Student's Needs Analysis for the Developing Science E-Modules Based on Guided Inquiry to Improve Science Literacy

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Abstract
Science literacy is a skill that is needed by students in the development of the 21st century. Science literacy is developed through various ways by utilizing innovative methods, models and media in the form of e-modules. The use of e-modules as a learning tool in science often focuses only on completing tasks without providing adequate encouragement to improve learners' science literacy. The lack of interactivity and opportunities for exploration in e-modules is also a factor that hinders the improvement of science literacy. Analysis of the needs for developing e-modules to improve science literacy needs to be done because e-modules are one of the teaching materials that become a reference in learning. This study aims to analyze the needs of students in the development of guided inquiry-based science e-modules in improving students' science literacy. The subjects of this study were fourth grade students of elementary schools in Palembang city, South Sumatra. The needs analysis was conducted using a qualitative approach, in terms of learning needs in the classroom and teaching materials in the form of e-modules. Data were collected using questionnaires and interviews, then analyzed descriptively. The results showed that 91 percent of students perceived themselves as needing the development of e-modules in learning that can bring out science literacy skills.
Keywords: e-module, science literacy, guided inquiry

Abstrak
Literasi sains merupakan sebuah keterampilan yang sangat dibutuhkan oleh peserta didik pada perkembangan abad ke-21. Literasi sains dikembangkan melalui berbagai cara dengan memanfaatkan metode, model, dan media inovatif yang berupa e-modul. Penggunaan e-modul sebagai sarana pembelajaran dalam sains sering kali hanya berfokus pada penyelesaian tugas-tugas tanpa memberikan dorongan yang memadai untuk meningkatkan literasi sains peserta didik. Kurangnya interaktivitas dan kesempatan untuk eksplorasi dalam e-modul juga menjadi faktor yang menghambat peningkatan literasi sains. Analisis kebutuhan pengembangan e-modul untuk meningkatkan literasi sains perlu dilakukan karena e-modul merupakan salah satu bahan ajar yang menjadi acuan dalam pembelajaran. Penelitian ini bertujuan untuk menganalisis kebutuhan peserta didik dalam pengembangan e-modul IPA berbasis guided inquiry dalam meningkatkan literasi sains peserta didik. Subjek penelitian ini adalah peserta didik kelas IV sekolah dasar di kota Palembang, Sumatera Selatan. Analisis kebutuhan dilakukan dengan menggunakan pendekatan kualitatif, ditinjau dari kebutuhan pembelajaran di kelas dan bahan ajar berupa e-modul. Data dikumpulkan menggunakan angket dan wawancara, selanjutnya dianalisis secara deskriptif. Hasilnya menunjukkan sebanyak 91 persen peserta didik mempersepsikan dirinya membutuhkan pengembangan e-modul dalam pembelajaran yang dapat memunculkan keterampilan literasi sains.
Kata kunci: e-modul, literasi sains, *guided inquiry*

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INTRODUCTION

Education is a conscious and planned process as an effort to realize a meaningful learning process. Through the education process, students are trained so that their abilities and potential to develop are realized optimally through the meaning of learning at school. Educational reform and teacher turnover cannot be separated from the common thread in education, but the challenges to achieve both are complicated and complex, therefore they continue to require attention in all education systems. Learning is carried out to replace traditional teaching styles with memorization and concept processes (Gabby, Avargil, Herscovitz, & Dori, 2017). Meaningful learning aims to improve life skills as the core of the constructivist paradigm. Meaningful learning can improve the quality of human resources with critical thinking, collaboration, communication, and creativity (innovation) that are ready to compete in the 21st century (Ngurah & Laksana, 2017).

The most important part of science learning is scientific literacy skills. Scientific literacy is a skill that is very much needed by students in the development of the 21st century which can be seen from the rapid development of science and technology (Sutrisna, 2021). Betari, et.al (2016) argued that in the 21st century, the scientific literacy of a nation is the key to education because the mastery of science and technology is key in a nation. Scientific literacy is an individual competency needed to see and respond critically to issues that include the ability to explain natural phenomena and their impact on society, the ability to use knowledge and understanding of scientific inquiry to identify questions, interpret and evaluate data and evidence scientifically (PISA 2018 Assessment and Analytical Framework, 2019).

Scientific literacy requires individuals to not only know scientific facts, but also understand scientific processes such as observation, experimentation, and logical reasoning. In addition, scientific literacy also involves the ability to evaluate scientific information skeptically and objectively and communicate effectively on scientific topics (Bybee, R. W.2021).

Scientific literacy can be divided into four main aspects which include context, knowledge, competence, and attitude. The context aspect refers to an individual's ability to relate scientific knowledge to real-life situations and relevant social issues. The knowledge aspect includes understanding basic scientific concepts and terminology needed to understand scientific information. Competence relates to individual skills in applying scientific methods, including the ability to design and conduct experiments, analyze data, and draw valid conclusions. The attitude aspect involves curiosity, openness to new information, and a critical attitude towards scientific claims and the application of ethics in science (Sartika, 2018).

Science literacy in science learning should always be applied. Students are not only required to learn more about concepts by rote but also experiential learning. Teachers should provide more experience to students by guiding them in mastering science knowledge in everyday life (Aydin & Cakiroglu, 2017). Teachers have an important role in teaching science literacy in the classroom through planning and organizing teaching and learning (Amnah et al., 2017). Teachers not only provide material concepts that must be memorized by students but also prepare a learning environment that allows students to build knowledge actively. Things to train teacher skills to students are one of the processes of preparing teaching materials that can train students' science literacy. Module teaching materials like this can be developed to help teachers (Paulo & Cruz, 2015).

One of the module developments is the electronic module (E-Module). In the design of e-modules, information is not only presented, but also encourages students to be able to carry out scientific inquiry stages, think critically, and be able to solve real problems. This approach involves the use of interactive simulations, case studies, and

scenarios that are appropriate in students' lives so that students can see practical examples of the scientific concepts they get in the learning process. In addition, e-modules must provide constructive feedback and opportunities for reflection, so that students can identify weaknesses in their understanding and improve them independently (Schiefer et al., 2020).

One of the e-module developments that is by scientific literacy is based on guided inquiry. The development of e-modules based on guided inquiry is a strategic step in improving the critical thinking process so that scientific literacy skills can be improved. E-modules based on guided inquiry are designed to guide students through a structured scientific investigation process, where they actively explore questions, collect data, and formulate conclusions according to existing data. With this approach, students will be directly involved in the learning process, not only gaining knowledge passively but this process makes students' thinking more analytical and reflective (Pedaste, M 2015). E-modules based on guided inquiry can also utilize interactive technology, such as simulations and animations, to make scientific concepts easier to understand and more interesting. In addition, by providing the right scaffolding, this e-module helps develop students' independence in learning and increases their curiosity about science (Tabak, I.2004). Thus, it is necessary to analyze students' needs for the development of learning and teaching materials that are full of scientific literacy.

The focus of the solution in this study is the development of a guided inquiry-based science e-module that is specifically designed based on an analysis of student needs. This approach provides a new contribution by integrating guided inquiry into digital media that is responsive to the individual needs of students, making it more relevant and effective in improving science literacy. This e-module not only aims to teach science concepts, but also to stimulate students' curiosity, build critical thinking skills, and connect science knowledge with everyday life problems. This solution differs from the traditional approach which is more theoretical, because it provides in-depth direct and interactive experiences.

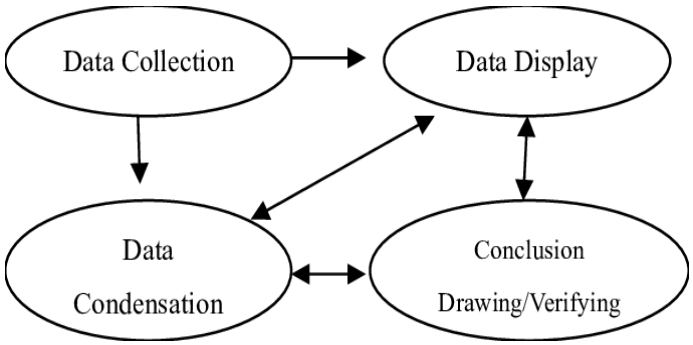
The benefits of this article in the development of science are as a contribution to the development of science education, especially in the context of technology-based learning and inquiry. The proposed Guided Inquiry-based e-module can be a model for the development of science learning media that is more effective, interesting, and in accordance with technological developments. In addition, this study can enrich the literature on the application of the inquiry approach in science learning, as well as provide a basis for educational policies that support more innovative science learning that is relevant to the challenges of the times. Thus, it is necessary to analyze the needs of students for the development of learning and teaching materials that are full of science literacy

METHOD

This study is a qualitative study conducted in 18 elementary schools in the city of Palembang, South Sumatra, Indonesia. The subjects were fourth-grade students in 18 elementary schools in the city of Palembang. The sample was randomly selected from 18 elementary schools, namely 90 fourth-grade students. Data were collected using questionnaires and interview sheets. The questionnaire was designed to determine the learning conditions and learning resources used by students during learning as a learning method applied to teacher learning. Interviews to confirm the results of the questionnaires that had been answered. Several statements from the questionnaire were statements developed by the researcher himself. The statements developed by the researcher relate to the application of process skills to teaching materials and the types of teaching materials that are expected to help teachers train students' scientific literacy. The questionnaire was divided into three groups of questions: students'

opinions about teaching materials, students' opinions about the content of scientific literacy in textbooks, and students' opinions about the expected teaching modules.

Data analysis in this study refers to qualitative data analysis according to Miles and Huberman which is carried out interactively and continuously through data reduction, data presentation, and drawing conclusions or verification (Sugiyono, 2020). Data analysis in this study was carried out in three stages, namely data reduction, data presentation, and drawing conclusions or verification. The data that appears is in the form of words and not a series of numbers. Data was collected through several methods, namely observation and interviews, then processed through recording and recording using words arranged into expanded text. The steps for data analysis are presented in the following figure.



Gambar 1. Steps of Interactive Data Analysis

Based on the image above, the stages of data analysis in this study can be explained as follows. First, the researcher collects data on the condition of elementary school students through questionnaires and interviews. Second, after data collection is complete, the researcher reduces the data that has been obtained, namely by classifying, directing, discarding unnecessary data, and organizing data. Third, the researcher presents data in the form of descriptive words. Fourth, the researcher draws conclusions from the data obtained. Furthermore, this study uses an inductive mindset in the form of drawing general conclusions from specific cases in the form of interpretation results. This means that a correct understanding of the reality faced and studied is achieved because it is based on objective evidence and the achievement of authentic truth, namely information about the need for e-module development.

RESULTS AND DISCUSSION

The analysis of e-module needs was distributed using a questionnaire of student needs for the development of e-modules consisting of 4 aspects containing 10 questions. These aspects include student responses to science learning and photosynthesis material, student responses to science learning activities in class, student learning resources, and student responses to the need for e-module learning media development to improve student science literacy. There were 90 grade IV elementary school students involved in this study. The answers to each instrument item had negative and positive answers through two choices (yes or no). The results of the analysis of student needs for the needs of e-modules based on guided inquiry on photosynthesis material were then analyzed. The results of interviews with teachers and students and data from the student needs questionnaire survey for e-module development were then analyzed using qualitative descriptive analysis.

Tabel 1. Student responses to science learning on photosynthesis material

QUESTIONNAIRE	ANSWER (%)	
	YES	NO
In your opinion, is the material on photosynthesis included in the material that is difficult to understand?	75	25
Are you having difficulty understanding the concept of photosynthesis?	75	25

Table 2. Student responses to science learning activities at school

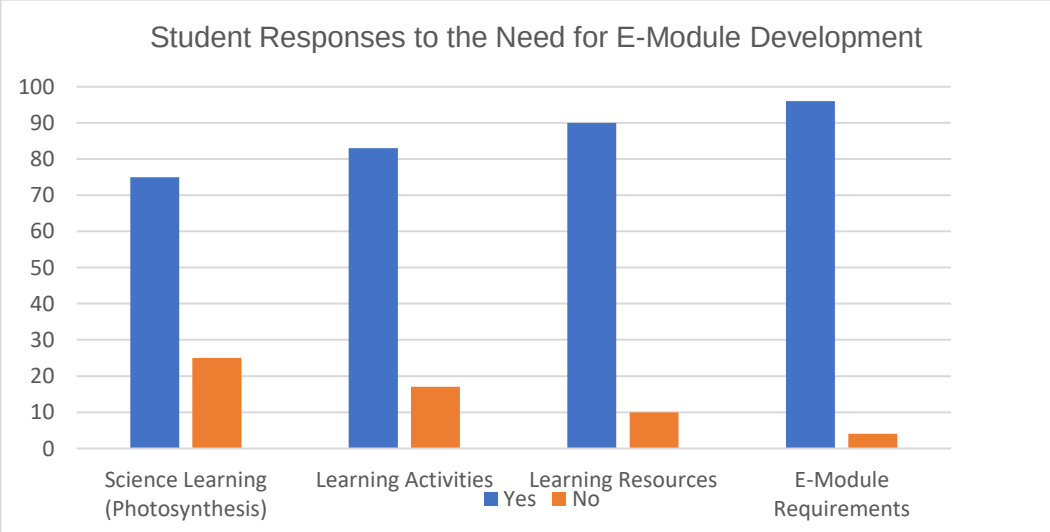
QUESTIONNAIRE	ANSWER (%)	
	YES	NO
Do teachers often use the same methods in science learning?	80	20
Are the methods used by teachers in science learning boring?	85	15
Do teachers rarely invite students to have group discussions or practical work on photosynthesis material?	100	0

Table 3. Learning resources used by students in learning activities

QUESTIONNAIRE	ANSWER (%)	
	YES	NO
Are learning resources such as textbooks and worksheets as study guides less helpful in understanding learning materials?	90	10

Table 4. Student responses to the need for e-module learning media development to improve students' scientific literacy skills

QUESTIONNAIRE	ANSWER (%)	
	YES	NO
Do you agree if there are science teaching materials that can be accessed with a smartphone anytime and anywhere?	100	0
Do you know that e-modules can be used as learning resources?	80	20
Are you interested if there are other learning resources such as e-modules to help understand photosynthesis material?	90	10
Do you think it is necessary to develop learning media in the form of electronic modules (e-modules) based on guided inquiry on photosynthesis material?	95	5



Gambar 2. E-Module Development Needs Percentage

Based on Table 1 on the aspect of student responses to science learning and student responses to photosynthesis material, it can be seen that 75% of students stated that photosynthesis material is difficult to understand because of the many terms and stages that must be memorized and the difficulty in connecting a science concept. Furthermore, 25% of students stated that photosynthesis material is easy to understand. Based on the graph, it can be concluded that the percentage of students who answered difficulties by answering "Yes" is greater than students who did not experience difficulties in photosynthesis material. This is relevant to the results of student interviews they stated that photosynthesis material is difficult to understand because many terms and procedures must be understood. Students receive a lot of material that is rote and only relies on the ability to remember, which causes students' mastery of the concept to be low. Students have difficulty in mastering the concept of photosynthesis. The concept of photosynthesis is often found in everyday life and is the key to understanding other concepts. If students' mastery of the concept of photosynthesis is low, students will have difficulty understanding the material at a higher level (Arikunto, 1983). The low ability of students to build concepts and knowledge also has an impact on students' scientific literacy skills. The basic competencies in scientific literacy that students must have include the ability to explain phenomena scientifically, evaluate and design scientific investigations, and interpret data and evidence scientifically (Education at a Glance 2019 OECD Indicators: OECD Indicators, 2019).

The results of the survey on the aspect of student responses to science learning activities in the classroom, obtained information that 88% of students were less interested in learning activities and 12% of students were interested in learning activities. This is by the results of student interviews that in learning activities teachers more often use the same method in teaching, namely the lecture method. Learning is only centered on the teacher and tends to make students less active. The learning implemented should be centered on students that involve students actively exploring their concepts and teachers only as facilitators (Zulaichah, 2021). Students' scientific literacy needs to be improved and trained by providing students with the widest possible opportunities, either through discussions practicums, or direct experiments.

Based on the results of a survey on the aspect of student responses to student learning resources, information was obtained that 90% of learning resources such as textbooks and LKS as learning guides were less helpful in learning activities because they were less interesting and interactive so that they were not able to support students in mastering the material. Printed teaching materials such as textbooks and LKS have shortcomings, namely being unable to present movements, the presentation of material is linear and it is difficult to guide readers (Heryani, 2018). This is by the response from students that they do not like the textbooks and LKS that teachers often provide and they feel that these learning resources are less helpful in understanding the subject matter.

Based on the results of the survey on the aspect of student responses to the need for the development of e-module learning media based on guided inquiry on photosynthesis material, it was found that 91% of students were interested in using electronic learning media that can be accessed via Android, namely e-modules. E-modules can be accessed by students anytime and anywhere depending on the availability of an internet signal network. This is by the results of student interviews which stated that they agree that teaching materials can be accessed with smartphones such as e-modules. They are also interested in using e-modules in understanding learning materials and there is a need for the development of e-modules based on guided inquiry on photosynthesis material.

CONCLUSION

Based on data from questionnaires and interviews, it can be seen that 75% of students stated that photosynthesis material is difficult to understand because of the many terms and stages that must be memorized and the difficulty in connecting a science concept. Students feel that in learning activities, teachers often use the same method in teaching, namely the lecture method resulting in 88% of students being less interested in learning activities. 90% of students stated that learning resources such as textbooks and LKS as learning guides are less helpful in learning activities because they are less interesting and interactive so they have not been able to support students in mastering the material. And 91% of students are interested in using electronic learning media that can be accessed via Android, namely e-modules.

Therefore, it can be concluded that the existing teaching materials are not optimal in improving students' scientific literacy, so they need to be developed in the form of e-modules. Students need the development of guided inquiry-based e-modules to improve scientific literacy in photosynthesis material. With the guided inquiry method, students can actively engage in exploring important concepts, develop critical thinking skills, and solve problems independently with appropriate guidance. In addition, the use of e-modules allows for more flexible and engaging access to materials, so that it can help students more easily understand the process of photosynthesis and its scientific relevance in everyday life.

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