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ANALYSIS OF SCIENTIFIC LITERACY SKILLS IN SOLVING QUESTION SCIENCE ON FOOD SECURITY THEMES IN SERANG CITY

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Abstract

In the 21st century, many changes have occurred in several aspects of life, one of which is the education aspect. Education in the era of globalization triggers comparisons of education internationally in terms of curriculum, assessment methods and student achievement in scientific literacy. The Program for International Student Assessment (PISA) is a program implemented by the OECD. Indonesia is a country with low PISA results with scientific literacy skills that are below average. Scientific literacy is the ability to think scientifically in understanding natural phenomena and solving problems found in nature. Scientific literacy ability consists of three dimensions, namely aspects of content, context and competence. This study aims to find out how the literacy skills of students in Kota Serang Junior High School in completing science on the science theme of food security. This type of research is descriptive qualitative research. The subjects of this study were 130 students of SMPN Serang City class IX who came from three schools, namely SMPN 1 Kota Serang, SMPN 13 Kota Serang and SMPN 25 Kota Serang. The research method used is descriptive qualitative research using research techniques in the form of test on the science of food security themes as many as 10 PG questions and analyzed using the Milles and Hubberman analysis method. Based on research data the quality of scientific literacy skills of junior high school students in Kota Serang is in the very low category with a percentage of 36%. If it is described in each aspect of scientific literacy ability, in the content aspect the percentage is 35%, the percentage context aspect is 35% and the percentage competence aspect is 36%.

Keywords: Science Literacy, Science Questions, Food Resilience Theme

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INTRODUCTION

In the 21st century, changes have happened in several aspects of life, one of which is in the aspect of education. Education in the globalization era faces more complex challenges in forming human resources who have excellent and qualified competence abilities because, in the 21st century, there is free competition between countries in some aspects of life, especially in the education aspect.

According to Amin (2017), globalization caused international comparisons among schools, curriculum, assessment methods, and student achievement. The example was the comparisons of students' scientific achievement skills in scientific literacy, such as achievements in PISA (Programme for International Student Assessment). In the 21st century, the demands of education are no longer applying the teacher center system but turning into the student center system. One of the demands of the student center system is that students must maintain scientific literacy skills.

Scientific literacy is the skills to employ scientific knowledge, identify problems, and draw conclusions based on evidence in understanding and making decisions regarding nature and its changes because of human activities (Anjarsari, 2014). Toharudin (2011) stated that individuals who had scientific and technological literacy skills were characterized by having the ability to solve problems using scientific concepts gained in the educational process. Scientific literacy skills could be applied as a parameter of the education quality in the country.

Programme for International Student Assessment (PISA) is a literacy study that aims to periodically analyze the international level scientific literacy skills of third-grade junior high school students, which is conducted by the Organization for Economic Co-Operation and Development (OECD) and the Unesco Institute for Statistics.

Scientific literacy consists of four aspects: content aspects, context aspects, competence aspects, as well as attitude aspects. According to Wulandari and Solihin (2016), the context of scientific literacy is an aspect with scientific issues that have an important relationship with everyday life. In the context there are several places to apply science, namely; individual or personal, national or local and global.

In konten scientific, there are three aspects of konten that are assessed, including content knowledge (knowledge that is in harmony with everyday life), procedural konten (Knowledge by exploring experiments on knowledge), and epistemic konten (Knowledge related to science, justifying data, and making scientific explanation) Activities with the main focus in the form of process activities that involve students when solving a question and problem are called aspects of competence. (Toharudin, 2011). There are three parts of the scientific process based on PISA 2015 namely: explaining scientific phenomena, identifying scientific problems and evaluating and designing scientifically to draw conclusions. Attitudes towards scientific literacy include freedom in scientific research, scientific thinking skills, curiosity, and critical thinking skills.

According to the Ministry of Education and Culture (2019), based on the results of the PISA conducted every three years, Indonesia was categorized as the country with scores and rankings below the average. From 2006 to 2012 Indonesia's ranking continued to decline, at position 64 out of 65 participants. In 2015 Indonesia ranked 62 out of 70 participants, and in 2018 it dropped to 72 out of 77 participants.

Those scores and ranks indicated that the scientific literacy scores in Indonesia were still particularly low, and Indonesia stayed at the lower ranks every single year. Several factors caused the low scores and ranks of Indonesian students in scientific literacy, which were: 1) Lesson materials that had never been taught so that students had difficulties answering questions; 2) Students were not used to solving questions that applied discourses; 3) Teachers were less familiar with the learning process based on the development of scientific literacy (Anggraini, 2014). Based on the statement above, one of the factors for the low skills of scientific literacy was that students were not used to solving science questions. Questions could be defined as a test conducted by educators. Tests were techniques used to conduct measurement activities. Tests contained various questions, statements, or a range of tasks that students must answer to measure students' abilities. There were two types of written tests, which were essay tests and objective tests. (Arifin, 2012).

Tests are one of the most crucial things in academics. Tests are conducted to understand the improvement, progress, and lack of student learning outcomes achieved in the learning process. Assessment of science learning could be done by assessing scientific literacy. Scientific literacy itself is knowledge and understanding of scientific concepts and the ability to make decisions independently.

The scientific literacy assessment instrument was developed based on four aspects of the characteristics of scientific literacy assessment: scientific literacy competence, scientific literacy context, knowledge dimensions, and cognitive demands referring to the OECD scientific literacy assessment guidelines (2015).

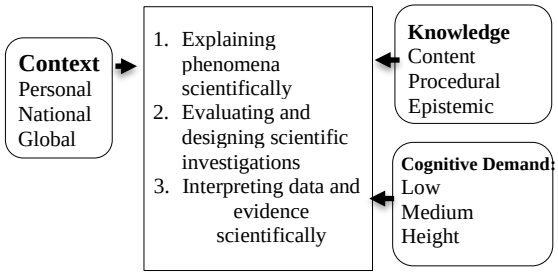

Figure 1. Scientific literacy assessment unit

According to Nofiana and Julianto (2017), one of the components of scientific literacy level was functional literacy, which referred to individuals' ability to relate to basic human needs such as food security. Food security, according to UURI (2012), was the condition of fulfilling food for the country to individuals, which could be viewed from the availability of sufficient food, both in quantity and quality, safe, numerous, nutritious, well-distributed as well as affordable, and did not contradict with the beliefs and culture of the community in order to establish healthy, active, and productive life continually.

Indonesia is an agricultural country that has various agricultural sectors to support food needs. The theme of food security was used in order to develop students' abilities in creating or utilizing the existing surroundings into products or services to improve the quality of food and quality of life. Learning using the theme of food security can practice students in solving the food problems they face, such as the lack of land to cultivate plants.

According to the results of interviews with teachers at SMPN 1 Serang City, SMPN 13 Serang City, and SMP PGRI Walantaka, learning in Serang city schools implemented the 2013 curriculum. One of them was by implementing reading activities before starting learning, and the learning process was based on scientific literacy. However, in the evaluation process, teachers had not conducted tests based on scientific literacy, especially on the theme of food security. As a result, teachers did not understand the quality level of students' scientific literacy skills in Serang city's junior high school.

Based on the description above, we can understand that scientific literacy needs to be measured, known, and observed to improve the quality of education in Serang City. Therefore, the researchers tried to analyze students' scientific literacy skills in the field of science with the title "*An Analysis of scientific literacy skills of SMPN Serang City students in solving science problems on the theme of food security*". This study aimed to determine how the quality of students' scientific literacy skills at SMPN Serang in solving science problems with the theme of food security.

METHOD

The research method applied was descriptive qualitative. This research aimed to describe the quality of students' scientific literacy skills in solving science problems with the food security theme. The design adopted was the research design by Millees and Huberman (1995).

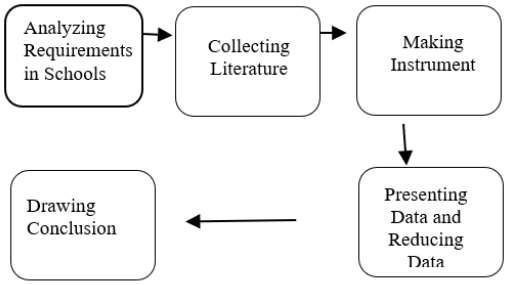

Figure 2. Research procedures analysis of students' scientific literacy skills

Sampling was conducted by using purposive sampling, which was determined with certain considerations. The research population obtained was 130 students in 9th grade of junior high school, aged 14/15 years old, who came from three State Junior High Schools according to the school category in Serang City. See the Table 1.

Table 1. Research sample

No	School	Male	Female
1	SMPN 1 Kota Serang	26	33
2	SMPN 13 Kota Serang	22	26
3	SMPN 25 Kota Serang	6	17
	Total	**54**	**76**

The period required to conduct this research was eleven months, starting from November 2020 to October 2021. Data collection was done using measurement techniques in the form of test instruments of science problems on the theme of food security contained multiple choice of 10 questions that had been tested for its validity. Students' scientific literacy skills were the score reached by students after solving the science problems on the theme of food security. The

research data were analyzed by calculating the percentage of scientific literacy achievement using the Purwanto (2013) formula as follows:

$$Percentage\ Score = \frac{J_b}{N}\ X\ 100\%$$

J_b : Total questions answered correctly

N : Total Students

The results of the data percentage were converted based on the criteria in Table 2.

Table 2. Category percentage of student achievements in scientific literacy

No	Score Interval	Category
1.	86–100	Very High
2.	76-85	High
3.	60-75	Moderate
4.	55-59	Low
5.	<54	Very Low

(Purwanto, 2013)

RESULTS AND DISCUSSION

Time development requires students to master some competencies, one of which is scientific literacy skills. This research aimed to determine the quality of students' scientific literacy skills in Serang City Junior High Schools in solving science problems on the theme of food security and to discover what factors influenced the quality of Serang City Junior High School students' scientific literacy skills. Data collection was done from July to August 2021 at three State Junior High Schools in Serang City, which were SMPN 1 Serang City, SMPN 13 Serang City and SMPN 25 Serang City.

Scientific literacy is a fundamental skill that students must master to face the era of globalization. According to Yulianti (2017), scientific literacy skills could be defined as the ability to understand science, identify questions, draw conclusions with evidence for every decision regarding nature and human activities.

Individuals who own scientific literacy skills have the competence to explain phenomena scientifically, evaluate as well as design scientific investigations, and interpret scientific data along with evidence. Scientific literacy skills consist of context, content, and competence. Measurement of the quality of scientific literacy skills is highly crucial to conduct as a reference for teachers to know how much the students master and apply learning in their daily life.

Table 3. The results of the scientific literacy skill test of serang city junior high school students in solving the science problems on the food security theme

Criteria	Interval	Frequency	Percentage
Very Low	X<49	91	70%
Low	50 < X ≤ 59	17	13%
Moderate	60 < X ≤ 69	9	7%
High	70 < X ≤ 79	7	5%
Very High	X > 80	6	5%
Total		**130**	**100%**

Based on Table 3, it could be seen that the results of the scientific literacy skills of students in Serang City Junior High School in solving science problems on the food security theme were divided into five categories. In the very low category, there were 91 people with a percentage of 70%, in the low category, there were 17 people with a percentage of 13%, in the moderate category, there were 9 people with a percentage of 7%, in the high category, there were 7 people with a percentage of 5%, and the last category was very high with 6 people in a percentage of 5%. The average scientific literacy skills of students in Serang City Junior High School were 35.5. As a result, Serang City Junior High Schools' scientific literacy skills were categorized in the very low category in solving science problems on the theme of food security. Scientific literacy skills consisted of four aspects. In this research, three aspects were applied: content (knowledge), context, and competence aspects. The following were the percentage results for each aspect of scientific literacy.

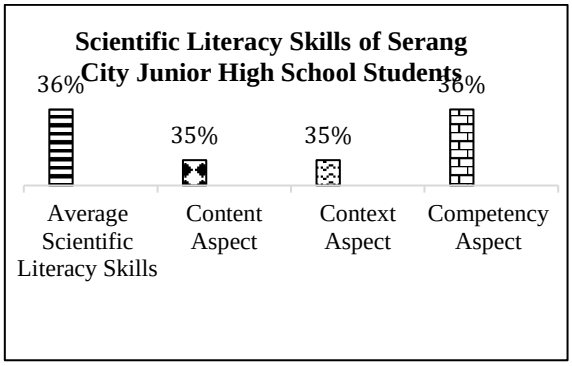

Figure 3. The graphic of scientific literacy skill results in each aspect

Based on the results of Picture 3, it could be seen that the category for each skill aspect was in the very low category.

Content Aspect

The content aspect focused on concepts that understood natural phenomena and were relevant to real-life situations. Knowledge aspects measured were content aspects, procedural aspects and empirical aspects. Measurement of the knowledge aspect aimed to understand how much students apply concepts in their daily life (Nofiana and Julianto, 2017). The percentage of the content aspect (knowledge) can be seen in Table 4 as follows.

Table 4. The scientific literacy skill of serang city junior high school students on the knowledge aspect

Item	Percentage	Average score	Category
Content	37%	35%	Very Low
Procedural	31%		
Epistemic	38%		

Based on Table 5, it could be seen that the average percentage of scientific literacy skills in the content aspect was 35% with the "very low" category. Most of the students in Serang City Junior High School had not been able to master concepts, facts, and ideas regarding natural phenomena that happen in the surrounding environment and had not fully understood scientific investigations. The knowledge aspect consisted of three aspect items: the percentage of content items was 37%, the procedural items were 31%, and the epistemic item was 38%. Based on the knowledge aspect items, procedural knowledge was knowledge with a lower percentage of achievement than content and empirical knowledge, which was 31%. According to Awara (2019), this result happened because procedural knowledge was the knowledge that required the combined ability of content knowledge and empirical knowledge.

The opinion above was in line with Sucianti's statement (2015) regarding the weakness of students' abilities in procedural aspects. This occurrence was caused by science learning activities which tend to be held by verbally transferring the knowledge from teachers to students, and teachers did not emphasize the scientific process to the students.

Many factors caused the low results of scientific literacy skills in the aspect of content (knowledge). According to Mujib and Suparingga (2013), students in Indonesia tended to be very good at memorizing but less skilled in applying scientific processes and analysis. This result was also supported by learning habits in the classroom. Besides that, the requirements to complete the material that must be in accordance with the curriculum made students accept the concepts of science material that may not be fully understood. As a result, misconceptions occurred.

Supporting the statement above, according to (Pantiwati and Husamah, 2014), the low results of content knowledge were because of the learning process that was still dominated by facts that must be memorized. However, they had not been able to connect what they learned in the application to new situations. In addition, there was a psychological burden on students regarding the demand that students must have high grades without improving the skills had by the students.

School facilities are also crucial supporting factors to improve student learning. 9th-grade students have entered the adult phase, where at this stage, students' thinking has changed from a concrete way of thinking to an abstract way of thinking. One of the science activities that can push students to improve their knowledge skills is the practical learning method: the PBL (Problem based learning) method and the project method. These methods have been supported by the 2013 curriculum, which makes learning centered on students. However, there are still many students who rely on the teacher to transfer the learning in their practice.

Context Aspect

Context aspect of scientific literacy involves big issues related to science in everyday life, including the application of science in personal, national, and global settings. In this research, the context aspect applied was personal and global settings. The percentage results in the context aspect can be seen in Table 5 below:

Table 5. Scientific literacy skills in context aspect

Item	Percentage	Average	Category
Personal	29%	35%	Very Low
National	41%		
Global	37%		

Based on the results of Table 5, it could be understood that the average percentage of students' scientific literacy skills in the context aspect was 35%, with a very low category. According to Permatasari and Fitizia (2019), the low achievement of scientific literacy skills in the context aspect indicated that students had not been entirely able to apply the knowledge they learned in real contexts in everyday life.

Scientific literacy skills in context aspect consist of three aspects: personal aspect, national aspect, and global aspect. The personal aspect was contained in question no 5 on biotechnology material and questions no 7 as well as 8 on the nutrition chapter regarding digestive system material. The personal aspect was an item in the context aspect with a low percentage of 29%. Question item for the national category was contained in number 3 regarding the material on the structure and function of plants, question no 6 was about food biotechnology, and question no 10, which was regarding food research data in the province of Banten.

Global aspects were contained in questions no. 1 as well as 2; on the material of the structure and function of plants, and number 4; on the material of food biotechnology and digestive system. The percentage in the context aspect with a high interval value on the national item was 41%, with a very low category and near the low category. This result happened because questions no. 3, 6, and 10 were familiar material for students and have been studied by students in 10^{th} grade, so that the questions were particularly easy to do by students. Problems regarding the use of hydroponics have been widely done by Indonesian, and the problem of waste is quite familiar because of the many food factories in Indonesia.

According to PISA 2016, context covers the fields of science application, which include health, resources, environmental quality, and the latest development. The Health field was contained in questions no. 7, 8 and 9. This material explained ideal body health, efforts to prevent diabetes, and efforts to keep the body healthy. The resources field was presented in questions no. 3, 5 and 10, which were to improve the existing resources in Indonesia and develop resources to be better. The environmental quality field was mentioned in questions number 1, 2, 6 and 7, which explained efforts to reduce the effect of pollution on the environment and create a healthy environment. The latest development was presented in question no 4, regarding conducting genetic engineering to develop products with better quality.

The contextual aspect of learning has been applied in schools based on the development of the 2013 curriculum. The learning process in the classroom requires students to be able to connect the material to real issues, both personal, national, and global issues. At some schools in Serang City, students had not been able to connect the material to the problems in everyday life. This phenomenon occurred because learning in 2021 applied online methods, so teachers could not be able to control students during the learning process.

Permatasari and Fitizia (2019) argued that the low achievement of scientific literacy skills in the context aspect indicated that students had not been completely able to apply the knowledge they learned in real contexts in daily life.

This research was also related to research conducted by Nofiana (2017). Nofiana's research explained that the low context aspect happened because the curriculum used in schools tended to apply more material than its application. As a result, science learning was less relevant and less popular for junior high school students and caused students to be less responsive to developments and problems in the surrounding environment.

Lima. et al. (2010) stated that learning with the concept of field learning was an alternative that could be used to improve students' scientific literacy. Field trip activities included observation and analysis, both from the geological aspect and the existing environmental context. This activity could make students understand concepts that require an abstract level.

Competence Aspect

The aspect of scientific competence focused on the students' mental processes involved when answering a question or solving a problem (Toharudin, 2011). The competence aspect measured in the research consisted of three items: explaining scientific phenomena, interpreting data along with evidence scientifically, and evaluating as well as designing scientific questions. The

results of the percentage of students' scientific literacy skills in the aspect of competence in each item can be seen in Table 6 below:

Table 6. Students' scientific literacy skill in the competence aspect

Item	Percentage	Average	Category
Explaining Scientific Phenomena	38%	36	Very Low
Interpreting data and evidence scientifically	35%		
Evaluating and designing scientific questions	35%		

Based on Table 6, the competence aspect of junior high school students in Serang City in solving science problems on the food security theme with an average of 36% was included in the 'very low' category. This result significantly affected the students' poor scientific literacy skills. The competence aspect consisted of three items: on the item of explaining scientific phenomena with a percentage of 38%, on the item of interpreting data and evidence scientifically with the percentage of 35%, and on the item evaluating and designing scientific questions with a percentage of 35%.

The aspect of explaining scientific phenomena was the aspect item with the highest percentage compared to items in other competence aspects, which was 38%. This result was because the aspect of explaining scientific phenomena was a question that was easy to be understood by students. Aspects of explaining scientific phenomena were shown in three questions, which were in questions no. 2, 4, and 6. According to the OECD (2016), questions with indicators explaining students' scientific phenomena were easy questions because students were required to remember the knowledge they learned and can use as well as interpret it in certain situations based on the existing facts to explain a scientific phenomenon.

Competence aspects that interpret data and evidence scientifically had a low ability with a percentage of 35%. The questions on the aspect of interpreting scientific data and evidence were included in three questions: questions no. 5, 9, and 10. The questions presented were questions that required students to identify problems through scientific exploration, distinguish questions, propose how to explore questions scientifically, and evaluate exploration questions scientifically. Besides that, the problems aimed to push students to explain and evaluate objectivity, data conditions, and generalization of explanations. According to Wulandari and Solihin (2016), the low skills of students on items of interpreting data and evidence scientifically was because of the students that could not be able to describe clear and logical relationships regarding evidence and conclusions of a particular problem. In this research's case, the difference in the cognitive level on the questions highly impacted the results of student analysis. Another factor revealed by Hadinugraha (2012) showed that the science learning process tended to emphasize understanding based on memory and rarely improved analytical skills based on scientific data.

The competence aspect in evaluating and designing scientific investigations was problems with a very low percentage of 35%. There were four questions presented in questions no. 1, 3, 7, and 8. According to the OECD (2016), the competence aspect of evaluating and designing scientific investigations was problems with the demand to explain and evaluate scientific questions and propose efforts or ways to deal with scientific question plans. Competence aspects in evaluating and designing scientific questions were linked with the context aspect of knowledge and attitudes. As a result, this connection caused a very complex relationship. Other research of competence aspects can be seen in Nofiana's research (2017). She stated that the low skills of scientific literacy in the competence aspects were due to the science learning process that was still only transferring knowledge and having lacked emphasis on the scientific process.

One of the efforts that can be conducted was by using scientific-based learning. Abidin (2014) said that scientific learning was learning that could make students solve problems with accurate analysis so that they could make conclusions. The impact of scientific activities was to improve students' scientific literacy skills (Asyhari and Hartati, 2015).

CONCLUSION

Based on the research result, it could be seen that the scientific literacy skills of junior high school students in the Serang City in solving science problems on the theme of food security were in the very low category, with a percentage of 36%. Scientific literacy skills had three aspects:

content, context, and competence aspects. Each aspect was in the very low category with the percentage of content aspect 35%, context aspect 35% and competence aspect 36%.

This research should be further developed to improve scientific literacy skills and familiarize students with working on problems that refer to indicators of scientific literacy skills so that students will be accustomed and trained to solve those problems.

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