

Analysis of Junior High School scientific literacy skills: domain competence on vibrations, waves and sound materials

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Abstract. This study aims to determine junior high school students' scientific literacy skills on vibration, wave, and sound materials. This study used a quantitative descriptive study to analyze the results of the ninth grade students' scientific literacy skills in one of junior high school in East Luwu Regency, Indonesia. The sample of the study were 90 students by using purposive sampling techniques. The instrument used scientific literacy skills test that was adapted from scientific literacy aspects and indicators according to the OECD. The number of questions consist of 8 items in the form of multiple-choice, free descriptions, brief and true false descriptions that have been developed by researchers and validated by experts. The Analysis of data used quantitative percentages. Based on the results of the analysis, it showed that the average achievement of scientific literacy skills of students in the domain competence was still in medium category. As for the acquisition of each aspects explained that scientific phenomena was 42.8% (medium category), identifying scientific issues was 37.5% (low category), and interpreting scientific data and evidence was 47.7% (medium category). The results of this acquisition indicated that the scientific literacy skills of domain competence of the students must be a serious concern.

Keywords: *scientific literacy, competence, vibration, waves, and sound*

1. Introduction

Natural Sciences is a way of thinking related to the phenomena found in nature, how to investigate in the universe, a collection of knowledge, and interactions that occur between technology and society. Formerly science is called natural philosophy [1], [2]. Natural philosophy is the study of unanswered questions about nature, but when the answer to that question is discovered, that's when it is called science [3]. Science learning is more directed at providing direct experience to students in developing competencies so that students more easily understand the environment because students involved in the process of finding and doing. This way can make students gain more knowledge than just simply following the learning process without directly involved [4], [5].

Along with the times, all things must adjust to the needs and demands of the times. 21st Century requires to be able to use technology, media, and information in learning [6],[7]. Science education is expected to be able to face global challenges to make science and technology literate societies. This is the background for changing the national paradigm of education in the Minister of Education and Culture Regulation No. 96 of 2013. In the 2013 curriculum, science education in schools is expected to form students who have high scientific literacy [8]. One of the students' skills must have to be able to compete in the 21st century is the scientific literacy ability. One of the symbols of change in the world of science education is scientific literacy which serves to move science in providing better



directions so that science learning is more useful with the primary goal of preparing society for the 21st century[9]. Full participation of students in society is a matter of very important [10]. Some abilities that must be possessed by students in the 21st Century have mostly been taught by educators so far, except for understanding the characteristics of scientific knowledge [11].

Scientific literacy is the skill of students to apply scientific knowledge either in the form of concepts or theories in identifying, explaining, and communicating to be able to solve problems in everyday life [12]-[14]. Scientific literacy is also considered as basic knowledge, basic critical thinking skills or their application in decision making so that students do not just read and write [15], [16]. Introducing students to science content that is relevant to daily life is very important because it can help in making personal decisions which are something that is needed by the workforce today [17]-[19]. Assessment of scientific literacy based on the 2015 PISA framework there are four interconnected scientific literacy domains as follows [20]:

- The Context domain, which includes personal, local /national and global
- The Domain competence, which consists of aspects of explaining phenomena scientifically, aspects of evaluating and designing scientific investigations, and aspects of interpreting scientific evidence and data
- The domain of attitude, which consists of aspects of interest in science, aspects of respect for scientific inquiry and aspects of concern for environmental problems
- The domain of knowledge which includes aspects of content knowledge, aspects of procedural knowledge, and aspects of epistemic knowledge

Educators can improve students scientific literacy by identifying and collecting interesting science topics and integrating them with curriculum topics; involve students to read research and help explain the relationship between concepts and social issues; and guide students in evaluating data such as where to collect data, how to collect data and whether the data obtained has represented the population [21].

One of the main goals in learning science is to in still scientific literacy in everyday life with it being evidence of the success of science learning that is done [22], [23]. Besides [24] revealed that learning science can help students in understanding and using the concepts of science and technology in everyday life. Science literacy is considered to have an important role in life. However, if observed, the ability of scientific literacy has not been maximally trained in learning science in Indonesia. Because students have not been able to develop questions in scientific investigations and experiments conducted are still proof of something that is in a textbook.

Therefore, researchers consider the need for research to provide a preliminary picture of existing problems and an overview of the scientific literacy skills of students today. By providing tests in the form of multiple-choice questions, free descriptions, brief descriptions, and true and false that have referred to aspects and indicators of scientific literacy in the domain competence.

2. Research Method

This study was quantitative descriptive research. This study aimed to determine the scientific literacy skill of students. This research was conducted in Junior high school students in East Luwu Regency, Indonesia. The sample in this study were 90 students from nine class with a purposive sampling technique. The instrument used scientific literacy skills test that was adapted from scientific literacy aspects and indicators according to the OECD [20]. The questions consist of 8 test items in the form of multiple-choice, free descriptions, brief and true false descriptions that have been developed by researchers and validated by experts. The instrument test was developed to measure the skills of scientific literacy in every aspects and indicators that was explored by the test items. The domain competence includes 3 aspects, namely aspects of explaining scientific phenomena, aspects of identifying scientific issues and aspects of interpreting data and evidence scientifically. Data obtained from the analysis of students' answers, then the scores obtained by students then were converted to a

percentage. The percentage of students' scientific literacy skills will be interpreted descriptively based on the category of students' scientific literacy skills presented in the table 1 [25].

Table 1. Categories of scientific literacy skills.

Interval	Category
81-100	Very High
61-80	High
41-60	Medium
21-40	Low
0-20	Very Low

3. Results and Discussion

This study was conducted to analyze the scientific literacy skills of students in one of Junior high school in East Luwu through vibration, wave, and sound materials. The skills of scientific literacy of students in the domain competence was based on 3 aspects, namely aspects of explaining scientific phenomena, aspects of identifying scientific issues and aspects of interpreting data and evidence scientifically [21]. The aspects of explaining scientific phenomena (LS1) consists of 2 indicators namely remembering and applying appropriate scientific knowledge: identifying, using and making simple illustrative models to explain scientific phenomena. The aspect of identifying scientific issues (LS2) included indicators in recognizing important elements in scientific inquiry and proposing a way in scientific inquiry. Aspects of interpreting data and scientific evidence (LS3), indicators analyzing and interpreting data appropriately and indicators changing data from one form to another. The material used to measure the scientific literacy skills of students in the domain competence of vibration, waves, and sound materials. Questions were made in the form of multiple-choice, free description, short description and correct false. The results of students' scientific literacy skills were presented in figure 1.

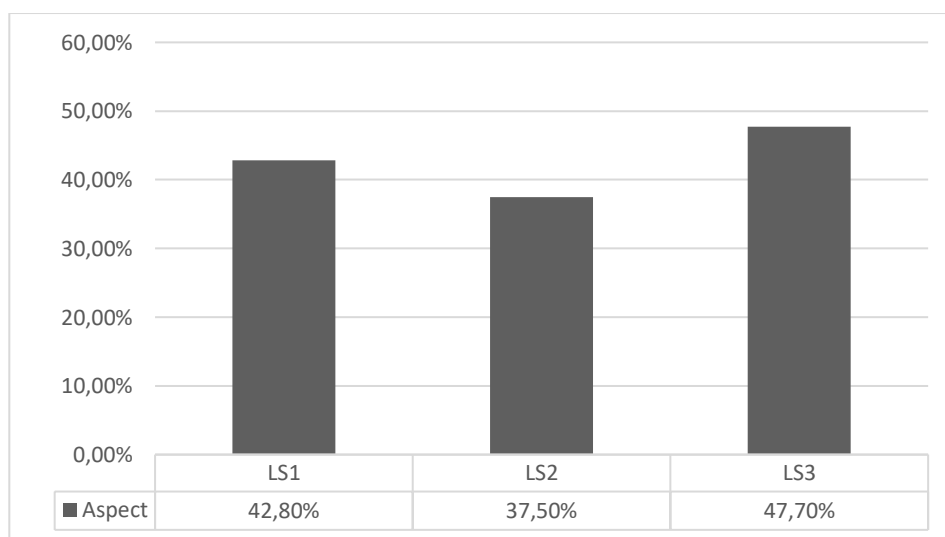


Figure 1. Percentage of domain competency scientific literacy skills.

Figure 1 showed that there was one aspect that fall into the category of inadequate namely the aspect of identifying scientific issues (LS2) with a percentage of 37.5%, while two aspects fall into the medium category namely aspects of explaining scientific phenomena (LS1) with a percentage of 42.8% and for aspects of interpreting data and scientific evidence the percentage (LS3) was 47.7%. The low achievement of scientific literacy of students was most likely due to students not familiar with the type of science literacy questions and can also be caused by educators often teach formulas compared to concepts, students do not understand the basic concepts taught by educators, students do

not have knowledge of the facts terminology, and sufficient concepts, learners' skills in critical thinking, inductive deductive reasoning, analyzing scientific data were lacking and students spend more time memorizing without any effort in understanding [28], [29]. Science literacy was something new for some students so it was taken time for students to get used to and have the skills of scientific literacy [28].

3.1. The Aspects of Explaining Scientific Phenomena

The results obtained by the students of explaining aspects of scientific phenomena included in the medium category in this aspect there are two indicators measured namely remembering and applying scientific knowledge in accordance with the acquisition of a percentage of 44.9% included in the medium category and for indicators identifying, using and making a simple picture model to explain scientific phenomena obtained by a percentage of 40.7% included in the category of lacking. These results were presented in figure 2.

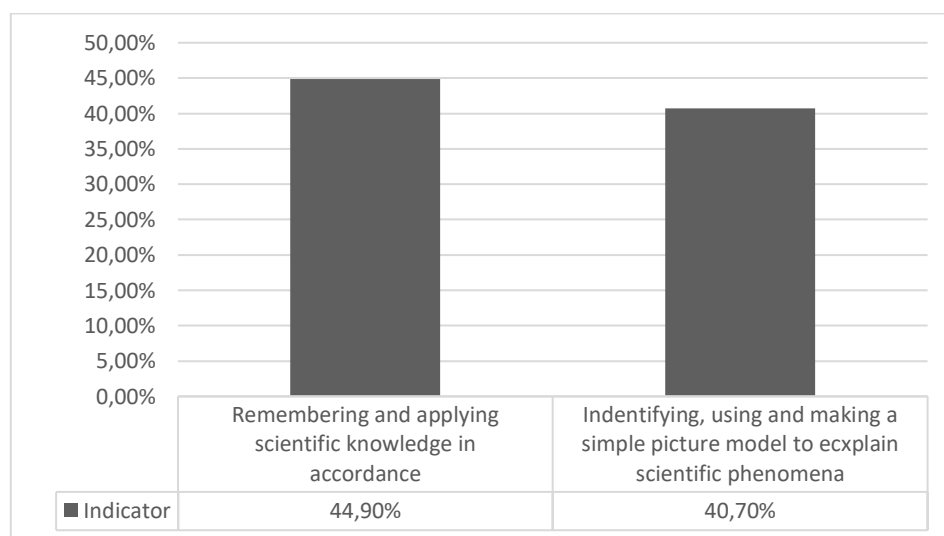


Figure 2. Percentage of each indicator from aspects explaining scientific phenomena.

The skills of students to explain scientific phenomena included in the medium category. The results obtained that students have not been able to understand the concepts and principles of vibration, waves, and sound that were given so that it has an impact on the students' skill to explain scientific phenomena. The low achievement in the aspect of explaining scientific phenomena was also found in research with a cycling theme [26]. Because in general students just able to know the concepts, theories, principles, or formulas in science but students' understanding was still limited to the definition of aspects. The reason, students consider the description of the question is too long so they have difficulty in finding the essence of the question. So the factors that influence the skill of scientific literacy was the skill to read [25].

3.2. Aspects of Identifying Scientific Issues

Students showed the lowest results on aspects of identifying scientific issues that fall into the less category. The indicator used in this aspect was identifying important elements in scientific investigations with a percentage of 36.2% included in the lack category and proposing a method in scientific investigation with a percentage of 38.9% in the lack category. The results were presented in figure 3.

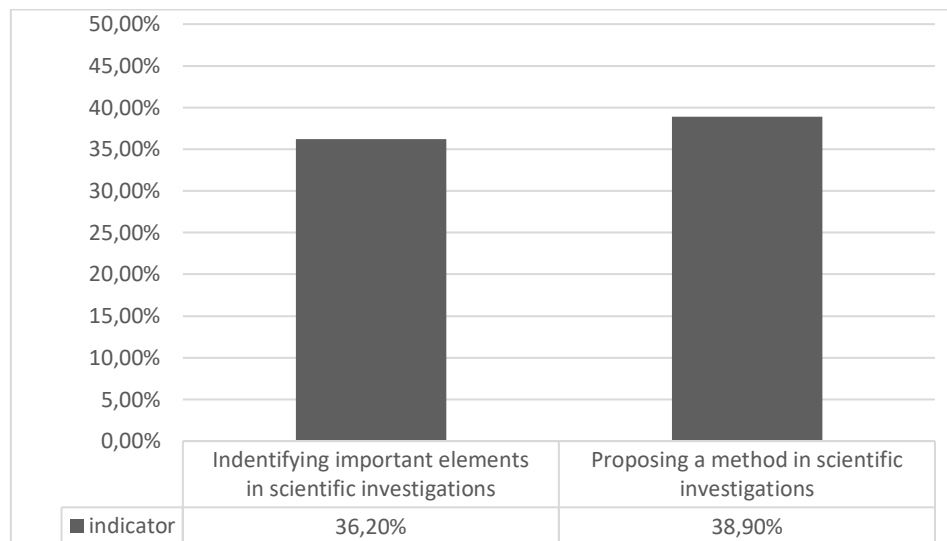


Figure 3. Percentage of each indicator from aspects identifying scientific issues.

The low achievement in each indicator in terms of identifying scientific issues because this aspect was one of the core of scientific literacy science. Where in answering questions about vibrations, waves, and sounds given the skill of students to solve problems and the skill to analyze. The low achievement was due to participants preferring group activities compared to individual activities so that individual students do not think in applying their knowledge in daily life [29].

3.3. Aspects of Interpreting Data and Evidence Scientifically

In this aspect, there were 2 indicators namely analyzing and interpreting data appropriately with a percentage of 48.9% including the medium category while for indicators changing data from one form to another obtained a percentage of 46.6% the medium category. The results were presented in figure 4.

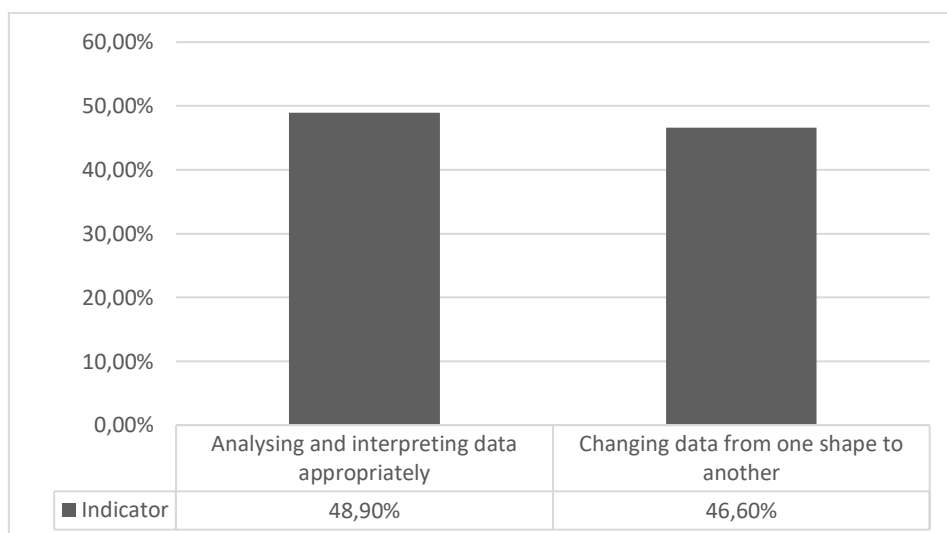


Figure 4. Percentage of each indicator from the aspect of interpreting data and evidence scientifically.

The aspect of interpreting data and evidence scientifically was the aspect with the highest percentage acquisition. However, this aspect was still in the medium category. Students who were lacking in interpreting data and evidence mean students have less skill to relate news in the form of paragraphs, charts, graphs or table to new forms of expression because they were not use it [30]. Based

on interviews, most students claim that educators rarely provide an analysis of a problem in the form of graphs or table [25]. Though the skill to interpretate the results in the form of table or graphs was part of the indicators that would make students have the scientific literacy skill.

Based on the result of research and analysis of scientific literacy skills of students' in one Junior high school in East Luwu Regency included in the medium category. This indicates that students' have fairly good scientific literacy skills meaning students have tried to apply basic knowledge and critical thinking skills that have been owned in decision making [15], [16]. Scientific literacy skills well enough stating that the learner can identify questions, acquire new knowledge, explain scientific phenomena, understanding the characteristics of science, as well as making a good conclusion [13]. Although included in the category are researchers argued about the need for efforts to improve scientific literacy skills. One way that science educators can apply this aspects and indicators of scientific literacy in scientific learning class to prepare students' who have literacy skills [31]. Effort to improve students literacy can be done by applying the SETS approach (Science, environment, technology, and society) [32]. The implication in the next research will be developed learning tools that support the achievement of students' scientific literacy.

4. Conclusion

The Achievement of students'scientific literacy in one of Junior high school in East Luwu Regency was categorized into the medium category through elaboration on aspects of explaining scientific phenomena was categorized in the moderate category, aspects of identifying scientific evidence was categorized into fewer categories and for aspects of interpreting data and scientific evidence was categorized in the medium category. The skill of scientific literacy applied in learning will make students have good scientific literacy skills.

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