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Research Article

SCIENCE LITERACY SKILL OF CHEMISTRY EDUCATION STUDENTS ON WASTE MANAGEMENT MATERIALS

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Abstract

This study is a descriptive study with a quantitative approach that aims to analyze instrument validity and scientific literacy skill of the third Chemistry Education students in the faculty of teachers and training at the University of Mataram on waste management materials. There are 68 students in this study's sample, with simple random sampling as the technique for collecting the sample. This study's data collection is a test instrument similar to PISA based on scientific literacy analyzed using descriptive statistics. The result of instrument validity from validators (expert lecturers) shows that the average of 79.40% is entirely valid and can be used for measuring scientific literacy skills, but it needsrevision. The result of each aspect shows that the average knowledge aspect (60.80%), context aspect (63.30%), competency aspect (66.50%), and attitude aspect (66.30%) so that the scientific literacy skill of third-semester chemistry education students at faculty of teachers and training at the Universityof Mataram is in enough category (63.30%). This study shows that the scientific literacy skill of chemistry education students at the University of Mataram needs to be improved, so each of the indicators gets a sufficient number and the scientific literacy skill becomes better.

Keywords: Analysis, Science Literacy Skill, Test Instrument, Waste Management.

INTRODUCTION

Rapid technological developments affect a person's competitiveness and ability in the community. The 21st century is marked by the rapid development of science and technology in various countries (Yuliati, 2017). This must be balanced with the ability of all students to have the skills to use reason, thoughts, ideas to face challenges in the future (Pratiwi, 2019). 21st century abilities are needed to help competitiveness between individuals, and one of them is scientific literacy knowledge (Fuadi, 2020). According to the OECD (Organization For Economic Cooperation and Development), scientific literacy is defined as the scientific knowledge of an individual and its use in identifying questions, acquiring new knowledge, explaining scientific phenomena, and drawing evidence-based conclusions about science and understanding the characteristics of science as a form of knowledge. man. This is also related to investigation, awareness of how science and technology shape our material, intellectual and cultural environment, and willingness to engage in science issues and related science ideas as a reflective citizen (Pratiwi, 2019). Knowledge of scientific literacy has an effect on increasing the competitiveness and welfare of a nation (Matsun, 2018). The progress of a country can be seen from the quality of science education applied in each country. So it is important to prepare a quality science education. The achievement of scientific literacy in Indonesia ranks low, where since 2000 Indonesia has several times participated in the scientific literacy assessment organized by PISA. PISA (the program for international student assessment) is a program to measure achievement in mathematics, reading, and science.

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The latest PISA results data in 2018 Indonesia ranks 71st out of 79 PISA participating countries. The average score of Indonesian scientific literacy is 396, this is far below the international average score of 500, these results show that the scientific literacy of students in Indonesia is still relatively low (Shaleh, 2020). The cause of the low scientific literacy ability is the selection of learning resources (Agung, 2019). This is in line with the results of previous research (Hasanah, 2015) where the low scientific literacy ability of students is directly related to the selection of learning resources. Science literacy in science learning is mostly still limited to textbooks or textbooks rather than direct learning. Stake and Easly (Aqil, 2018) state that textbooks are used by 90% of all science teachers and 90% of the allocation of learning time. Knowledge and application of science books that only rely on textbooks or texts have not fully made students understand, as a result, lessons become boring and students do not understand lessons in the context of life (Fuadi, 2020). When learning takes place students are not trained to express opinions, so when given questions related to the meaning and relevance of the material to the surrounding environment, students are not able to solve them (Rusilowati, 2016). The low scientific literacy ability of students is also caused by the instrument technique used, the instrument is still not able to measure students' scientific literacy ability (Permanasari, 2011). Educators contribute a lot to determine the quality of scientific literacy skills, one of which is in making scientific literacy test instruments. Educators also contribute to what students know, and it is influenced by what educators provide at the time of learning. This means that the low quality of science education in terms of students' scientific literacy skills is largely contributed by the quality of educators (Rusilowati, 2017). Prospective educator students must also have scientific literacy skills as a provision when they become teachers later, so that they are able to improve the quality of education and are able

to produce students who understand science and have high scientific literacy abilities (Gherardini, 2016). Chemistry is included in the scientific family, so chemical literacy is part of scientific literacy (Sujana, 2014). Chemical science literacy refers to students' ability to understand and apply chemical knowledge in everyday life (Thummathong, 2018). Science literacy at the university level is very important for students because scientific literacy can be a provision for students in facing any challenges in the global era (Yuliati, 2017).

Therefore, efforts are needed to analyze students' scientific literacy skills by making scientific literacy-based test instruments. The test instrument used to analyze students' ability in terms of scientific literacy is to use several questions similar to PISA. Test instruments using PISA questions can train reasoning and improve students' scientific literacy skills, and can address issues that exist in the midst of society, especially those that require an understanding of science (Hasriani, 2019). These PISA questions are equipped with discourses related to contexts such as personal, local, national and global issues that discuss science, technology, energy, health, and food (Laksono, 2018). The PISA standardized test questions not only measure the ability to solve problems but the ability to solve problems, namely starting from applying (C3), analyzing (C4), formulating (C5), and expressing ideas (C6) to others (Bidasari, 2017). Scientific literacy in PISA measures 4 aspects, they are knowledge, context, competence, and attitudes (Wulandari, 2016). A test instrument similar to PISA is very good given to prospective chemistry teacher students because chemistry is part of science. Analysis of the scientific literacy ability of third semester students of Chemistry Education on waste management materials needs to be carried out as prospective chemistry teachers.

METHODS

This type of research is descriptive research with a quantitative approach. Descriptive research is used to analyze data, namely by describing or describing sample or population data that has been collected as it is (Sugiyono, 2016). Quantitative research is research that uses numbers, such as the interpretation of data and the appearance of research results (Arikunto, 2016). This research was conducted to examine the scientific literacy ability of the third semester Chemistry Education students of FKIP Mataram University on waste management materials. The population of this study was taken from the third semester Chemistry Education students of FKIP Mataram University who had completed the laboratory management course, and the waste management material in the previous semester.

The sampling technique used is simple random sampling, which is taking samples from the population randomly without regard to the strata that exist in the population. Data on scientific literacy ability was obtained using a test instrument in the form of description questions with a total of 20 questions that had been declared valid by the validator. The questions made contain aspects of scientific literacy, namely aspects of knowledge, aspects of context, aspects of competency, and aspects of attitude. Data were analyzed using descriptive statistics and described into categories of learning outcomes according to (Purwanto 2019), based on the range of scores categorized into: very good (80-100), good (76-85), adequate (60-75), poor (55-59), and very less (0-54).

RESULTS AND DISCUSSION

Expert Validity

Expert validity is carried out by experts in Chemistry Education. The instrument that was validated was in the form of scientific literacy test questions on waste management materials. Expert validation data is calculated per item, then the average validation result of each validator is calculated and analyzed based on the descriptive eligibility criteria in Table 1.

Table 1. Average validation results of scientific literacy instruments

Validator	**Validation** results	Category	Annotation
1	80,00%	Quite valid	Can be used but needs to be revised
2	80,70%	Quite valid	Can be used but needs to be revised
3	77,60%	Quite valid	Can be used but needs to be revised
4	79,40%	Quite valid	Can be used but needs to be revised

Table 1 shows that the results of the validation of the scientific literacy test instrument obtained from the validators have an average of 79.40% which is quite valid and can be used but needs revision.

Descriptive statistical analysis

Descriptive statistics provide an overview of the data that has been collected, namely the results of the science literacy test of the third semester Chemistry Education students of FKIP at the University of Mataram. The data from the scientific literacy test results obtained from 68 research samples were analyzed using the highest score with a value of 95, the lowest score with a value of 20, the total score of scientific literacy ability as many as 4305, the average calculation with a value of 63.30 and the standard deviation of 17.50. The average value of the scientific literacy test was then interpreted descriptively based on the scientific literacy category proposed by Purwanto (2019). The results of students' scientific literacy skills on waste management materials are in the sufficient category. Based on the average value of the scientific literacy ability test, it is then interpreted descriptively based on the scientific literacy category proposed by Purwanto (Purwanto, 2019). Then an analysis of each aspect is carried out, namely (1) knowledge aspects, (2) context aspects, (3) competency aspects, and (4) attitude aspects.

Knowledge aspects

The knowledge aspect contains three indicators, namely content knowledge, procedural knowledge, and epistemic knowledge. Content knowledge is an understanding of theories, facts and concepts. Questions containing content knowledge indicators test students' understanding of the impact of waste, types of waste, relative molecular mass, oxidation number and waste treatment. The average obtained from the content knowledge indicator is 67.90% or sufficient. Indicators of procedural knowledge are understanding of concepts and procedures used in scientific investigations and data analysis collection. Questions containing indicators of procedural knowledge test students' understanding of research hypotheses and waste treatment techniques. The average obtained from the procedural knowledge indicator is 55.90% or less. This data is in accordance with Yana's research (2018) that the scientific literacy ability of prospective Physics teacher students on

procedural knowledge indicators is 41.66% or less, this is because students have not been able to identify question variables and explore their knowledge. Epistemic knowledge indicator is understanding in explaining an idea to build scientific understanding. Questions containing epistemic knowledge indicators test students' understanding of solutions and impacts of waste, characteristics of liquid waste, determine conclusions, and objectives of waste treatment. The average obtained from the epistemic knowledge indicator is 58.60% or less. This data is in accordance with the research of Rahmayanti (2021) that the scientific literacy ability of chemistry education students on the epistemic knowledge indicator is 43.00% or still lacking, this is because students have not mastered the theory or concept as a whole. The percentage of scientific literacy skills in the knowledge aspect is presented in Figure 1.

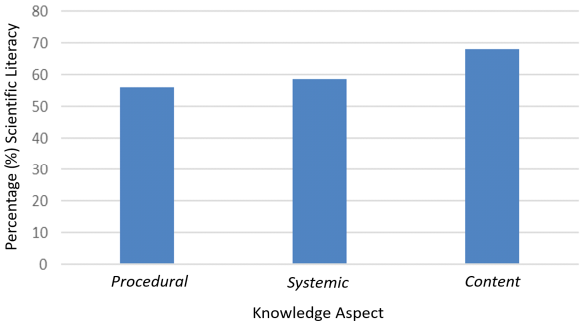

Figure 1. The results of the student's scientific literacy ability test on the knowledge aspect

Figure 1 shows that the content knowledge indicator produces a higher average than the other indicators. The content indicator contains an instrument of knowledge questions consisting of theoretical and concept questions. The high score on the content aspect shows that students have mastered the theory given during the learning process. The average value of procedural and epistemic knowledge indicators is lower because students have not fully mastered the concepts in conducting scientific investigations and do not understand the role of an idea in question. The average value generated from the three indicators is 60.80% which is included in the sufficient category. This data is in accordance with the results of research from Tursinawati (2018) that in the aspect of knowledge, prospective PGSD teacher students obtain an average of 66.60% or sufficient in the aspect of knowledge. Nurhiddayah (2020) also proved that in terms of knowledge, biology students obtained an average of 71.03% or sufficient. These three indicators, many students did not answer correctly on the procedural knowledge indicator, namely in question number 13. Question number 13 contained a discourse about the increasing use of detergents and students were asked to determine the appropriate detergent waste treatment technique. Students who can answer correctly as many as 27 respondents while those who answered incorrectly were 41 respondents. This shows that students do not understand the concept of waste treatment techniques and only understand theory.

Context aspects

The context aspect consists of three indicators, namely personal, local/national and global. Personal indicators are indicators related to the daily life of students and their families, local/national indicators are indicators related to the community where students live, while global indicators are indicators related to life around the world. The context aspect in this question only contains local/national indicators. Questions containing local/national indicators are found in discourses related to surrounding problems that test students' understanding of waste management techniques and theories related to waste management, the average obtained from local/national indicators is 63.30% or enough. This data is in accordance with Nurhidayah's research (2020) that in the context of microbiology students achieving adequate results with an average of 73.23% and Marlina's research (2019) that the use of concepts or theories significantly is in the sufficient category (64.40%). Local/national indicators, many students cannot answer correctly to questions that contain discourses that show the characteristics of tofu liquid waste used in waste management and students are asked to draw conclusions from the parameters of the tofu liquid waste. There were 22 students who could answer correctly, while 46 respondents who answered incorrectly. This shows that students have not been able to draw conclusions from experiments packaged in tabular form.

Competency aspects

The competency aspect consists of three indicators, namely explaining phenomena scientifically, evaluating and designing investigations and interpreting data and evidence scientifically. Indicators explain phenomena scientifically with the aim of identifying and explaining problems and keywords from scientific investigations to seek scientific information. Questions that contain indicators that explain phenomena scientifically test students' understanding of the impact and treatment of waste, the nature and types of waste. The value obtained on this indicator, the average is 63.90% or sufficient. Furthermore, the indicators of evaluating and designing investigations are applying science in interpreting scientific phenomena as well as identifying evidence and reasons behind conclusions. Questions that contain indicators of evaluating and designing investigations test students' understanding of how to reduce the impact of waste, the purpose of processing, determining research hypotheses, processing techniques and drawing conclusions, the average obtained from the indicators of evaluating and designing investigations is 51.90% or very less . The results of this study are in accordance with the results of Yana's research (2018) that the scientific literacy ability of prospective Physics teacher students on the indicators of evaluating and designing investigations is 50.56% or less, this is because students have not been able to investigate scientifically about the questions in the questions so that students have not been able to provide relevant answers.

The indicator of interpreting data and evidence scientifically is interpreting scientific evidence and communicating it and the social implications of science and technological developments. Questions containing indicators interpret data and scientific evidence to test students' understanding in determining relative molecular mass, oxidation number and determining pH, the average obtained from indicators interpreting data and scientific evidence is 83.80% or both student teacher candidates on the aspects of competence obtained an average of 60.00% or sufficient. These three indicators, many students cannot answer correctly on the indicators of evaluating and designing investigations, namely in question number 3. Question number 3 contains a discourse about water pollution in the Pagesangan river, which is one of the rivers in Mataram

and students are asked to determine how to deal with detergent waste. in the pagesangan river. Students who can answer correctly are 34 respondents while those who answer incorrectly are 34 respondents. This shows that students do not understand the concept of detergent waste management and only understand the theory because the answer choices are almost similar to make students fooled. The percentage of scientific literacy skills in the aspect of competence is presented in Figure 2.

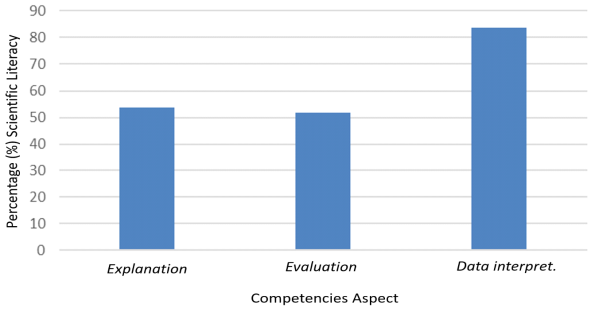

Figure 2. The results of the student's scientific literacy ability test on the aspect of competence

Attitude aspect

The attitude aspect consists of indicators, namely interest in science with indicators interpreting scientific data and evidence using a scientific approach to investigation and environmental awareness and Indicators explaining scientific phenomena and evaluating and designing investigations. An indicator of interest in science is a high curiosity towards investigation. The indicator interprets data and scientific evidence more highly than other indicators. Indicators interpret data and scientific evidence containing calculation questions, showing students already understand the formula used and how to count. Indicators explain scientific phenomena and evaluate and design lower investigations because there is quite a lot of discourse on the matter. The low score on points is due to the lazy nature of reading so that they do not understand the problems presented. Students could not find the keywords from the discourse. The average value obtained from the three indicators is 66.50% which is included in the sufficient category. The results of this study are in accordance with Yana's research (2018) that scientific literacy skills are in science and are willing to acquire additional scientific knowledge and the ability to use natural resources. Questions containing indicators of interest in science test students' understanding of the nature and types of waste, relative molecular mass, oxidation number, determining pH, waste treatment techniques, waste impacts and benefits, the average obtained from the interest in science indicators is 62, 00% or enough. Indicators of environmental awareness are concern for the environment and environmentally friendly behavior. Questions containing environmental awareness indicators test students' treatment in handling waste and how to reduce detergent waste so that they are environmentally friendly, the average obtained from the environmental awareness indicator is 70.60% or sufficient. The percentage of scientific literacy skills in the attitude aspect is presented in Figure 3. Based on Figure 3, it can be seen that the indicator of environmental awareness is higher than interest in science, this is because most students prefer nature and the surrounding environment so that it triggers high environmental awareness to protect the environment.

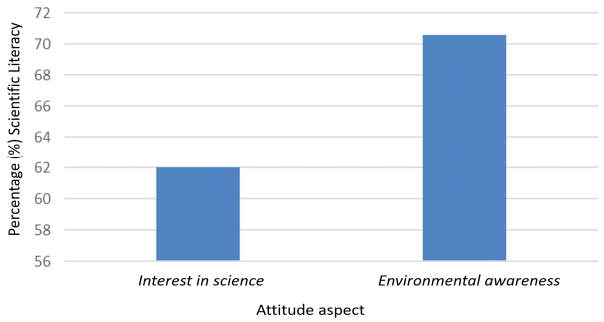

Figure 3. The results of the student's scientific literacy ability test on the attitude aspect

On the indicator of interest in science the average score is lower because students' curiosity about science is very minimal, because students need more reasoning in understanding it. The average value obtained from the two indicators is 66.30% which is included in the sufficient category. The results of this study are in accordance with Laksono's research (2018) that the scientific literacy ability of Chemistry Education students in the attitude aspect obtains an average of 75.75% or sufficient. Novitasari (2018) states that the average value of science literacy skills for prospective biology teachers on all indicators is included in the sufficient category (Nurhidayah, 2020; Novitasari, 2018; Tursinawati, 2018; Yana, 2018; Sunarti, 2015).

Conclusion

The results showed that the students' scientific literacy skills were in the sufficient category with the following details; on the aspect of knowledge, the category is sufficient (60.80%). The context aspect is categorized as sufficient (63.30%). Aspects of competence obtained a sufficient category (66.50%). The attitude aspect is in the sufficient category (66.30%).

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