



Development of Assessment Sheet for Measuring Students' Scientific Literacy Level in the Era of Revolution 4.0

Syarifah Rita Zahara¹, Riska Imanda^{1*}, Sirry Alvina¹

¹Department of Chemistry Education, Malikussaleh University, Lhokseumawe, Aceh, Indonesia.

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Abstract: This study aims to develop an assessment sheet as a measuring tool for the level of scientific literacy in the 4.0 revolution era for high school students in North Aceh. The development model used in this study is the ADDIE model which consists of 5 steps, namely: analysis, design, development, implementation and evaluation. Samples were selected by stratified cluster random sampling and purposive sampling. The instruments used were in the form of a module quality assessment sheet filled out by expert validators and a questionnaire response sheet for teachers and students. The Data analysis used is the percentage formula. The average percentage of module quality assessment questionnaire sheets obtained from 6 validators is 93.00% while the responses of teachers and students are 84.65; 83.81%. The results of the research can be concluded that the assessment sheet as a measuring tool for the level of scientific literacy in the 4.0 revolution era for high school students throughout North Aceh which has been developed is suitable for use in chemistry learning and it is hoped that there will be further research for other materials in a wider scope.

Keywords: ADDIE; Assessment sheet; Science literacy level

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Introduction

Education is currently in the 21st century and is also known as the industrial revolution era 4.0 which is marked by the rapid development of science and technology (Sutrisna, 2021; Rusilowati, 2018; Yore & Treagust, 2006). The era of the 21st century makes the world's development faster and more complex. These changes are basically aimed at improving the quality of life of modern society. In the stict challenges faced by society, a paradigm shift in the education system is needed that can provide a set of 21st century skills needed by students to face every aspect of global life (Soh & Osman, 2010; Liu, 2009; Gultepe and Kilic, 2015). Education in the 21st century aims to encourage students to have skills that support them to be responsive toward the changes throughout the times. The skills that must be possessed by students in the 21st

century are scientific literacy skills. Scientific literacy is the ability to understand scientific concepts and processes and use science to solve problems in everyday life (Sutrisna, 2021; Laugskch, 2002; Rahim et al., 2016).

Science learning is related to how to find out about nature and is a holistic discovery process (Trianto, 2014). Science learning is done by involving students in using their reasoning abilities to solve various problems (Fabby and Koenig, 2015). This is in accordance with one of the main objectives of learning science, namely the realization of a scientifically literate society. Scientific literacy includes a series of strategies that students use in solving various problems that exist in society (Fabby and Koenig, 2015).

Science learning is not only centered on existing knowledge and understanding. A practical activity is needed in the laboratory and can support learning in the classroom. Activities in the laboratory can support

* Corresponding Author: riska.imanda07@unimal.ac.id

learning, because students can analyze and prove the causes that occur in a theory that has been studied. Laboratory skills are needed in learning to improve

higher-order thinking skills. This is used to be able to improve students' scientific literacy (Agastya, 2017). Furthermore, Sari et al. (2017) states that scientifically literate students are students who have knowledge and can apply their knowledge to solve problems in real life. Based on this, the realization of students who have scientific literacy has become a demand of the times (Amri, 2013)

This is in line with the previous research test conducted by Sutrisna, 2021 in analyzing the Scientific Literacy Ability of High School Students in Sungai Penuh City. The data from the previous research shows that the scientific literacy ability of students is very important, because the literacy ability will support the thinking ability of students. This statement is also emphasized by Amri, 2013 which states that science education has great potential and a strategic role in preparing quality human resources to face the era of industrialization and globalization. Then other research also found that scientific literacy-based test instruments to map critical thinking and practical skills on the material of the circulatory system were declared valid theoretically and empirically (Khayati and Raharjo, 2020). In line with research conducted by Astuti (2012), explaining that teacher knowledge about scientific literacy is still limited and has never used a scientific literacy test instrument.

The results of this study are not in line with the teacher's role, namely using related issues in society to teach students to overcome science problems (Lederman et al., 2014). Based on the results of interviews with several science teachers in one of Malang City and District Junior High Schools, the assessment instruments that are often developed are limited to understanding students' concepts. Teachers have never developed an assessment instrument that can train students' scientific literacy skills.

Based on these observations and descriptions, it is stated that the importance of scientific literacy in learning, therefore students do not understand the use of scientific literacy tools and materials in the laboratory, this will have an effect on the level of scientific literacy that students have. And the same thing happened to the teaching team who had not yet have the right assessment sheet to assess the literacy level of students. This is the main focus in the teaching and learning process, so in this case students need an appropriate assessment sheet in assessing scientific literacy skills (Lederman et al., 2014).

Method

This study uses research and development methods (Research and Development) which are used to produce

a particular product, and test product effectiveness (Sugiyono, 2019; Imanda, et al. 2017). The development model used is the ADDIE model, consisting of stages of analysis (analysis), design (design), development (development), implementation (implementation), and evaluation (evaluation) (Perbadi, 2011). The ADDIE model was chosen because this model has clear, systematic, effective and efficient steps.

This research will be carried out at senior high schools (SMAN) in North Aceh, which will be carried out from July to October 2021. The sample in this study is a chemistry teacher at the intended high schools in North Aceh. The sample selection technique used a stratified-cluster random sampling technique, which was based on the even distribution of the population of chemistry teachers of SMAN in North Aceh in terms of school rankings, while the technique for determining the location of implementation of responses and student learning outcomes was based on purposive sampling technique.

The instrument used was in the form of an assessment sheet quality validation sheet given to the validator, consisting of 3 professors at the University, and a chemistry teacher from SMAN in North Aceh as well as a questionnaire response sheet from teachers and students. According to Epinur et al., 2013; Septina, et al (2018) stated that to analyze the data obtained from the distribution of the questionnaire, the percentage formula was used.

Result and Discussion

The development of the physical science literacy assessment instrument refers to the competency demands in the 2013 Curriculum which are in line with competence in scientific literacy. It will be very appropriate if middle-level students are faced with questions that contain scientific literacy, even in learning given the low scientific literacy ability of students. The development of the assessment sheet instrument in this study aims to determine the level of scientific literacy of students. Scientific literacy is a knowledge and understanding of scientific concepts and processes that will enable a person to use them in identifying problems, drawing conclusions based on scientific evidence, and applying them in social life by making decisions about nature and changes that occur as a result of humans in everyday life. Improving scientific literacy through science education: aims to develop creative abilities in utilizing scientific evidence-based knowledge and skills, in solving problems especially those related to everyday life (Holbrook, 2009; Gormally, 2011; Vitasary, 2018).

Novianti et al. (2018) explained that the level of scientific literacy consists of 5 levels where each level has its own indicators. The descriptions of the 5 levels of scientific literacy are in Table 1.

Table 1. Indicators of scientific literacy level

Level	Achievement indicators
Level 5	<ul style="list-style-type: none"> - Identify the scientific component of complex situations - Compare, select, or evaluate appropriate scientific evidence to respond to life situations - Build evidence-based explanations and arguments based on critical analysis
Level 4	<ul style="list-style-type: none"> - Draw conclusions about the role of science and technology - Integrating explanations from science and technology in aspects of life - Reflect on the actions of the decisions taken using the knowledge and evidence possessed
Level 3	<ul style="list-style-type: none"> - Identify scientific problems in various contexts of life - Choose facts and knowledge to explain phenomena
Level 2	<ul style="list-style-type: none"> - Provide possible explanations in the context of general knowledge - Making interpretations of the results of investigations or problem-solving technology
Level 1	<ul style="list-style-type: none"> - Has limited knowledge that can only be applied to some frequently encountered situations - Presenting Scientific Explanations by following the information provided

(Novianti et al., 2018)

This study uses the ADDIE development model which consists of 5 stages, where the analysis stage, researchers collect information about learning in the field. Researchers collect information aimed at determining the problems that exist in the field as a source of initial research for researchers in developing an assessment sheet. The researcher's data collection was done by observing and asking questions in the field. At this stage, student analysis and concept analysis are also carried out. Student analysis is the stage of studying the characteristics of students which will be used as a reference in developing an assessment sheet. These characteristics include academic abilities, cognitive and affective development, and individual and social skills so that patterns of activity in the learning that are followed will be found (Soma et al., 2014). Concept analysis begins with determining the content of the material and competencies that must be achieved in learning

The design stage, at this stage the researcher finds a more effective and efficient way to develop the initial product design based on the data obtained at the analysis stage. In this stage, the researcher determines the format for developing the assessment sheet and conducts the initial design. The development stage, at this stage is the implementation of product planning that

has been carried out in the previous stage. The purpose of this stage is to produce the final product of the assessment sheet development that is feasible for used. The steps taken by researchers at this stage are: conducting a review by the development team. The results of the assessment sheet review can be seen in Table 2.

Table 1. Expert Validation Results

Evaluation	Comment	Revision
Language struture	The text (font) is the same, the picture is clarified and the answer key is included	It's been fixed according to the suggestion
Arrange ment	The homogeneity of the answer options is checked again	Fixed according to suggestions

Draft 2 which was developed was further validated by 6 expert lecturers who were carried out by filling out a product quality assessment questionnaire. Furthermore, validation is the stage of testing the product feasibility level by a team of experts and science subject teachers. The input and suggestions given by the expert team aim to achieve a perfection of a product being developed (Ngussa, 2014). Validation is carried out to improve products that still have many shortcomings. A product that is suitable for use if the expert based on his experience states that the product is suitable for use (Epinur et al., 2013).

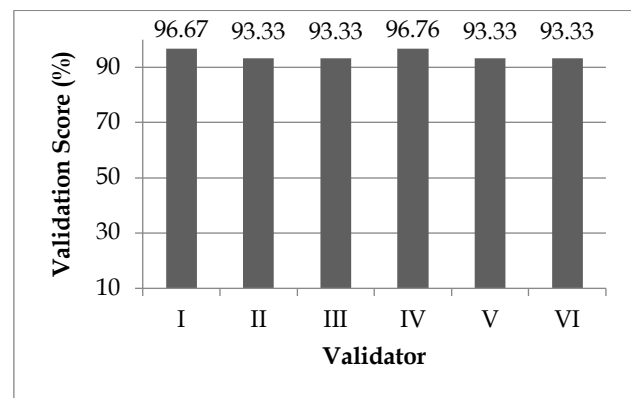


Figure 1. Validation Results

Implementation is a step to implement the assessment sheet that has been prepared (Imanda et al., 2017; Rangkuti, 2014). The implementation phase, to see the responses of science teachers, was carried out at 50% of the total population of science teachers in North Aceh, with a review of the existing population distribution. Implementation of the assessment sheet on student responses was carried out at SMAN in North Aceh. In this implementation stage, an evaluation is carried out based on comments from respondents, where these comments will be used as material for improvement and

further development. According to Mercedes (2009) the responses of teachers and students through a questionnaire were carried out to see how the responses and opinions of teachers and students were developed, whether the assessment sheet was effective. Implementation to the teacher is done by showing a print-out of the assessment sheet that has been developed and explaining how to apply it in learning, then the teacher gives an assessment of every aspect of the statement about the assessment sheet contained in the questionnaire. The purpose of implementing the teacher is to find out the teacher's response to the assessment sheet that has been developed.

The teacher's response data to the assessment sheet is obtained by providing the teacher's response sheet to the developed assessment sheet. The response questionnaire covers several aspects including; benefits, materials, language, motivation and appearance of the assessment sheet. This initial trial was conducted on high school teachers throughout North Aceh. The percentage of initial test results on teachers can be seen in Figure 4.

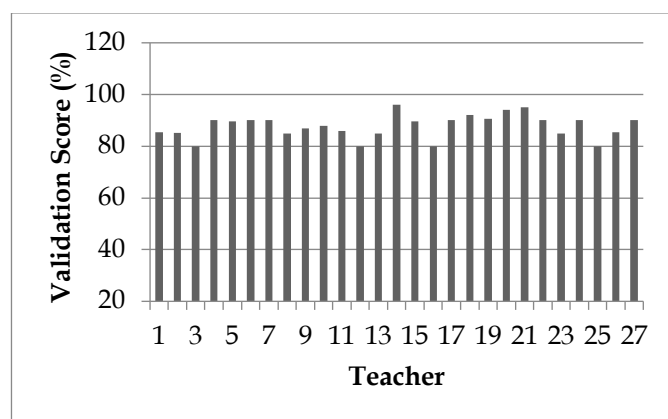


Figure 2. Results of Teacher Response Questionnaire Analysis

Figures 1 and 2 show that 84.65% of teacher responses and 83.81% of students respond. The level of achievement is classified as a very feasible / very attractive qualification. From this percentage, it can be stated that the assessment sheet deserves to be continued at the implementation stage, although there are some things that need to be improved. The initial trial aims to obtain wider suggestions and input on the developed assessment sheet. This is in accordance with that stated by Davis et al. (2004) that the importance of testing its use is to ensure the functionality of the prototype is developed before the actual research. Furthermore, Yuliawati et al. (2013) stated that the suggestions and input obtained can be used as a basis for improving a product before it is used in learning. This is in accordance with what was stated by Mercedes (2009), and Alias and Siraj (2012) that the importance of implementing a prototype assessment sheet in a lesson

can be proven by the emergence of positive responses from teachers and students during implementation.

Evaluation, this stage is the last stage of the ADDIE development stage. After implementation, it is known the response of teachers and students to the assessment sheet that has been developed. The results of the implementation of teachers and students showed that the module was classified as very good category, although there were several things that needed to be improved for the perfection of the resulting product. The evaluation stage was improved because there were still some shortcomings that were obtained at the implementation stage. The evaluation phase of what is being done is product improvement based on the implementation of the developed product (Pawana et al., 2014; Rangkuti, 2014).

Conclusion

Based on the research findings, it is concluded that the assessment sheet was developed using the ADDIE development model. The quality of the module in terms of expert validation and the responses of teachers and students belonging to the qualification is very suitable to be used as an assessment sheet in measuring the level of scientific literacy of students and it is hoped that there will be improvements to the assessment sheet that has been made by subsequent researchers by optimizing the use of assessment.

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