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# Analysis of Scientific Literacy Ability of Students of The Physics Education Study Program at Musamus University

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## ABSTRACT

Scientific literacy is defined as the ability to use scientific knowledge, identify questions, and draw conclusions based on evidence in order to understand and make decisions regarding nature and its changes due to human activities. Physics Education Department students are required to have a good level of scientific literacy. Good scientific literacy is one of the requirements for becoming a professional teacher and educator. This research was conducted with the aim of knowing the scientific literacy level of students of the Physics Education Department at Musamus University. As preliminary research (elementary research) it is hoped that this research can become the basis for subsequent research and development and can be used as a basis for making policies by interested parties. The research method used is descriptive qualitative method using inductive data analysis techniques. The research subjects were students of the Physics Education Study Program at Musamus University level one and level two for the 2022/2023 academic year. The research data was obtained through a literacy test which refers to the development of the TOSLS (Test of scientific Literacy Skills) test kit which consists of 2 indicators which are then broken down into 9 sub-indicators and then the results are analyzed using descriptive qualitative methods. The results showed: (1) The final score of scientific literacy ability of students of the Physics Education Study Program at Musamus University was 48.98 with a very low category, (2) The low scientific literacy ability of students of the Physics Education Study Program at Musamus University was caused by a lack of interest in reading, limited means and infrastructure, limited reading materials and lack of access to information technology in Merauke Regency, poor basic science at the previous level of education, physics education majors were not the desired majors, and lack of demands from lecturers to dig up a lot of information relevant to physics science.

**Keywords:** *Analysis, Scientific Literacy, Physics Education*

## 1. INTRODUCTION

The increasingly complex world of education with its various problems and challenges demands that tertiary institutions, especially the Faculty of Education and Teacher Training, be able to produce human resources for prospective teachers who are qualified, competent, competitive, innovative and able to collaborate and have good literacy in their fields [1]. Scientific literacy is defined as the ability to use scientific knowledge, identify questions, and draw conclusions based on evidence in order to understand and make decisions regarding nature and its changes due to human activities

[2]. Good literacy skills for prospective teachers are very important considering that a teacher is a source of knowledge, a medium of knowledge and a role model for students. In particular, a physics teacher candidate must master the basic concepts of science and supporting scientific methodology [3].

The OECD explains that the understanding of scientific literacy used in the assessment consists of two main indicators, namely: (1) Understanding inquiry methods that lead to scientific knowledge, (2) Organizing, analyzing and interpreting quantitative data and scientific information. Where each of these indicators is further broken down into six nine sub-

indicators [4]. Four sub-indicators from the first indicator and five indicators from the second indicator [5].

Efforts to increase the literacy level of the Government, in this case the Ministry of Education, Culture, Research and Technology of the Republic of Indonesia, have paid serious attention so that since 2015. (Putra & Algiranto, 2023) As a legal basis or legal standing for efforts to increase the literacy level of Indonesian society, the Minister of Education and Culture issued Regulation number 21 of 2015 concerning Growth of Mind Pekerti [7]. The main purpose of issuing this regulation is to motivate students' interest in reading and writing so that noble character grows. In the long term, this is expected to produce Indonesian students or people who have better literacy skills [8]. However, this literacy movement seems ironic with the fact that it is based on the international PISA (Program for International Student Assessment) survey initiated by the OECD (Organization for Economic Co-operation and Development) which was released in 2019. PISA is a program that aims to evaluate the education in the world which is currently being attended by more than 70 countries around the world. The test is conducted every 3 years for students aged 15 years from randomly selected schools. These students took tests in the main subjects, namely reading, mathematics and science [9].

Based on this survey, it was found that Indonesia was ranked 62nd out of 70 countries that took part in the survey, or are the bottom 10 countries that have the lowest literacy rate. In line with these findings, UNESCO, as released by dpr.go.id in 2021, found that Indonesian people's interest in reading is only 0.001 percent. This figure shows that only 1 Indonesian likes to read out of 1,000 surveyed. The results of a different research entitled World's Most Literate Nations Ranked conducted by Central Connecticut State University in which was reported in March 2016, stated that Indonesia was ranked 60th out of 61 countries regarding reading interest [10].

Based on data and findings by these international institutions, it shows that the problem of low literacy among the Indonesian people is an issue that can become an obstacle to Indonesia's vision of becoming a developed country in 2045. Of course, this must receive serious attention from all stakeholders in the country, especially the government, in this case is the Ministry of Education and Culture. Because the level of literacy reflects the quality of human resources (HR) of a nation.

Quality human resources (HR) is a prerequisite for welcoming Indonesia Gold in 2045 [11].

Because of this the authors are interested in measuring the level of physics science literacy by students in the Faculty of Education and Teacher Training. Related research has been carried out by previous researchers, but this has never been done at the Physics Education Department at Musamus University. Among the researchers who have conducted similar research is Elsy Zuriyani who was published in a journal entitled "Science Literacy and Education". The results of this study reveal that scientific literacy is important to integrate into science learning because good scientific literacy skills support the achievement of learning objectives. Similar research was also conducted by Fayhaa N. Al-Momani in an international journal entitled "Assessing the Development of Scientific Literacy among Undergraduates College of Education". The results of this study reveal the importance of scientific literacy in improving the academic abilities of students in science majors and connecting them with social issues [12].

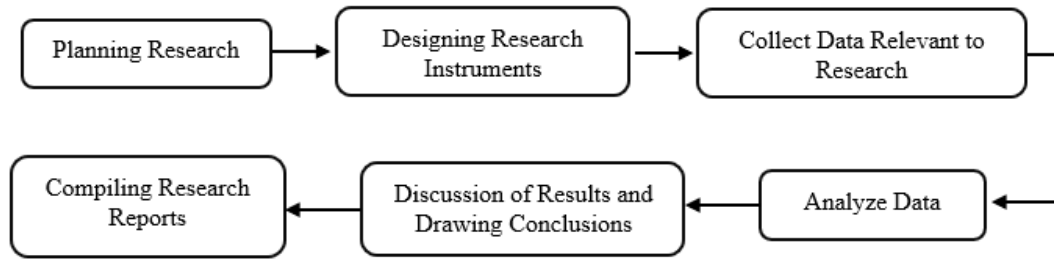
The findings from these studies state the importance of knowing the level of scientific literacy of students in education study programs as prospective teachers as a first step in fostering a culture of scientific literacy among prospective physics teachers as well as a concrete reference step in policy making and strategic planning at Musamus University.

Based on the background of the problem, the problem in this study can be formulated as follows;

- a. What is the scientific literacy level of students of the Physics Education Study Program at Universitas Musamus?
- b. How to learn and influence previous education on the physics science literacy of students of the Physics Education Study Program at Universitas Musamus?

## **2. RESEARCH METHOD**

This research is a descriptive research. The aim of this research is to systematically and carefully describe the facts and characteristics of the subjects studied. This method is used to describe the scientific literacy abilities of students of the Physics Education Study Program at Musamus University. Broadly speaking, the stages in this study can be described according to Figure 1 below;



**Figure 1.** Research flow

Data collection used a research instrument developed from the scientific literacy test indicator reference contained in the development of the TOSLS (Test of scientific Literacy Skills) test tool by Gormally in 2011. The research instrument was developed in the form of a

scientific literacy test which consisted of two indicators and the two indicators were divided again into nine sub-indicators. The indicators and sub-indicators according to the TOSLS can be seen in Table 1 below;

**Table 1.** Literacy test indicators and sub-indicators according to TOSLS [13]

Indicators		Sub indicators	
1	Understand inquiry methods that lead to scientific knowledge	a.	Identify valid scientific arguments.
		b.	Using effective literature.
		c.	Evaluation in using scientific information.
		d.	Understand the elements of research design and how they impact scientific findings.
2	Organize, analyze and interpret quantitative data from scientific information	a.	Represent data with graphs.
		b.	Read and interpret data.
		c.	Problem solving using quantitative abilities including probability statistics.
		d.	Understand and be able to interpret basic statistics.
		e.	Presents predictions and conclusions, based on quantitative data.

The sample in this study were students of the Physics Education Department at Musamus University in their first and second years of the 2022/2023 academic year. The number of samples in this study were 10 people with details of 5 first year students and 5 sophomore students. The reason for selecting grade 1 and level 2 students is that these two levels are still relatively new to joining the Physics Education Department at Musamus University, so it is important to know their scientific literacy abilities. This will be related to the treatment that will be given by the department at a higher level (Putra & Ekasari, 2023).

Sampling in this study using purposive sampling. This technique is a non-random sampling method. In sampling, the researcher first ensures that the sample matches the research objectives so that it is expected to

be able to answer the formulation of the problem that has been formulated (Himawati, 2020).

Data analysis and drawing conclusions were carried out based on the percentage of achievement of physical science literacy skills in the competency domain. The interpretation of the data from the percentage of achievement of physics literacy skills in the competency domain is shown in Table 2 [15];

**Table 2.** Score Data Interpretation Category

Category	Interval
Very high	86-100
High	76-85
Middle	60-75
Low	55-59

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Very low <54

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### 3. RESULT AND DISCUSSION

The results of data processing on the scientific literacy abilities of students of the Physics Study Program at Musamus University can be seen in Table 5. The details of the level of scientific literacy per indicator are as follows.

#### 3.1. Indicators Understand Inquiry Methods That Lead To Scientific Knowledge

This indicator is intended to test the literacy level of Physics Education Department students at Musmus University in their mastery of basic physics concepts. This indicator consists of 4 sub-indicators. Where each sub-indicator is represented by one question. The first sub-indicator question consists of 20 arguments. These arguments were taken from various basic physics literature programmed in the 1st and 2nd semesters of the Physics Department at Musamus University. The results of the literacy test obtained for this first indicator are as follows;

**Table 3.** Results of The First Indicator Literacy Test

Respondent	Percentage of correct answers (%)
	62,5
	10
Indicator 1	80
	61
Average	53,375

#### 3.2. Indicators organize, analyze and interpret quantitative data and scientific information

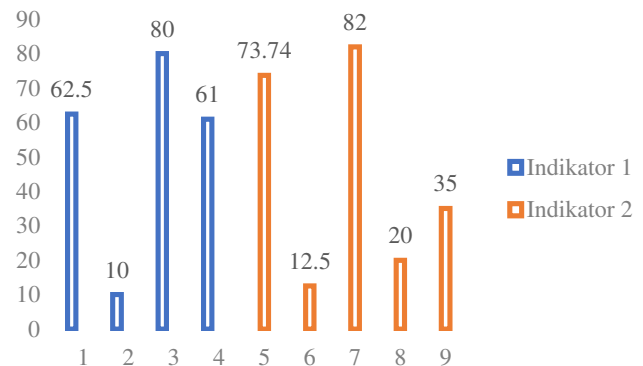
This indicator is intended to test the literacy skills of students of the Physics Education Department, Musamus University, how to browse valid and effective literature, interpret quantitative data, basic research knowledge and the ability to conclude and express in their own language the data presented in graphs, diagrams, tables and scientific maps. This indicator is further broken down into five sub-indicators where each sub-indicator is

represented by one question. The results of the literacy test obtained on this indicator can be seen in Table 4 below;

**Table 4.** Results Of The Second Indicator Literacy Test

Respondent	Persentase jawaban benar (%)
	73,34
	12,5
Indicator 2	82
	20
	35
Average	44,57

The percentage of each sub-indicator can be seen in the chart below!



**Figure 2.** Percentage of correct answer for each sub-indicators

In more detail, the percentage of correct answers for each indicator is presented in Table 5 below,

**Table 5.** Percentage of correct answers for each indicator

Indicators	Sub indicators	Score	Category
1 Understand inquiry methods that lead to scientific knowledge	a. Identify valid scientific arguments.	62,5	Middle
	b. Using effective literature.	10	Very low
	c. Evaluation in using scientific information.	80	High
	d. Understand the elements of research design and how they impact scientific findings.	61	Middle
2 Organize, analyze and interpret quantitative data and scientific information	a. Represent data with graphs.	73,34	Middle
	b. Read and interpret data.	12,5	Very low
	c. Problem solving using quantitative abilities including probability statistics.	82	High
	d. Understand and be able to interpret basic statistics.	20	Very low
	e. Presents predictions and conclusions, based on quantitative data.	35	Very low
<i>Final score</i>		48,98	Very low

The results of the final analysis of student literacy test scores show that there are quite large percentage variations between the sub-indicators. The correct answer that gets the highest percentage is the third sub-indicator in the second indicator with the percentage of correct answers reaching 82% in the high category. While the correct answers with the lowest percentage are found in the second sub-indicator in the first indicator with a correct answer percentage of only 10% with a very low category. The average percentage of correct answers in the first indicator reached 53.375% with a very low category. This figure is higher than the average percentage of correct answers in the second indicator which is only 44.57% in the very low category. Of all the sub-indicators, none are in the very high category, two are in the high category, three are in the moderate category, none are in the low category, and four are in the very low category. The final average score was 48.98 in the very low category.

Based on the interviews and observations that the authors conducted, the very low ability of the physics science literacy of the Physics Education Department students at Musamus University was caused by many factors including; (1) lack of interest in reading among students, (2) Limited supporting facilities and infrastructure such as reading materials and limited information technology in Merauke Regency, (3) Basic science that was not good at the previous level of education (4) Physics education major was not the desired major, (5) Lack of demands from lecturers to dig up a lot of information relevant to physics

#### 4. CONCLUSSION

The scientific literacy ability of students of the Physics Education Study Program at Musamus University received a final score of 48.98. This figure is

categorized as very low. Based on the interviews and observations that the authors conducted, there are many factors that cause the low literacy level of Musamus University Physics Education students including (1) lack of interest in reading among students, (2) Limited supporting facilities and infrastructure such as reading materials and limited information technology in Merauke Regency, (3) Basic science that was not good at the previous level of education (4) The physics education department was not the desired major, (5) Lack of demands from lecturers to dig up a lot of information relevant to physics science.

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