

# Analysis of comprehension scientific literacy concept of science education students at UNIMUDA Sorong

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**Abstract.** The aims of this study is to find out how students of science are comprehended about science literacy concepts with the indicators of basic concepts of science, process of science, and the concept of science. The research approach is a descriptive study. The formulation of the problem is how to comprehend the concept of literacy in the education students of the Faculty of Teacher Training and Education at UNIMUDA Sorong in the academic year 2018/2019. The sample consisted of 20 students in 3rd semester students who followed in the Science Concept Basic Subject. Data collection techniques used multiple choice tests. The analysis technique used percentage formula. Then it is done through data reduction, data presentation and conclusions. The result of this research showed that most of the students of science already mastered the science literacy concepts. The criteria which has been appointed by PISA 2015 that is, the basic literacy science concept, the students achieved 66% (very high), the content of science is 60% (high), the process of science is 52% (enough), the science application context is 43%. So based on the result it needs to improve science learning in the content and context science through observation, demonstration, and practice process. So the students will be trained in writing practice report and deliver their observation result that has been conduct in science laboratory.

## 1. Introduction

Developed nation is not only built by relying on abundant natural wealth and a large population. A large nation is characterized by a literate society, which has a civilization and is actively advancing the world community [1]. In this context literacy is not only a matter of how a nation is free from illiteracy, but also more importantly, how citizens have the life skills to be able to compete with other nations to create prosperous world. In other words, a nation with a high literacy culture shows the nation's ability to collaborate, think critically, creatively, and communicatively, so it can reach the era of the industrial revolution 4.0.

Now days, it has entered the era of the industrial revolution 4.0 where industrial change is accelerating due to advances in science and technology to fulfil human needs. The rapid development of the industry demands that the state must move quickly in building the future of the nation and the state will be at the forefront. To realize this dream the government must prepare students and their environment to be able to compete globally, one of the methods used is to increase the ability of scientific literacy in students. Increasing the understanding of the concept of scientific literacy in students is the goal of developing countries by integrating it into the learning objectives in schools, this has also been done by our country Indonesia. The first step taken by the Indonesian government is to create a comprehend of the concept of scientific literacy to the students.

Scientific literacy in Indonesia learning is still lack. This is evidenced by the results of the 2015 Program for International Student Assessment (PISA) research showing the average science score of OECD countries is 493, while Indonesia has only reached a score of 403 and ranked 62 out of 70 countries [2]. In Indonesia Science Literacy is perceived only in learning science. Science learning is also mostly limited to textbooks/texts. This is due to the narrow interpretation related to PP No. 13 of 2015 Article I paragraph 23 which explains that "textbooks are the main source of learning to achieve basic and core competencies". Science literacy in learning in Indonesia is perceived only in science

learning. Science learning is also mostly limited to textbooks/texts. This is due to the narrow interpretation related to PP No. 13 of 2015 Article I paragraph 23 which explains that "textbooks are the main source of learning to achieve basic and core competencies". According on this the researcher is interested in analyzing the understanding of the science literacy concept of science education students as prospective teachers.

Science Literacy directs students to apply the concepts of natural science and natural phenomena in daily life through scientific activities that formulate problems, formulate hypotheses, set research variables, establish work procedures, collect data, process and analyze data, make conclusions and communicate research results , so it can be concluded that scientific literacy is a human effort to use natural science through scientific processes including identifying problems, gathering evidence, analyzing the evidence so that it can draw conclusions based on findings in order to understand the universe and its phenomena.

Science Literacy is the main key to face the challenges of the 21st century to meet the needs of water and food, control disease, produce enough energy and deal with climate change [3]. Many issues arise at the local level when individuals deal with decisions relating to practices that affect health and food supply, the use of appropriate new materials and technologies, and decisions about energy use. Science and technology have major contributions related to all the challenges above and all challenges will not be resolved if the individual does not have a scientific awareness. Science literacy helps us to shape mindsets, behaviour, and build human character to care and be responsible for himself, society, and the universe, as well as the problems faced by modern societies that depend heavily on technology. Based on the previous explanation, it can be concluded that students are very important to learn and know the concepts of scientific literacy in order to understand living things and their processes, economics, environment and other problems faced by modern society which are very dependent on technology and the progress and development of science. The indicators of scientific literacy according to PISA are the concepts of scientific literacy, science processes, science content and the context of science applications.

According to the background above, the purpose of this study is to find out how science education students of the Faculty of Teacher Training and Education of UNIMUDA Sorong able to comprehend the concepts of scientific literacy.

## **2. Method**

This study used descriptive. It is the search for facts with the right interpretation, descriptive methods describe, explain and summarize the various problems that occur in society and try to pull that reality to the surface as character traits, traits, models, signs or descriptions of conditions particular situation or phenomenon. According to Arikunto (2013), descriptive research is not intended to test certain hypotheses, but only describes what they are about a variable, phenomenon or condition, that is, the state according to what it was at the time the research was conducted [4]. This study examines the forms of activities, characteristics, relationships, changes, similarities and differences with other phenomena. The purpose of this study is to analyze and describe the understanding of scientific literacy concepts through indicators of the basic concepts of scientific literacy.

### **a. Data and data sources**

Arikunto (2013) states that the intended source of data in the study is the subject from which the data was obtained [4]. Data source is something that is very important, because it can help the birth of quality research. Data sources consist of primary and secondary data sources. The primary data in this study are the results of interviews and test results from students, while for secondary data is by documentation, data is collected through written information

### **b. Technique of data collection**

To find out the average student who understands the concept of scientific literacy, we used data collection techniques, they were tests and interviews. Test scores are obtained from the ability to understand the concepts of scientific literacy in the form of multiple-choice tests. The interview in this study is in the form of an outline of the question of the problem solving process of the research

subject related to problem solving that is adjusted to the research indicators that have covered how to solve the problem according to the pattern.

**c. Technique of data analysis**

To find out the average student who understands the concept of scientific literacy, the researchers conducted research using data collection techniques, namely tests. Test scores were obtained from the ability to understand the concepts of scientific literacy in the form of multiple-choice tests.

Table 1. Science Literacy Assessment Components

No	Assessment of Science Literacy Concepts Understanding
1.	Concept of Basic Literacy a. Definition of Scientific Science b. Dimensi Literasi Sains c. The purpose of Science Literacy d. Factors Causing Low Literacy
2.	Process of Natural Science a. To identify science question b. To explain Phenomena Scientifically
3.	Context of Natural Science a. To comprehend natural science, norms and methods of science and scientific knowledge b. To comprehend the key of science concept c. Relationships Competencies in the context of science, the ability to read, write and comprehend human knowledge systems
4.	Natural Science Application Context a. To Apply some scientific knowledge and ability to consider in everyday life

To conduct the data analysis on the test. It is using percentage with average as showed below:

$$P = \frac{F}{N} \times 100\%$$

Evidence:

- P = the percentage will be calculate
- F = the total of test frequency from each data
- N = the total of whole final evaluation
- 100% = The constant calculation

Score interpretation as follows:

- 81% - 100% = Very high, 61% - 80% = High
- 41% - 60% = Enough, 21% - 40% = Low
- 0% - 20% = Very Low

**d. Validity test**

To determine the validity of the data required inspection techniques. Examination. The implementation of the inspection technique is based on a number of certain criteria [5]. Data validity test in qualitative research includes the credibility test (Internal Validity), transferability (external validity), dependability (reliability), and conformability (objectivity) [6]. In this study, the researcher is using validity test.

- 1) *Transferability* (Eksternal Validity)  
 The concept of Validation states that the generalization of an invention can apply and be applied to all contexts in the same population on the basis of the findings obtained in a representative sample representing that population [5].
- 2) *Depentability* (Reliability)

Reliability Tests are carried out to examine whether the qualitative research process is quality or not. By checking whether the researcher is careful enough, whether the researcher made a mistake in conceptualizing the research plan, collecting data, and interpreting it.

### 3. Result and Discussion

Table 2. Results of Component Assessment on Comprehension of Science Literacy Concepts in Students

No	Component of the assessment of comprehension the concept of science	%	Score Interpretation Criteria
1	Concept of basic science literacy		
	a. Definition of Science Literacy	90	Very high
	b. Dimension of Science Literacy	88	Very high
	c. Purpose of Science Literacy	40	Enough
	d. Factor causing Low Literacy	45	Enough
	<b>Average</b>	<b>66</b>	<b>High</b>
2	Process of Natural Science		
	To identify science question	55	Enough
	To explain Phenomena Scientifically	65	High
	<b>Average</b>	<b>60</b>	<b>Enough</b>
3	Content of Natural Science		
	To comprehend natural science, norms and methods of science and scientific knowledge	45	Enough
	To comprehend the key of Science Concept	70	High
	Relationships Competencies in the context of science, the ability to read, write and comprehend human knowledge systems	40	Enough
	<b>Average</b>	<b>52</b>	<b>Enough</b>
4.	Context of Natural Science Application		
	To Apply some scientific knowledge and ability to consider in everyday life	43	Enough
	<b>Average</b>	<b>43</b>	<b>Enough</b>
	<b>Total of Average</b>	<b>55</b>	<b>Enough</b>

As a whole can be described in the following diagram:

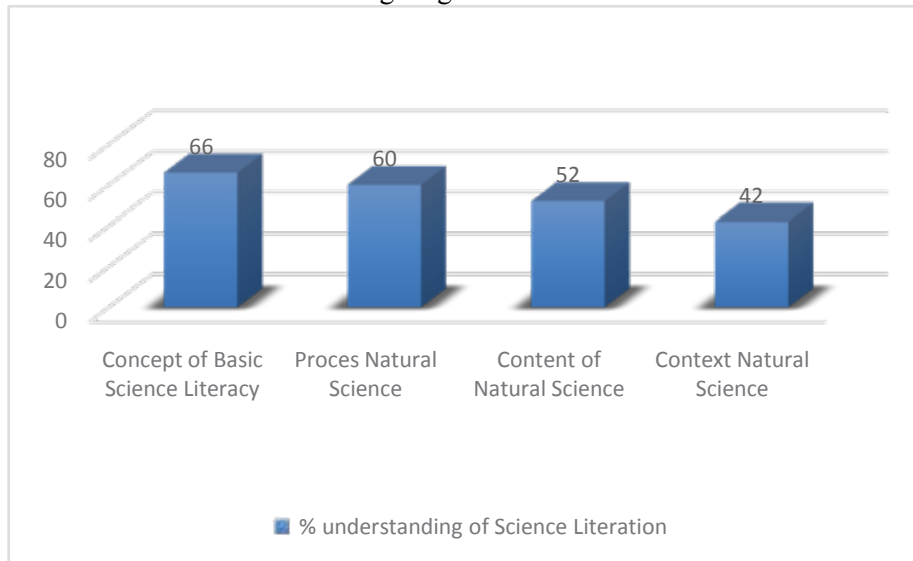


Figure 1. Percentage of Students the Science Literacy Concept of SIP Comprehend in UNIMUDA

Based on the results of the study, it founds that students' comprehend of the basic concepts of scientific literacy reaches 66% high category. In general, students have understood the definition of scientific literacy as shown in table 1 that the value obtained by students is 90% (very high), the dimension of scientific literacy value obtained by students is 88% (very high). However, the understanding of the concept of science literacy is 40% (enough) and the understanding of the causes of the low ability of scientific literacy is 42% in the category (enough). Based on the data above shows that science students in general have understood the meaning of science literacy as a whole, but have not understood the goals and factors that cause why junior high students are low on science literacy abilities. In the process component, the 60% natural science is in the sufficient category. The component is to identify scientific questions which get a value of 55% (high enough), and explain the phenomenon scientifically 65% (high).

The components of the science content obtained by third semester of science students can be seen that understanding about natural science, norms and methods of science and scientific knowledge reaches 45% (high enough), while understanding key scientific concepts reaches 70% (high), understanding the relationship to competence -competency in the context of science, the ability to read, write and understand the human knowledge system 40% (high enough). The total average understanding of the concept of science content by science students is 52% (quite high). Furthermore, in understanding the context of the application of natural sciences, namely applying some scientific knowledge and the ability to consider in everyday life it reached 43% with a high enough category.

The comprehension of the concept of science literacy in UNIMUDA Sorong science students as a whole reaches 55% with the category High Enough. The specifics can be observed in the understanding of the basic concepts of scientific literacy at 65% (high), 60% natural process (enough), 52% natural content (enough), and the context of IPA application 43% (low). The factors that influence the lack of understanding of science students to scientific literacy are aspects of applying some scientific knowledge and the ability to consider in everyday life is that students do not yet have an understanding of linking the concepts that have been learned with how they are applied in everyday life. In addition, students also do not understand the fields of science applications, namely life and health, earth and the environment, and technology. This needs a deeper teaching to students about how to apply each of the concepts of science in real life. One way is to involve students in designing technology and practical work related to the earth, environment and technology context. Another alternative that can be done is to involve students to make direct observations or be directly

involved with the technologies that have been utilized by the surrounding community. So they can significantly link the context of the application of science to real life.

Another component that needs to be improved is students' comprehension of the goals of scientific literacy only reaches 40% at the lowest value compared to the others. This shows that most students do not understand the purpose of scientific literacy well. This is very influential on other aspects of scientific literacy. If someone does not understand the purpose of an aspect well, then of course other aspects also cannot run well as well. Likewise, the understanding of the goals of scientific literacy is still lacking, showing that students do not yet comprehend the importance of scientific literacy in the science learning process for themselves, the environment, and society as a whole. So that every science lesson taught become meaningless to the student. So there needs to be an emphasis on the purpose of scientific literacy for students at the beginning of learning. On the other hand, most students do not yet understand the factors that influence the causes of low scientific literacy skills for Indonesian students. This causes a lack of alternative abilities of teachers or students in finding the right way to carry out the right learning in the learning process later. A learning process that does not lead to the development of science literacy skills, will have an impact on the low level of scientific literacy in students. Therefore, it is important for students to study and examine the factors that cause low literacy skills for all Indonesian students.

The other aspect is identifying scientific questions. Science students are still some who comprehend about the skills to identify problems. Many students do not yet understand how to identify problems with cases or problems that are given in learning or lectures. If students are still lacking in identifying problems then this will have an impact on the next science process. Because the stage of identifying the problem is the initial stage in the science process to investigate a case or finding natural events. With this stage blocked, then the next stage will also not be able to be obtained precisely such as identifying evidence, processing data, and drawing conclusions to the stage of communicating. Therefore students should have an understanding of identifying problems precisely.

The stages of the science process are the initial stages of the scientific literacy stage. This stage will guide students or scientists to obtain findings correctly on facts, events, natural phenomena investigated by students. If this stage is not properly implemented it will affect the natural science products produced, and have an impact on the student misconception process. At the stages of the science process students are required to be able to identify problems. Where this stage leads us to know the problems to be learned. Furthermore directed to be able to formulate the problem of these problems. Furthermore, with these problems, students submit a hypothesis that is provisional guessing from the formulation of the proposed problem. Furthermore prove the hypothesis, through the collection of data obtained in the field such as observations, experiments, investigations, theoretical studies. After the data is collected, the data is analyzed to determine the answer to the problem formulation. In the end, the whole process is then concluded through the activities of communicating the findings. Therefore it is important for students to have a comprehension of the science process as a whole and precisely.

After going through the stages of the science process, the next stage is students get the concept of science or the content of science. Some students do not comprehend science well. This can be demonstrated by the lack of student knowledge of the science concept, applicable norms obtained from the science process, and several other findings such as scientific methods in gaining scientific knowledge. So that the ability to connect or link competencies in the context of science is difficult to obtain. If we examine further, we can understand that students have not fully understood the concepts of science in the context of science through writing and reading activities. Students do not comprehend how the science content is applied in reading and writing activities. This shows that students are not accustomed to obtaining science content through reading and writing activities. In general, students gain knowledge in the form of verbal science and independent assignments in the form of papers that have not emphasized the writing of reports from their direct observations. So, it is important for students to discover for themselves the lecture process that they do.

From the results of the data obtained that the science literacy contained in three components, namely the process of science, the content of science, and the context of the application of science.

Naturally, the science literacy is inseparable from the nature of the science. We know that the nature of science consists of three elements, namely science as a product, science as a process, and science as a process. Based on the study above, scientific literacy aspects have not yet included scientific attitude aspects. This is certainly a process of scientific literacy that has not yet fully involved students with aspects of the nature of science as a whole. Therefore it is necessary to instill the value of scientific attitudes in the process of scientific literacy activities. So that it will produce student products that are also intact from the aspects of knowledge, attitudes, and skills.

#### 4. Conclusions

Based on the Results of Analysis and Discussion it can be concluded that the comprehension of the science literacy concept of UNIMUDA Sorong Science Education Students obtained the category of "sufficient" with a percentage value of 55%, as for each aspect as follows:

- a. The basic concept of scientific literacy reached 66% (high) category, Natural Sciences Process reached 60% (high) category, natural science content reached 52% (Enough) and IPA context reached 43%(Enough).
- b. Students' comprehension of the purpose of scientific literacy only reached 40% the lowest value compared to the others, so it is necessary to increase science learning in the content and context of science applications through the process of observation, demonstration and practicum so that students are trained in writing practicum reports and delivering the results of observations that have been made in the science laboratory.

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