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The Analysis of Science Literacy Competencies Ability on Digestive System Material of Eleventh Grade Students in SMAN 1 Bangsri Jepara

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Abstract

The research aims to analyze the students' scientific literacy competence abilities in 11th grade SMAN 1 Bangsri Jepara on the Digestive System material and the factors that influence it. The research method uses quantitative descriptive with survey techniques. The research sample was 143 science students of 11th grade SMAN 1 Bangsri Jepara in the 2020/2021 academic year. Instruments are science literacy competence test totaling 30 multiple choice and questionnaire for student responses related to learning. The results of students' scientific literacy competence ability in SMAN 1 Bangsri Jepara on the digestive system material were overall good. Students are able to remember, apply scientific knowledge; explain the implications of the article; identify and produce explanatory models; ensure objectivity, analyze, describe, and infer data; evaluate and propose ways of scientific investigation; identify problems, assumptions, arguments and scientific evidence. However, the ability of students is still lack in determining the right predictions; propose a hypothesis; and evaluating descriptions from different sources. The factors that affect student's scientific literacy competence are learning models, teaching materials, evaluation questions, and practicum on the digestive system material.

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INTRODUCTION

Facing the globalization era of the 21 centuries, there are four domains that students need to have there are digital literacy, inventive thinking, effective communication, and high productivity. In terms of digital literacy, one of the skills needed is scientific literacy. Scientific literacy is the ability to use scientific knowledge and apply this knowledge in everyday life. Scientific literacy is very important to understand and develop technology in the globalization era (Choi *et al.*, 2011).

In the assessment of scientific literacy according to the *Programme for International Student Assessment* (PISA) there are four aspects used, namely: aspects of competence, aspects of knowledge, aspects of context, and aspects of scientific attitudes. PISA assessment priorities for 2012, 2015, and 2018 in scientific literacy is focused on several aspects of scientific literacy competencies, there are evaluating and designing scientific investigations, explaining scientific phenomena, and interpreting scientific data and evidence. The aspect of scientific literacy competence is an interesting aspect to analyze. Because, one of the factors that causes low scientific literacy is the students are not usually solving problems or tests related to science process skills (science literacy competence) which are a major part of scientific literacy (Winata *et al.*, 2017).

Science literacy competence relates to students' skills in using tools and materials, measurement, and arrangement. In addition, social skills can also be seen when students discuss their observations. According to Diani (2015), this ability requires students to be able to find the truth from a scientific investigation, try to find arguments or laws, and draw conclusions from the experiments being carried out. According to Gürses *et al.*, (2015) the ability of the science process allows students to be active, develop a sense of responsibility, improve learning, and research methods.

SMAN 1 Bangsri Jepara is one of the best high school in Jepara Regency. This school is included in the four leading schools in the rural area of Jepara Regency. Accreditation of SMAN 1 Bangsri in 2017 was get a final score of 92.00. Based on interviews with biology teachers of SMAN 1 Bangsri Jepara, teachers already know the aspects of scientific literacy competencies. The student's ability to identify problems and find key features in the questions was good. Student Worksheets in the practicum have described that students are able to carry out practical activities properly, objectively, and the ability to relate theory to the results obtained. In addition, research has never been carried out on the analysis of students' scientific literacy competencies in biology subjects at the school. The material of the digestive system has a fairly broad scope and is directly related to humans, especially in everyday life. This material is one of the materials tested by PISA

The research aims to analyze the ability of student scientific literacy competence in 11th grade SMAN 1 Bangsri Jepara on the digestive system material and to determine the factors that affect the students' scientific literacy competency abilities.

RESEARCH METHOD

This research method uses a quantitative descriptive with survey techniques and 143 students of SMAN 1 Bangsri Jepara was involved as research sample. The research subjects were class XI students of the Mathematics and Natural Sciences in the 2020/2021 academic year. Methods of data collection were carried out by tests, questionnaires, and interviews. The research instrument uses 30 multiple choice test items to measure aspects of students' scientific literacy competence. Questionnaires to find out student feedback regarding their ability to complete test instruments, practical activities on digestive system material, and evaluation questions used by the teacher. The interview sheets in this study were aimed at teachers for introduction studies and to determine the factors that affect students' scientific literacy competence abilities. The instrument has been tested for validity, reliability, differentiation and difficulty level. Data analysis includes the results of the analysis of the ability of science literacy competencies, student feedback questionnaires and interview results.

RESULTS AND DISCUSSION

The results of students' scientific literacy competence ability in SMAN 1 Bangsri Jepara can be seen through three indicators, namely indicators of explaining scientific phenomena, evaluating and designing scientific investigations, and interpreting scientific data and evidence. The results of the analysis can be seen in Table 1 below.

Table 1. Percentage Each Indicator of Science Literacy Competency Aspects

Indicator of Science Literacy Competency Aspects	Percentage	Criteria
Explaining scientific phenomena	77,76 %	Good
Evaluating and designing scientific investigations	85,25%	Good
Interpreting scientific data and evidence	79,86%	Good
Average	80,96%	Good

Supporting data in the form of student feedback questionnaires is presented in Table 2 below.

Table 2. Recapitulation of Student Response Questionnaire Results

No.	Questionnaire Statement	Percentage
1.	Able to connect science concepts in doing test questions	77,8%
2.	Able to analyze scientific phenomena presented in texts / articles	78,88%
3.	Able to apply scientific knowledge in everyday life	80,14%
4.	Able to determine correct predictions in texts / articles related to scientific phenomena	75,2%
5.	Able to make hypotheses in accordance with the text / articles presented	79,2%
6.	Able to identify appropriate statements in accordance with the text / articles presented	81,4%
7.	Able to identify problems in the text / articles presented	81,7%
8.	Able to find key features in the text / articles presented	75%
9.	Knowing the proper way of investigating a problem	75,9%
10.	Able to understand the results of observations an experiment or research	83,78%
11.	Able to determine the variables used in an experiment or research	78,7 %
12.	Able to evaluate or justify ways of scientific investigation on an experiment or research	72,4 %
13.	Able to identify evidence in an experiment or research	77,62%
14.	Able to deduce data from the graph of an experiment or research presented	79,4%
15.	Able to conclude data from the observation table presented	81,26%
16.	Able to understand the reasons for the conclusions made	83,78%
17.	Able to provide arguments based on scientific theory	77,06%
18.	The questions given by the teacher on the digestive system are analysis-oriented	80%
19.	The questions given by the teacher on the digestive system are related to scientific phenomena	79,58%
20.	Have answered questions in literature, graphics, and pictures form	85,59%
21.	Carry out practical activities on the digestive system material directly	94,27%
22.	Able to formulate problems and formulate hypotheses when practicing the digestive system material	80,14%
23.	Collect observational data objectively	69,65%
24.	Able to analyze observational data accompanied by literature study	76,5%

Ability Aspects of Student Science Literacy Competencies in Digestive System Material

Based on the results, the students' scientific literacy competence abilities were included in the "good" category. There are three indicators seen in this competency namely, indicator explaining scientific phenomena, evaluating and designing scientific investigations, and interpreting scientific data and evidence. Indicators explaining scientific phenomena include in the "good" category. Students' ability to remember and apply scientific knowledge is good. They are able to recall initial knowledge to interpret and explain a scientific phenomenon. According with the research of Sari *et al.*, (2017) that the ability to remember and apply scientific knowledge gets the highest percentage, because it is the lowest ability to achieve scientific literacy skills. The results of the interview with the teacher were obtained, learning the digestive system took place online through the What's App (WA) group. The method used by the teacher is discussion and question and answer. According to Deta (2017), the application of the discussion method enables students to construct their knowledge either independently or in groups.

The ability to explain the implications of the articles presented in the questions is good. Students are able to explain the findings and conclusions from the results of research or scientific phenomena. Based on the results of the questionnaire, the questions used by the teacher were related to scientific phenomena, so that students were used to explaining the implications of scientific articles. Research by Penuel *et al.*, (2019), assignments or evaluation questions that present scientific phenomena can test students' mastery of performance. Students have good abilities to identify, use, and generate explanatory models from the articles presented. This is because students are able to find the key features of a problem in the text or article. Students are able to process information which is then converted into a model that can explain a scientific phenomenon. According to NCTM (2000), students can develop and deepen their understanding of concepts and relationships when creating, comparing, and using various representations.

However, students' ability to determine predictions is still lacking. This can be seen from the low percentage of student answers in number 14. Students do not understand the concept of the causes of digestive disorders presented in the questions. According to Schwartz and Brandy (2012), the concept of science is very important for students to have in order to respond to and assist in making decisions related to scientific phenomena in everyday life. The ability of students to propose a hypothesis is still lacking. This can be seen from the low percentage of student answers in number 27. Students find it difficult to reason from theory to experimental activities in explaining scientific phenomena. In addition, students do not understand the variables used. According to Darus & Saat (2014), the mastery of students' abilities in formulating hypotheses depends on the ability to understand basic skills and the ability to manipulate variables.

Indicator evaluating and designing scientific investigations included in the "good" category. This indicator can help students understand research data as a means of learning resources, improve student literacy and understanding (Hasasiyah *et al.*, 2020). Based on the research results, students have good abilities to describe, evaluate, ensure data reliability, objectivity and generalization. Students are able to process data into something that can be stated clearly and precisely. In addition, students can respond to and assess a scientific investigation, determine reliable and objective answers and conclusions from a scientific investigation. Most students can analyze the procedures and results of experiments on questions, and are able to evaluate the cause and effect of an experimental result. Research of Setiawan (2020) explains that increasing students' scientific literacy competence is easier to train using simple and large objects.

The students' ability in evaluating the way of scientific investigation is in the very good category. Students have been able to respond to and evaluate an experiment or research. Based on the test answers, they are able to assess and respond to a procedural text related to the experiment. The results of the questionnaire show that students have the ability to either evaluate or justify scientific investigations. Biology learning has the highest increase in the skills of evaluating and designing scientific investigations compared to learning physics (Setiawan, 2020)

The ability of students in proposing ways of scientific investigation is good. Students have used their procedural knowledge to examine and analyze a scientific experiment or investigation. Students have a

good ability to identify problems in an experiment. Students are able to find problems in terms of the data they have. According with research by Ulya (2016) states that students can understand problems after prior mentoring.

Indicator interpret data and evidence scientifically into the "good" category. The achievement of this indicator is seen from the students' ability to analyze, interpret data, and draw appropriate conclusions; identify assumptions, evidence and reasons in the text; identify scientific arguments and scientific evidence; evaluate explanation and scientific evidence (OECD, 2015). Students have good skills in analyzing, interpreting, and concluding data appropriately. Students are able to read and understand observational tables or charts, then students can interpret them into a concise sentence that describes the conclusions from the data. Data interpretation need to be learned by students, because data interpretation is related to understanding and giving meaning to data or information (Utami, 2013). The research questionnaire was distributed to students, it was found that the students had already worked on questions related to graphics or research data

Students are able to identify assumptions, evidence and reasons in the text presented in the questions. Identifying assumptions is one of the sub components in critical thinking skills. According with research Kadayifci *et al.*, (2012) explained that, there is a correlation between critical and creative thinking and the ability to identify deficiencies in an assumption or argument. Research conducted by Sari *et al.*, (2017) shows that students' ability to identify assumptions, evidence and reasoning with related sciences is still low. Project-based learning is needed to support the achievement of this ability.

Students can answer questions related to finding activities, identifying scientific arguments or statements that are supported by some evidence or facts that are measured and observed from scientific investigation activities. However, students' ability to evaluate an explanation from different sources is still lacking. This can be seen from the low percentage of student answers in number 12. Students have difficulty accepting or rejecting a statement based on data in a scientific explanation. Students only use their memorization but do not use their knowledge in solving these problems. According to Aryani *et al.*, (2016) the ability of Indonesian students to have low scientific literacy is caused by learning methods and science assessments that only emphasize memorization and forget about the process and its application in everyday life.

Based on the results of the interview with the biology teacher, during the discussion during online learning, the teacher observes students in making arguments. However, during the practicum, the activity of identifying arguments could not be implemented. Research (Sari *et al.*, 2017) shows that students who receive module-assisted project learning have been able to identify questions to be explored through scientific investigation.

Affecting Factors of Students Science Literacy Competence Abilities

Based on research data, literature study, interviews with teachers, and questionnaires aimed at students, the factors that affect the ability of students' scientific literacy competence aspects of the digestive system material are learning models, teaching materials used, evaluation questions, and practical activities digestive system material.

The interviews with the biology teacher, the learning model used in the classroom is the discovery learning model. Based on *Lete et al.*, (2016) discovery learning model is the right model in science learning in high schools because it can rise the ability of the competency or process science effectively by involving students actively in every process. Because learning takes place online, the method used by the teacher is discussion or in the WA group. Discussion activities can improve students' abilities in explaining their arguments or opinions. Based on Deta (2017) research states that learning with the discussion method can improve learning outcomes, explore activity, communicate and increase students understanding of the material discussed.

The learning model that needs to do is a model of student science process development. Where, students are guided to find and investigate themselves about a scientific concept. In addition, learning models based on scientific phenomena that are close to students are very good to do. Because, students will

be guided to have the ability to predict the causes and effects that occur.

In online learning the teacher uses the digestive system e-book, but it does not include aspects of scientific literacy competence. To achieve the ability of the competency aspect, the teaching materials are expected to contain indicators of competency aspects. The use of teaching materials is very important to make it easier for teachers in implementing learning. Example of teaching materials are handouts, leaflets, worksheets, modules, and other textbooks. In online practicum, the teacher provides student worksheets to do. According to Liandari *et al.*, (2017), student worksheets assessments are used to determine students abilities in formulating and testing hypotheses during practicum. Rosa (2015) research also uses teaching materials in the form of modules based on aspects of scientific literacy competence which can improve learning outcomes and science literacy competence ability.

Some of evaluation questions used already contained aspects of scientific literacy competence, and included graphics, data, literature, and pictures. Graphical and picture test can help students improve their data analysis and interpretation skills. According to Rusilowati *et al.*, (2016), evaluation instruments based on scientific literacy, especially aspects of scientific literacy competence, need to be developed, so that students are familiar with problem solving based on scientific literacy. The test can be in multiple choice, right-wrong, essay, or can be seen through student worksheets. Some of the instruments for assessing aspects of scientific literacy competence are designed using a multiple-choice format, because it is relatively easier and less time consuming to process.

During online learning, starch practicum is carried out independently in each house. With practicum activities, students' scientific literacy competence skills will increase. The results of the questionnaire showed that students were sufficient in formulating problems and formulating hypotheses through practicum activities on the digestive system material. The ability of aspects of scientific literacy competence is closely related to practicum activities. Through practicum activities students can designing experiments, assembling tools and materials, analyzing data, proposing hypotheses, and predicting and drawing conclusions from research results. Activities performed during the practicum is the implementation of indicators science literacy competence aspects. Rusilowati *et al.*, (2016) mentions one factor that causes low literacy skills in science, including students rarely doing lab activities or experiments in science lessons.

CONCLUSION

The ability of students' scientific literacy competencies in the digestive system material in 11th grade SMAN 1 Bangsri Jepara was good for each indicator. Students are able to remember, apply scientific knowledge; explain the implications of the article; identify and produce an explanatory model; ensure objectivity, analyze, describe, and infer data; evaluate and propose ways of scientific investigation; identify problems, assumptions, arguments and scientific evidence. However, the ability of students is still lacking in determining the right predictions; propose a hypothesis; and evaluating descriptions from different sources. Factors that affect the ability of students' scientific literacy competencies of the digestive system material in 11th grade SMAN 1 Bangsri Jepara are learning models on digestive system material, teaching materials used in digestive system material, evaluation questions on digestive system material, practicum activities on digestive system material.

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