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The Development of Contextual-Based Science Learning Modules to Develop Scientific Literacy of Junior High School Students

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Abstract

This research is motivated by the low scientific literacy skills of junior high school students. One of the causes of the low scientific literacy skills of students is the lack of teaching materials that can shape students' scientific literacy skills. The available teaching materials have limitations in the relevance of learning materials to problems in everyday life. Therefore, a module was developed that is integrated with the problems in Kemiri Village to develop students' scientific literacy skills. This study aims to examine the validity and readability of contextual-based modules to develop scientific literacy of junior high school students. The type of research used is development research with the ADDIE design model. The subjects of the study were 3 science teachers as validators and students of Class VIII of SMP Negeri 1 Panti, Jember. Based on the validation results, the contextual-based module obtained a content validation percentage of 92.55% and a construct validation of 92.00% which is included in the very valid criteria. The readability of the contextual-based module obtained a readability percentage of 90.38%, also included in the easy criteria. Based on the research results, it can be concluded that the contextual-based science learning module to develop science literacy is feasible to be applied in science learning and can develop the science literacy of junior high school students.

Keywords: *Science Learning, Contextual, Learning Module, Science Literacy, Junior High School.*

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INTRODUCTION

Science literacy in the 21st century is very important along with the rapid development of information technology. Science literacy skills not only include the ability to read and understand science, but also include a broader understanding of scientific concepts, critical thinking, and the ability to apply scientific knowledge in everyday life (Nahdiah et al., 2017). PISA (Program for International Student Assessment) states that the level of science literacy in Indonesia is ranked 74 out of 79 countries, with an average score of 369. These results indicate that students' science literacy skills in Indonesia are still relatively low (OECD, 2017). The latest PISA results in 2022, Indonesia's science literacy ranking rose 6 levels but the score decreased by 13 points. The score of Indonesian students in science was 383 points, lower than the average score of students in OECD member countries which reached 485 points (Kemendikbudristek, 2023). This fact is also supported by the results of interviews with science teachers at SMP Negeri 1 Panti which show that students' science literacy skills are still relatively low.

The results published by PISA can be an evaluation for the development of science education. Well-designed science learning not only broadens students' knowledge of science, but also equips students with science literacy skills that are important for active participation in society (Aiman & Ahmad, 2020). Several factors that cause low levels of students' science literacy include learning approaches that are not contextual and less relevant to everyday life, inappropriate selection of science teaching materials, low interest in reading, conceptual errors, less supportive learning environments and atmospheres, and difficulties in applying science in real life (Fibonacci & Sudarmin, 2014). In accordance with the findings of Suparya et al. (2022), determining learning resources is one of the factors in the low level of science literacy in Indonesia.

Based on the problems that have been described, innovation is needed in the development of teaching materials to improve students' science literacy skills and be relevant to everyday life. One alternative that can be done is to present a contextual-based science learning module. Contextual science learning modules in the context of science literacy function as effective teaching materials to improve students' understanding of science concepts because the modules are equipped with clear explanations, relevant examples, and activities designed to connect theory with practice. So far, various studies have shown that the application of contextual-based modules can implement students' science literacy. One of them is the research of Maryam et al. (2023) which developed a contextual-based science module to improve junior high school science literacy skills which was stated to be very valid and effective in developing students' science literacy. In addition, according to Yuliana et al., (2017) contextual-based modules are generally still general in nature, not linking learning to the environment or specific problems around students.

This study produces a module that integrates local context as a learning resource. The contents of the module raise the problem of the sense of sight in Kemiri Village. Based on this explanation, the researcher developed a contextual-based module to improve students' science literacy. This module reviews the material on light and optics with the sub-material on the human sense of sight which is related to eye health problems that occur in Kemiri Village to develop science literacy skills in students of SMP Negeri 1 Panti. The purpose of this study is to describe the validity and readability of contextual-based modules to improve students' science literacy.

RESEARCH METHOD

This research is a type of research and development using the ADDIE model including analysis, design, development, implementation, and evaluation. The validity and readability test of the contextual-based module was carried out at SMP Negeri 1 Panti by including 3 science teachers and grade VIII students of SMPN 1 Panti selected as research subjects. Primary data collection used a research instrument in the form of a questionnaire sheet of content validity and construct validity, as well as a percentage score of readability carried out with a research instrument in the form of a questionnaire. Meanwhile, secondary data collection was interviews and observations. The data analysis carried out was analysis of content validity, construct validity, and readability. The validity results were then calculated using the following formula.

$$Vi=\frac{\sum x}{\sum Xi} \times 100\%$$

Description:
Vi = Percentage of content validity
$\sum x$ = Total score of assessment result
$\sum Xi$ = Total maximum score
100% = Constant

Furthermore, the calculation results obtained will be adjusted to the module validity category presented (Akbar, 2013) in Table 1 below.

Table 1. Module validity categories

Percentage (%)	Category
80 < v ≤ 100	Very valid
61 < v ≤ 80	Valid
41 < v ≤ 60	Quite valid
21 < v ≤ 40	Not valid
x ≤ 20	Very invalid

The results of the readability test are seen from the readability sheet and the score calculation uses the following formula.

$$K = \frac{x}{X\ maks} \times 100\%$$

Description:
X = Total score for each aspect
X max = Highest score for each aspect

Furthermore, the score results will be adjusted to the readability criteria (Suharsono, 2008) in table 2.

Table 2. Module readability categories

Percentage (%)	Category
≥ 60	Easy
41-59	Medium
< 40	Difficult

RESULTS AND DISCUSSION

The results of the development that has been carried out are in the form of a contextual-based module to improve the science literacy of junior high school students. This development research applies the ADDIE model which consists of five stages, including analysis, design, development, implementation, and evaluation. The final result of this study is to produce a contextual-based module that is valid in terms of content and construct, as well as a good level of readability when applied to science learning.

1. Analyze

The initial analysis carried out by the researcher was through observation and interviews with class VIII science teachers at SMPN 1 Panti and observation of the environment around students, namely Kemiri Village, including analysis of problems, needs, and goals. Based on interviews and observations obtained problems at SMPN 1 Panti, namely: 1) The implementation of science learning only uses textbooks and there are no other supporting learning resources; 2) Lack of contextual application in learning so that students focus on understanding the material in theory without providing a real context in everyday life; 3) Science learning at SMPN 1 Panti still does not pay attention to the development of students'

science literacy skills. The analysis stage also includes an analysis of the real conditions or situations around the student's location, namely in Kemiri Village. The identification process focuses on the main problems related to visual health faced by the community. Based on the interviews conducted, it shows that Kemiri Village has problems related to the lack of public awareness of visual health. The results of the observation will be used as a basis for compiling relevant learning materials and reflecting real conditions in the village in the form of a case study in a contextual-based learning module.

Based on the analysis of problems at SMPN 1 Panti, it is known that the learning process only refers to the 2013 curriculum science textbooks provided by the government so that there is a lack of other learning resources. The results of the analysis prove that students need teaching materials that support learning and provide a more meaningful learning experience by connecting science concepts with real situations. In addition, it is known that there are no science learning activities and teaching materials that focus on supporting the development of science literacy so that students' science literacy skills at SMPN 1 Panti are still relatively low and still need to be improved. The learning objectives that must be achieved in the use of contextual-based learning modules are increasing students' science literacy through more relevant and meaningful learning. Learning objectives are formulated to develop science literacy in accordance with science literacy indicators. The module also refers to the 2013 curriculum to adjust to school conditions.

2. Design

The design stage involves preparing the basic framework and systematics of the module and compiling the concept of the material. The contextual-based module uses the help of the Canva application which is then designed in an attractive and systematic way. The next step is to design the presentation of the module which includes the systematics of the module, the draft of the material presented, images, illustrations, fonts, and the color palette used. The material presented is adjusted to the indicators of scientific literacy skills according to PISA and the 2013 curriculum. Learning material that is suitable to be integrated with the eye health problems of Kemiri Village is the material on the visual sensory system in class VIII. The results of observations in Kemiri Village that have been carried out are used as case study material in a contextual-based module that aims to develop the scientific literacy of junior high school students.

The contextual-based module refers to KD 3.12 analyzing the properties of light, the formation of shadows on flat and curved planes and its application to explain the process of human vision, insect eyes, and the working principles of optical devices. The sub-material on the human visual sensory system is one of the important topics in health education, especially in the context of efforts to increase awareness and scientific literacy in the community and students. The material in the contextual-based module includes explanations related to the structure and function of the eye, types of visual impairments, as well as the causes and prevention of eye diseases that are often found in the village. The material is complemented by case studies based on real experiences of Kemiri Village residents who face eye health problems, as well as practical activities such as making educational posters about preventing visual impairments. This approach is expected to help students

understand the connection between science and everyday situations in the surrounding environment.

3. Develop

The development stage is the stage of designing a contextual-based module that is realized into a product that is ready to use. This stage includes the preparation of a module draft, editing, revision 1, readability test, and revision 2. The draft of the cover display and contextual-based module information can be seen in Figure 1.

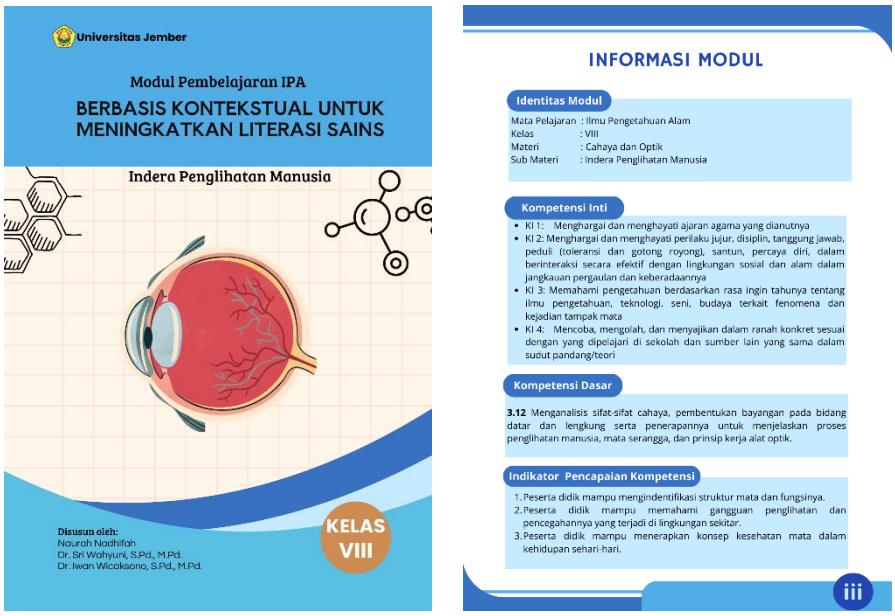

Figure 1. Cover and Module Information

The activities carried out by students will be adjusted to the scientific literacy indicators that include aspects of context, knowledge, and competency. The context aspect includes personal, local, and global contexts. The knowledge aspect includes content, procedure, and epistemic knowledge. While the competency aspect includes explaining scientific phenomena, evaluating and designing scientific investigations, and interpreting data and evidence scientifically. The preparation of the module also considers contextual aspects that present specific cases, such as low public awareness of the importance of maintaining eye health due to exposure to sunlight while farming, the use of inadequate eye protection, and other eye disorders. In raising these issues, students are invited to link the concept of the sense of sight with local conditions, analyze the causes and impacts of problems, and design relevant science-based solutions. This approach aims to build students' scientific understanding while fostering a sense of concern for problems in their surroundings.

Content Validity of Contextual-Based Science Learning Module

Content validity was obtained from 3 validators through the results of the content validity sheet on a Likert scale of 1-5. Then the results of the validity test were obtained and an analysis was carried out based on the calculation of scores and validity criteria. The assessment of content validity includes material, contextual aspects, and aspects of science literacy. The results of the content validity of the contextual-based module can be seen in Table 3. as follows.

Table 3. Results of content validity test

Aspek Penilaian	Persentase (%)	Kategori
Materi	93.94	Sangat valid
Kontekstual	91.11	Sangat valid
Literasi sains	92.59	Sangat valid
Rata-rata Persentase	**92.55**	**Sangat valid**

Based on the results of the content validity analysis, the results were 92.55% with a very valid category. This is also because the contextual-based module adjusts to the characteristics of the module, namely Self Instruction, Self Contained, Stand Alone, Adaptive and User Friendly (Gunawan, 2022). These results indicate that the material or content in the module is in accordance with the material on the Human Visual Sense System in grade VIII. The components in the module are complete with material explanations, practice questions, learning objectives, and concepts of the sense of sight. The module covers all aspects of learning about the sense of sight, from eye anatomy, vision mechanisms, to eye health problems. This is in accordance with the opinion of Sugianto et al. (2018) that one of the characteristics of the module is self-contained, which means that all the learning materials needed are contained in the module. This gives students the opportunity to study the material thoroughly because all learning content is arranged in one complete unit.

The module also provides clear instructions, study guides, and structured activities so that students are able to understand the material independently. In line with the opinion of Harahap & Fauzi (2017) Module is also interpreted as a learning package that contains a concept of material that can be learned independently without the help of others (self-instructional). The contextual-based module is adapted according to the student's environment, namely in Kemiri Village and contains several case studies related to visual health in the village. The supporting images used were taken when conducting research on the community in Kemiri Village, Jember Regency, which can be useful for students in the learning process. According to Cristiana et al. (2021) that material that is relevant to students' daily lives will build a strong foundation of knowledge, so that students can solve existing problems and find solutions to overcome them.

The aspect of scientific literacy is a crucial aspect because the module developed aims to develop scientific literacy so that it includes the scope of scientific literacy indicators, namely aspects of context, knowledge, competence, and attitude with learning objectives that can help develop students' scientific literacy skills. Student activities in the module include reading, observing, and analyzing case studies related to visual health problems in Kemiri Village using a scientific approach, as well as considering contextual aspects that are relevant to the lives of the local community.

Construct Validity of Contextual-Based Science Module

Construct validity consists of 3 aspects, namely language, presentation, and graphics. The results of the construct validity of the contextual-based module can be seen in Table 3 as follows.

Table 3. Construct validity test results

Aspek Penilaian	Persentase (%)	Kriteria
Bahasa	94.67	Sangat valid
Penyajian	93.33	Sangat valid
Kegrafisan	88.00	Sangat valid
Rata-rata Persentase	**92.00**	**Sangat valid**

Based on the results of the construct validity of the contextual-based module, the results were 92.00% with a very valid category. The use of language in this module is designed to comply with language rules, coherent, and communicative, adjusting to the target reader so that the material can be conveyed well and easily understood. Agree with Sugianto et al. (2018) that one of the characteristics of the module is its user-friendly nature, which means that every instruction and information presented is intended to facilitate and support the user. The use of simple, easy-to-understand language, and the selection of commonly used terms are one form of user friendly.

The presentation aspect includes the structure and components in the module, cover, foreword, table of contents, module information, instructions for use, materials, activities, summaries, evaluations, answer keys, and bibliographies. Supported by the statement of Sembiring et al., (2021) that a module with a good and coherent system can facilitate students in the learning process. Clarity of indicators and learning objectives will improve the quality of learning better. The layout and layout of the contextual-based module are designed to be attractive and provide students with comfort when studying the material. The module layout should be neat, structured, and easy for students to follow. The use of elements on the module page, such as text, images, diagrams, tables, and titles, should be done logically so that students do not feel confused (Samsu et al., 2020).

Readability Test of Contextual-Based Science Learning Modules

The module readability test was carried out by grade VIII students at SMPN 1 Panti in the form of a questionnaire. This stage begins with students reading the contextual-based module that has been printed in hardfile form. During the readability test process, students read the module independently and fill in the readability sheet. The results of the contextual-based module readability test can be seen in Table 4.

Table 4. Readability test results

Aspek Penilaian	Rata-RataTiap Aspek	Kategori Tiap Aspek
Kemudahan	4.55	Sangat Baik
Kemenarikan	4.50	Sangat Baik
Keterpahaman	4.53	Sangat Baik
Literasi Sains	4.50	Sangat Baik
Rata-rata	**4.52**	**Sangat Baik**
Persentase	**90.38%**	
Kriteria	**Mudah**	

The readability test results obtained a result of 90.38% which indicates easy criteria. So, it can be concluded that the contextual-based module is easy for readers to understand and can be used in science learning to develop science literacy because it has met the aspects of science literacy. The readability test of the contextual-based module contains an assessment of the aspects of ease, interestingness, understandability, and science literacy skills (Hendikawati & Arini, 2016).

The use of simple explanations, relevant analogies, and reflective activities that support understanding and make it easier for students to absorb the material. As Fauzi et al (2023) argues that understandability is related to the characteristics of words and sentences, such as the length and frequency of use of words or sentences, sentence structure, and paragraph structure.

CONCLUSION

This study successfully developed a contextual-based module to improve students' scientific literacy. The validity results by the validators showed that the content validity module obtained a content validity percentage of 92.55% with a very valid category. The construct validity of the contextual-based science learning module to improve junior high school students' scientific literacy obtained a construct validity percentage of 92.00% with a very valid category. The readability test of the contextual-based module to improve scientific literacy obtained an average percentage of 90.38% with the criteria of being easy for students to understand. Based on these results, this module can be used as an alternative material to develop students' scientific literacy skills.

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