



Analysis on Students' Scientific Literacy of Newton's Law and Motion System in Living Things

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Abstract. The 21st century skills focus on scientific literacy competences in various urban and rural areas, one of which is Papua. Scientific literacy has competences to identifying scientific problems, explaining scientific phenomena, and utilizing scientific findings to solve problems. The purpose of this study was to determine the science literacy competences of IPA class VIII students of SMPN 5 Jayapura. Scientific literacy is competencies to understanding science, communicating science, and applying scientific conceptual to solve problems. A descriptive qualitative approach is used as this type of research. This research was conducted at SMPN 5 Jayapura. The sample selection used purposive sampling technique. There were 33 students who became respondents and teste in this study. The research instruments were documentation, observation, tests and interviews. The average percentage of competency aspects with indicators of identifying scientific problems, explaining scientific phenomena, and utilizing scientific findings is below 80%. The average percentage of aspects of knowledge about the concept of motion, with sub-concepts of regular motion, force, and Newton's laws is below 90%. The average percentage of human, animal and plant movement systems is below 70%. The highest score, average, median, mode, and lowest score of the cognitive scores of students' scientific literacy abilities were 100; 68.33; 75; 80; and 30. The scientific literacy competences of grade 8 students of SMPN 5 Jayapura are still low, which is shown in terms of the percentage of competence and is classified as moderate for the knowledge aspect. The conclusion of this study is that the scientific literacy competences of students at SMPN 5 Jayapura are in the sufficient category.

Keywords: Scientific literacy, Newton's law, motion, force

Introduction

The awareness of the importance of 21st century skills in Indonesia nowadays can be found in a document issued by the National Education Standards Agency in 2010 which states that "National Education in the XXI century aims to realize the ideals of the nation, namely a prosperous and happy Indonesian people, with a position that is respectable and equal to other nations in the global world, through the formation of a society consisting of quality human resources, namely individuals who are independent, willing and able to realize the ideals of their nation". Richard Crawford refers to the 21st century transformation process as the Era of Human Capital, an era in which science and technology, especially communication technology, are developing very rapidly which results in intense free competition in human life (Christie, et al., 2012; Crawford, et al., 1994).

In the tight challenges faced by society, a paradigm shift is needed in the education system that can provide a set of 21st century skills needed by students to face every aspect of global life (Soh, et al., 2010). From various studies on the concepts and characteristics of 21st century education, it is inevitable that they are both a demand and a big challenge for teachers in conducting learning (Johnstone & Lee, 2014). Teachers like it or not, like it or not, agree or disagree must balance the demands of the 21st century (Gay & Howard, 2000). The provision of quality science education will have an impact on the achievement of a country's development. Science education depends on the learning used in each country (Christie, et al., 2012; Egan, et al., 2017). Through science education, students can be involved in the impact of science in everyday life and the role of students in society (Mason, 2017). By applying the concept of science in science education, Indonesian students are expected to be able to solve problems in real life in the era of the 21st century (Johnstone & Lee, 2014; Seethal & Menaka, 2019).

Students who have the knowledge to understand scientific facts and the relationship between science, technology and society, and are able to apply their knowledge to solve problems in real life are called scientific literacy societies (Toharudin, et al., 2011). Scientific literacy is one of the skills needed in the 21st century among the 16 skills identified by the World Economic Forum (Council, 2012; Forum, 2015). Given the importance of scientific literacy, educating people to have scientific literacy is the main goal in any science education reform (Christie, et al., 2012; DeBoer, 2000; Egan, et al., 2017; Mason, 2017).

Scientific literacy views the importance of thinking and acting skills that involve mastery of thinking and using scientific thinking in recognizing and addressing social issues (Lederman, 2006). Scientific literacy is important for students to understand the environment, health, economy, modern social, and technology (Holbrook & Rannikmae, 2007). Therefore, measuring scientific literacy is important to determine the level of scientific literacy of students in order to achieve high or good scientific literacy so that the quality of education in Indonesia can increase and can compete with other countries (Nurdin, 2019; Prasetya, et al., 2019; Juanda, et al., 2020; Rosana, et al., 2020).

Based on PISA (Program for International Student Assessment) data, the scientific literacy ability of Indonesian students is still below the average when compared to the international average score and in general is at the lowest measurement stage of PISA (Toharudin, et al., 2011). As quoted from The Organization for Economic Co-operation and Development (OECD, 2014) Indonesia's ranking in PISA in 2009 was 57th out of 65 with a score of 383. The low results of learning science are suspected to be related to the science learning process which has not provided opportunities for students to develop reasoning skills critically (Suryanti, et al., 2018; Toharudin, et al., 2011).

Science learning is still characterized by the transfer of science as a product (facts, laws, and theories) that must be memorized so that aspects of science as a process and attitudes are completely ignored (Istyadji, 2007). In his research, (Suryanti, et al., 2018) concluded that learning is not related to real life contexts, learning rarely starts from actual problems, science learning in elementary schools tends to start from subject matter not from the main objectives of science learning and the needs of students, and science learning actions. tend to just anticipate the test. Thus, the lead back results will be scientific findings through the year.

Various empirical findings that have been previously described are an indication that science learning that has been carried out so far tends to be a conventional activity which has an impact on the low learning outcomes of students (Bieber & Martens, 2011; Council, 2012; DeBoer, 2000; Istyadji, 2007; OECD, 2014; Ratcliffe & Millar, 2009; Shwartz, et al., 2005; Toharudin, et al., 2011). This condition requires improvements in science learning to realize more effective learning, especially at the elementary school level so that the process emphasizes product achievement, processes, and scientific attitudes. This is very

important, because the assessment of scientific literacy according to PISA is not only on content but includes context, knowledge (knowledge of science and knowledge about science), and attitudes (OECD, 2014). In this case the teacher has a very vital role in determining the success of students. Therefore, teachers should have capable abilities in planning and implementing learning. One alternative that can be done in order to solve the above problems is to apply science learning which not only emphasizes mastering concepts but also pays attention to other aspects (Bond, 1989; Egan, et al., 2017; Lederman, 2006; Seethal & Menaka, 2019).

Scientific literacy according to PISA is defined as "the capacity to use scientific knowledge, to identify questions and to draw evidence-based conclusions in order to understand and help make decisions about the natural world and the changes made to it through human activity" (Kaya & Elster, 2018; Olsen, et al., 2011). Based on this explanation, scientific literacy can be 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 changes made to nature through human activities. The main elements contained in scientific literacy according to (Harlen & Qualter, 2004: 64). The indicators are including: 1) concepts or ideas, which help understanding of scientific aspects of the world around and which enable us to make sense of new experiences by linking them to what we already know; 2) processes, which are mental and physical skills used in obtaining, interpreting and using evidence about the world around to gain knowledge and build understanding; 3) attitudes or dispositions, which indicate willingness and confidence to engage in inquiry, debate and further learning; and 4) understanding the nature (and limitations) of scientific knowledge.

The research background explained will lead us to the research gap which is not yet done widely to students' scientific literacy in Indonesia. Acquired by the appliance and accordance to 21st century skills era, we attempted to determine students' scientific literacy competences in Papua, Indonesia. The major research on the area have not yet been explored. The purpose of this study was to identify the scientific literacy competences of IPA class VIII students of SMPN 5 Jayapura. The findings of this study we expect to become new ladder to purposively studying about scientific literacy competences in one of outer place of Indonesia.

Methods

The focus of this research is the identification of scientific literacy competences of students in Jayapura. Descriptive qualitative approach was used as the type of this research. Whether the goal is to identify and describe trends and variation in populations, create new measures of key phenomena, or describe samples in studies aimed at identifying causal effects, description plays a critical role in the scientific process in general and education research in particular (Djınger, 2018; Loeb, et al., 2017). Descriptive analysis identifies patterns in data to answer questions about who, what, where, when, and to what extent (Anunah & Hodge, 2005). This guide describes how to more effectively approach, conduct, and communicate quantitative descriptive analysis (Kheirabadi & Mirzaei, 2019).

This research was conducted at SMPN 5 Jayapura. We elaborated the study on secondary school or junior high school to maintain the insight to begin with students' scientific literacy as students at the certain age tended to construct their knowledge based on contextual and concrete visual of learning material (Piaget, 2003). This study was conducted from March 2020 to October 2020 (eight months). The population of this research were all students of class VIII SMPN 5 Jayapura. The sample selection used purposive sampling technique. There were 33 students being respondents of this study. Students who were involved in this study were given test and interview as part of research

validation and data triangulation. Of the recorded results, students were given consent form to take part in this study. All of students being samples are eight grade students.

Data collection techniques are used to obtain relevant and appropriate data according to research objectives. The data collection techniques used in this study are documentation, test, interview, and observation. Observation in this study were done during pilot study. The stest is used to measure students' scientific literacy competences. The test instrument was used to measure scientific literacy competences. The purpose of the data obtained from this instrument was to identify scientific literacy competences. The interview used in this study was a free guided interview or an unstructured interview, where the researcher brought guidelines that only outline the things to be asked. The sample of teachers was all science teachers teaching at SMPN 5 Jayapura. Interviews were used to collect qualitative data from students and teachers. This interview instrument is used to explore the learning carried out by the teacher and the correctness of the concepts obtained by students. Data were analyzed after collected.

The results of the students' cognitive tests got a score of 0-100, where each item got a score of 5. The results of the students' cognitive tests were processed to obtain the mean (average), median and mode which were analyzed quantitatively. The cognitive results of these students also reflect aspects of knowledge and aspects of student competencies. The aspects of knowledge consist of the concept of motion, human motion systems, animal motion systems, and plant motion systems. The competency aspect consists of identifying scientific issues, explaining scientific phenomena, and using scientific evidence. The results of the students' scientific literacy tests were analyzed descriptively.

Results and Discussion

This research refers to the scientific literacy competences, namely aspects of competences and aspects of knowledge (OECD, 2014). The results of this study indicate that problems are found in the ability of scientific literacy, especially in the aspect of identifying scientific issues in the aspect of knowledge, especially the concept of the human movement system, which gets the lowest result, namely 18.18%. The complete results can be seen in Table 1.

Table 1. Students' Scientific Literacy

Cognitive Aspect	Percentage on Each Competency			Mean
	Identifying Scientific Issues	Explaining Scientific Phenomena	Utilizing Scientific Findings	
Concepts of Regular Motion	93.94	90.91	78.79	87.88
Motion Force	96.97	60.61	45.45	67.68
Newton's Law	87.88	63.64	72.73	74.75
Human Motion	18.18	78.79	66.67	54.55
Animal Motion	51.52	66.67	75.76	61.36
Plant Motion	68.18	54.55	57.58	62.12
Mean	67.05	69.19	66.16	

The average percentage of competency aspects with indicators of identifying scientific issues, explaining scientific phenomena, and using scientific evidence was 67.05%; 69.19%; and 66.16%. Details of the percentage of competency and knowledge aspects can be seen in Table 1. Figure 1 shows that the cognitive scores of students contain scientific literacy competences in competency and knowledge aspects. The cognitive scores shown in Figure 1 consist of the highest scores, mean, median mode, and lowest scores of

33 students of SMPN 5 Jayapura. The highest score, mean, median, mode, and lowest score are 100 respectively; 68.33; 75; 80; and 30. The students' cognitive score can be seen in Figure 1.

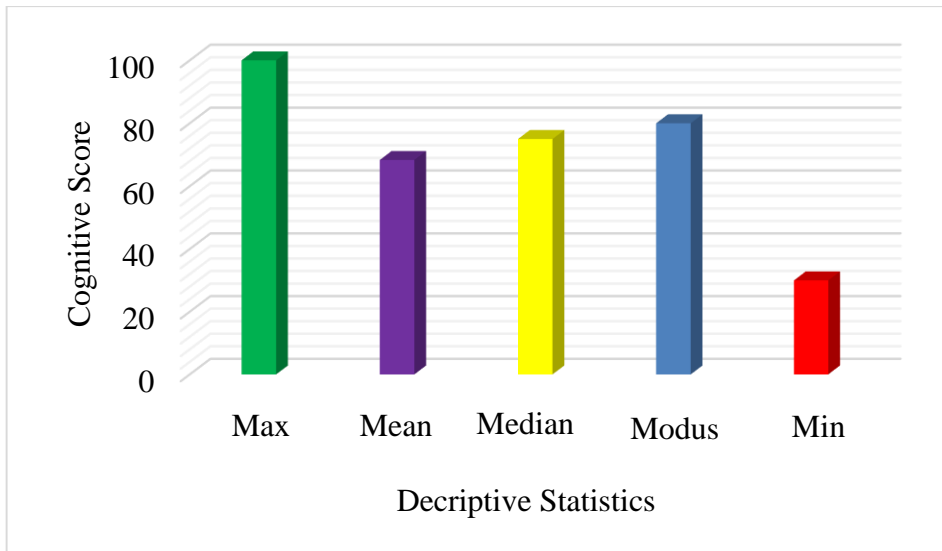


Figure 1. Students' cognitive scores

Aspects of scientific literacy consist of context, knowledge, competence, and attitudes (OECD, 2014). The PISA assessment is made so that students can understand that science has particular value for individuals and society in improving and maintaining the quality of life and in the development of public policies (Anunah & Hodge, 2005; Millar, 1998). In this study, the aspects of scientific literacy ability that were measured were aspects of competence and scientific knowledge. Based on Table 1, it is found data on scientific literacy competences, especially in the competency aspect with indicators identifying scientific issues in the knowledge aspect, especially the concept of human motion systems, which get the lowest results, namely 18.18%. This shows that students are not able to identify scientific issues in the concept of human motion systems.

Figure 2 is an example of student results that contains scientific literacy competences in the competency aspect with indicators identifying scientific issues in the knowledge aspect, with the concept of human motion systems.



Figure 2. Sample on students' answer to identifying scientific Issues in human Motion competence aspect

Identifying scientific issues, namely recognizing issues that may be investigated scientifically, identifying key words for scientific information, recognizing the characteristics of scientific investigation (Behrendt, et al., 2001; OECD, 2014). Figure 2 shows that students are unable to identify scientific issues about the mechanism of action of muscles displayed by muscle images in humans. The mechanism of action of the muscles in humans is that the biceps in the upper arm relaxes, so the triceps in the forearm will contract. Thus, the arm muscles can do the job well (Pipeleers, et al., 2008; Zatsiorsky & Zaciorskij, 2002).

An example of the second students' answer in the test result is the ability of scientific literacy in the aspect of competence with indicators using scientific evidence on the concept of style. It can be seen in Figure 3.



Figure 3. Sample on students' answer to utilizing scientific findings in concept of force competence aspect

Using scientific evidence, namely interpreting scientific evidence and drawing conclusions, providing reasons to support or rejecting conclusions and identifying assumptions made in reaching conclusions, communicating conclusions regarding the evidence and reasoning behind conclusions and making reflections based on the social implications of scientific conclusions (Bieber & Martens, 2011; Loeb, et al., 2017; OECD, 2014). Based on Figure 3, it can be seen that students are not able to use scientific evidence which is shown from the pictures contained in the questions. Students are expected to understand the concept of force which is a vector quantity that has value and direction, but students apparently do not understand the resultant concept of force which is influenced by value and direction. Scientific evidence should be obtained by students in interpreting the images presented in the questions (Aryani, et al., 2019; Kurniawan, 2018).

Figure 4 is an example of student results containing scientific literacy competences in the competency aspect with indicators explaining scientific phenomena in the aspect of knowledge, with the concept of Newton's Law.

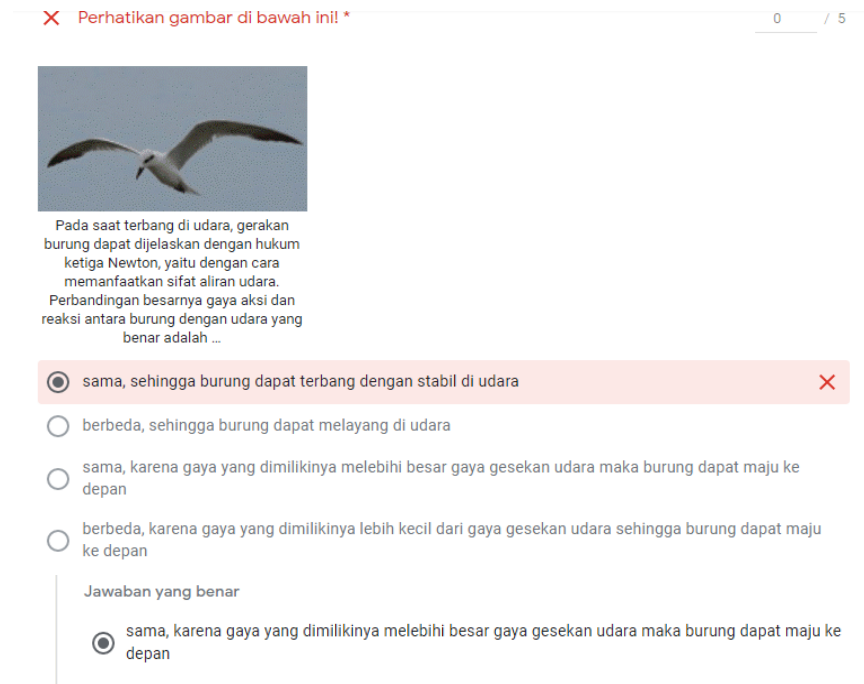


Figure 4. Sample on students' answer to explaining scientific phenomena in Newton's law competence aspect

Explaining scientific phenomena, namely applying scientific knowledge in a given situation, describing or interpreting phenomena and predicting change, identifying appropriate descriptions, explanations and predictions (OECD, 2014; Seethal & Menaka, 2019). Based on Figure 4, it can be concluded that students are unable to explain scientific phenomena about the concept of Newton's Law. When flying in the air, the movement of birds can be explained by Newton's third law, namely by utilizing the nature of air flow. The ratio of the magnitude of the action and reaction forces between birds and air is the same, because the force they have is greater than the frictional force of the air, so the bird can move forward.

Based on interviews with two science teachers at SMPN 5 Jayapura, science learning in the new normal era is currently online and offline. For students who have facilities such as Android phones and data packages, learning is carried out online, while students who do not have these facilities take material in the form of printouts to school (Handhika, et al., 2020). Online learning at SMPN 5 Jayapura uses the Jitsi Meet Videoconferencing application to do face-to-face online. The learning constraint faced during the new normal period is that sometimes the internet network is unstable, so the learning process becomes disrupted (Eshet, 2004; Forum, 2015; Ratcliffe & Millar, 2009; Seethal & Menaka, 2019).

According to the two science teachers who were respondents, students' scientific literacy competences were still lacking. This can be seen from the way students' analysis or higher-order thinking skills are still lacking. Thus, there is a need for a teacher strategy to be able to improve students' scientific literacy competences in the learning process. The interview of science teacher in is written as follows. The science learning at school during pandemic at SMPN 5 Jayapura held the problems related to technology and gadget as if the internet access is low in the area.

"Learning in this pandemic era is offline and online learning. At SMPN 5 Jayapura, not all students have access to the internet. There are several categories of access here: students who do not have cell phones, students who have cellphones but not Androids, students who have Android phones but do not have

internet data plans, and students who have Android phones and internet data plans. We use Jitsi Meet for online meetings, Google Classroom for assignments, and Google Doc for formative tests. Limited facilities and children's ability to use the application. Our learning strategy is now Powerpoint-based learning. Students' understanding of concepts is not optimal. Students don't try to open reference books at all." – **Science Teacher at SMPN 5 Jayapura**

If the first teacher interviewed focused on the learning media using gadget, Android, and internet, the second source from teacher 2 as respondent showed that the students' enthusiasm is good. Of 29 students, 21 students attended the class.

"Our learning runs less optimally throughout this pandemic era because there are obstacles such as the absence of face-to-face learning at school conventionally, the absence of learning variations, and the boredom that students have from learning online. As many as 29 of our students today, 21 students are taking online learning. Students who are absent are usually constrained by their gadgets. Students' enthusiasm is good. The internet network is also a major obstacle to our online learning." – **Science Teacher at SMPN 5 Jayapura**

The scientific literacy of students at SMPN 5 Jayapura are quite good in medium category. They held the apperception from elementary school as they were able to show the conceptual understanding properly during the lesson.

"Scientific observation is held since the beginning of the the 7th class. We have met students in the first year and gave conceptual flowchart of physics. They were able to infer the conceptual framework they obtained and understood the learning objective properly. Thus, we can say that students' scientific literacy is enough—in the medium category. They were curious to join science club and attend the students' scientific projects." – **Science Teacher at SMPN 5 Jayapura**

The second teacher even tried to bring comprehensive effort by visiting the students' houses and explaining the material to the students. The teacher brought the simple but contextual observation in surrounding related to plant motion.

"Students learn to rely on teachers to learn because they cannot focus on their own studies so we have to be proactive in coming to students' homes to explain material they do not understand. In this way, we can still monitor the students' scientific literacy competences because I am also the students' guardianship. To improve conceptual understanding, I provide students with a contextual picture of making observations around them. For example, I asked what would happen to the *Mimosa pudica* if it was touched. I assigned them to touch the *Mimosa pudica* directly and write down their experiences. Therefore, the students' literacy skills were low at our class." – **Science Teacher at SMPN 5 Jayapura**

According to Toharudin, et al. (2011) a person has scientific and technological literacy characterized by having the ability to solve problems by using scientific concepts obtained in education according to his level, recognizing technological products around him and their impacts, and being able to solve problems. Other study also found that students with good scientific literacy can use technology products and maintain them, be creative in making simplified technological results so that students are able to make decisions based on the values and culture of society (Lederman, 2006; Shwartz, et al., 2005). If traced in more detail, there are actually two large groups of people who have views about scientific

literacy (Holbrook & Rannikmae, 2007). The first group, namely the “science literacy” group views that the main component of scientific literacy is the understanding of science material, namely the basic concepts of science (Holbrook & Rannikmae, 2007; Toharudin, et al., 2011). The understanding of this first group is what is widely understood by science teachers today both in Indonesia and abroad to understand the concepts (Holbrook & Rannikmae, 2007; Ratcliffe & Millar, 2009; Roberts, 2013; Suryanti, et al., 2018; Toharudin, et al., 2011).

The second group, namely scientific literacy, views that scientific literacy is in line with the development of life skills (Rychen & Salganik, 2003). It is a view that recognizes the need for reasoning skills in a social context and emphasizes that scientific literacy is for everyone, not just those who choose a career in science or a specialist in science. (Behrendt, et al., 2001) bridged these two groups with a scientific literacy model such as Figure 5, which shows that scientific literacy is competency-based and is the result of the intersection of “what do people know” (consisting of the ability to understand science material and the epistemological ability of science nature of science), “what do people value” (consisting of ethical or moral abilities), and “what can people do” (consisting of learning skills, social skills, ability to perform procedures, communication skills). This scientific literacy model emphasizes the need balance between various abilities and requires skills in decision making on socio-scientific issues (Holbrook & Rannikmae, 2007).

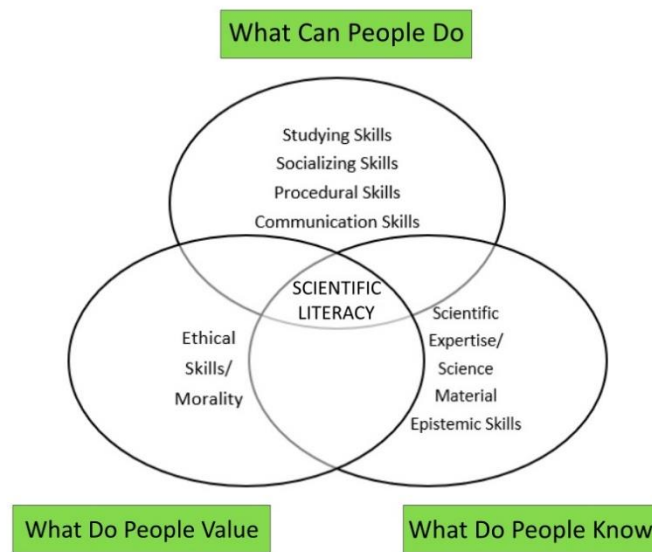


Figure 5. Scientific literacy model of Gräber

The developed definition of scientific literacy which is the target of science education as stated by Chowdhury, et al. (2020) and Valdmann, et al. (2020). They suggest the need for an appreciation of the Nature of Science (NoS) and its relevance to the science being studied, so that developing scientific literacy through science education is an effort to develop the ability to use scientific knowledge and skills creatively based on sufficient evidence, especially those relevant to careers and everyday life in solving important problems, and proposing personal arguments in making sociocultural decisions in a responsible manner (Kheirabadi & Mirzaei, 2019; Chowdhury, et al., 2020; Handhika, et al., 2020). In addition, scientific literacy also requires the ability to develop collective interaction skills, self-development with a communicative approach, and the need to show

understandable and persuasive reasoning when arguing on socio-scientific issues driven by the teacher in the classroom during the lesson (Egan, et al., 2017; Holbrook & Rannikmae, 2007; Kaya & Elster, 2018; Valdmann, et al., 2020).

In principle, although there are various kinds of definitions of scientific literacy, there are at least 3 things that are generally agreed upon, namely: (1) knowledge of scientific concepts and ideas; (2) understanding of the process of inquiry and the nature of how to obtain knowledge (nature of science); and (3) awareness of the influence of scientific activities on the social context in which these activities are carried out, and their influence on daily life, personal and social decisions about scientific ideas and practice (Ratcliffe & Millar, 2009: 946). In addition, almost every description of scientific literacy focuses on the importance of good language, reading and writing skills in understanding and explaining phenomena, evaluating information, communicating ideas to others and applying scientific knowledge and reasoning skills to everyday life situations and processes of decision-making (Kaya & Elster, 2018). Scientific literacy provides aspirations for curriculum development, teaching materials and assessment practice, so that if material and science learning are facilitated with the aforementioned competencies, students' scientific literacy will develop (Roberts, 2013; Shwartz, et al., 2005). Scientific literacy also closely related to problem-solving skills. Previous research found that scientific understanding related to scientific literacy in heat and temperature concepts cannot be neglected as if it is existed in comprehensive local wisdom in *Bakar Batu* Papua Cultural Practice (Budiarti, et al., 2020; Budiarti, 2017). The correlation in 21st century skills with scientific literacy is very close.

The effort to understand and engage in critical discussions about science and technology issues is defined as there are three specific competencies in scientific literacy that are needed, namely explaining scientific phenomena scientifically, evaluating and designing investigations or inquiries, and interpreting data scientifically (OECD, 2014). All these competencies require knowledge. This knowledge is called procedural knowledge and epistemic knowledge (Anggraini, et al., 2018; Glynn & Muth, 1994; Osborne, et al., 2003). Procedural knowledge is a standard procedure that underlies the various methods and practices used to build scientific knowledge. Epistemic knowledge some call it the nature of science (Lederman, 2006), "ideas about science" (Millar, 1998), or scientific practices (Al-Momani, 2016; Loeb, et al., 2017).

The 21st century education, scientific literacy is important to be integrated in the learning process (Dewi, et al., 2019). The purpose of science education is to increase the competence of students to be able to meet their needs in various situations including in facing the challenges of life in the global era (Prastika, et al., 2019). With scientific literacy, students will be able to learn further and live in a modern society which is currently heavily influenced by developments in science and technology (Bussi, et al., 2012). In addition, with scientific literacy, students are expected to have sensitivity in solving global problems such as environmental, health and economic problems (Carson, 2007; Himawan & Winarti, 2018; Osborne, et al., 2003; Pratiwi, et al., 2019; Yerushalmi & Eylon, 2004). This is because understanding science offers a solution to these problems. Talking about the environment which is one of the central issues in this global era, the reality that is currently happening is very far from being concerned about the environment (Chang Rundgren & Rundgren, 2017; Vieira & Tenreiro-Vieira, 2016; Webb & Mayaba, 2010). This is shown by various bad habits that are often carried out by the community, such as littering, illegal cutting of trees, mining exploration that is not environmentally friendly, land use change and others. By having scientific literacy competences, students are expected to be able to overcome various problems caused by these various activities (Budiarti, et al., 2013; Sari, et al., 2020). Literacy skills also can be achieved through the use of game (Naimah, et al., 2019).

Based on this statement, in other words, it can be concluded that with scientific literacy students are expected to be able to meet the demands of the times, namely to

become problem solvers with personalities who are competitive, innovative, creative, collaborative, and characterized (DeBoer, 2000; Karademir & Ulucinar, 2017). This is because mastery of scientific literacy competences can support the development and use of 21st century competencies to support the understanding of contextual concepts in science learning (Holbrook & Rannikmae, 2007).

Conclusions

The average percentages of competency aspects with indicators of scientific literacy competences to identifying scientific problems, explaining scientific phenomena, and utilizing scientific findings to solve problems are 67.05%; 69.19%; and 66.16%. The average percentage of aspects of knowledge on the concept of motion, with sub concepts of straight motion, force, and Newton's Law, respectively, was 87.88%; 67.68%; and 74.75%. The average percentage of knowledge aspects on the concept of motion systems in humans, motion systems in animals, and motion systems in plants are 54.55% respectively; 61.36%; and 62.12%. The highest score, mean, median, mode, and lowest score of the students' cognitive scores containing scientific literacy competences were 100; 68.33; 75; 80; and 30. The scientific literacy competences of grade 8 students of SMPN 5 Jayapura are still low, which is shown from the percentage of competency aspects and is classified as moderate for the knowledge aspect. The results will be reflected on science learning at SMPN 5 Jayapura.

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