practicum Activities on Change of Being

Classification			%
Indicator	Interval	Kategori	
Creating Graphs	1.00 – 1.75	Very not Good	2.5
	1.76 – 2.50	Not Good	12.5
	2.51 – 3.25	Good	52.5
	3.26 – 4.00	Very Good	32.5
Total			100.0
Describe the Relationship Between Variables	2.00 – 3.50	Very not Good	5.0
	3.51 – 5.00	Not Good	12.5
	5.01 – 6.50	Good	27.5
	6.51 – 8.00	Very Good	55.0
Total			100.0

The integrated process skills in the practicum activities for transforming the shape of a shape were found that the graphic skills possessed by students were included in the good category with a percentage of 52.5%. This can be seen when students are conducting experiments, they swiftly make graphs of the measurement results obtained. While the skills to describe the relationship between variables by 55% of 40 students are included in the very good category. The researcher also observed the students while doing the experiment, it was seen that the students connected each variable in the shape change experiment. This is also due to the effective use of the m-module and is based on the good basic abilities of students in the practicum of changing forms. This is in accordance with the opinion Darmaji et al, that basic science process skills influence the development of integrated science process skills, where communication and measurement skills are part of basic science process skills [17].

4. CONCLUSION

Based on the observations of researchers during the practicum and the results of data analysis, it was obtained that the science process skills that were well mastered by Jambi university physics education students were basic science process skills, namely measuring skills. Through practicum activities using the m-module based practicum manual can improve students' science process skills.

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