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Preliminary Research on the Development of E-Module Learning Media with Ethno-STEAM Approach to Increase Scientific Literacy

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Abstract

This research is a preliminary study regarding the description of teacher-led learning, students scientific literacy abilities, and the need for developing Ethno-STEAM integrated e-media on pollution material to increase students literacy. This research used the descriptive method. The subjects of this research were 64 students in class X and 4 science teachers at SMK Takhassus Al Qur'an Wonosobo. The data collection instruments used were questionnaires, interview guides, and scientific literacy test questions. Based on the results of interviews with teachers, it shows that students' scientific literacy abilities are still lacking. It can be seen from the results of the students' scientific literacy test, which showed a percentage of 39%. On the indicator identifying keywords to gain scientific information, most of the students answered correctly with a percentage of 71%, while on the indicator recognizing scientific inquiry features, only 42% of students could answer correctly due to a lack of scientific literacy and student knowledge about technology use. Based on the results of the questionnaire analysis, Ethno-STEAM integrated e-media to increase students' scientific literacy as an alternative learning medium on pollution material is needed to be developed with a percentage of 84%. The use of Ethno-STEAM integrated e-media is expected to increase students' understanding, provide meaningful learning for students through the application of ethnoscience, and improve students' scientific literacy skills.

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INTRODUCTION

The rapid development of technology and science is one of the characteristics of 21st century education or education in the 4.0 era. 21st century education aims to encourage students to have skills and responsiveness in dealing with changing times. 21st century learning requires technology-based learning by applying the 4C skills (Critical Thinking, Communication, Collaboration, Creativity) (Andaresta & Rachmadiarti, 2021). This ability can be applied with appropriate teaching methods to enhance scientific literacy skills.

According to Prastiwi et al. (2020), scientific literacy is the capacity to apply knowledge of science based on facts in order to draw conclusions during the comprehension process. The capacity of a person to comprehend and use scientific ideas in daily life is another definition of scientific literacy (Kimianti & Prasetyo, 2019). According to the PISA study findings from 2018, which 78 nations participated in, Indonesian students' scientific literacy abilities received an average score of 396 (OECD, 2019). The average score is 500, therefore this one is really low. This demonstrates that scientific literacy among Indonesian students is still considered to be low.

Students require scientific literacy to attain 21st century abilities, so that they not only grasp science as a concept but can use it in their daily life (Sutrisna, 2021). Scientific literacy skills can be developed with scientific knowledge, so that they can be applied in daily basis (Holbrook & Rannikmae, 2009). Choosing the right medium can help implement scientific literacy. In addition to media, teaching strategies that are tailored to students' scientific literacy levels will make it simpler for students to comprehend the information provided so they can improve their skills. An alternative learning method that can support the skill development in 21st century is an Ethno-STEAM based learning approach (Ethnoscience and STEAM).

STEAM learning teaches students to solve a problem through science, technology, engineering, mathematics, and art. Combining STEM in an art to increase students' interest in learning science (Yakman & Lee, 2012). STEAM integrated learning guides students to develop problem solving, critical thinking and collaborative skills (Rahmawati et al., 2019). STEAM learning can encourage students to develop creativity and critical thinking skills more effectively than traditional learning approaches (Rahmawati et al., 2020). Through STEAM students are trained to think comprehensively with problem solving patterns so that it can help stimulate their ability to face challenges in the 21st century (Saddhono et al., 2020).

Meanwhile, ethnoscience is knowledge in society or ethnicity that is obtained through methods and procedures in certain community traditions, and its 'truth' can be tested empirically (Sudarmin, 2014). Ethnoscience is also defined as the study of culture and events related to the universe in society(Fitria & Widi, 2015). Ethnoscience integrated learning can also improve students' scientific literacy skills (Atmojo et al., 2019). So ethno-STEAM learning connects science, technology, engineering, mathematics, and art based on culture and the potential of a region to maintain a citizen's identity.

Learning with an ethno-STEAM approach will be more effective if it uses appropriate and suitable media that are efficient and attractive in both form and content. The existence of technological advances requires teachers to be able to utilize various types of appropriate media in the teaching and learning process. There are various types of learning media, including print media, audio, visual, video, e-learning, and digital media. Digital media can be used as an alternative for students to increase their reading interest (Ruddamayanti, 2019) and their scientific literacy (TD Kurniawati et al., 2021).

Electronic module or e-module is one alternative medium used. An electronic module, or E-module, is a source of information that is presented electronically in book format and can be read using a computer or an electronic book reader (Istiqomah et al., 2021), such as laptops, computers, tablets, or smartphones. The ease of use of e-modules allows students to study independently anytime and anywhere (Pamujo, 2021). The text on the e-module is made using Microsoft Word (Kaniyah et al., 2022). The material included in the e-module can be arranged according to the needs of 21st-century students. The use of e-modules that are adapted to the learning approach used will help achieve learning objectives (Azis & Yulkifli, 2021).

The e-module used with the ethno-STEAM approach in science learning will affect student learning outcomes and enable meaningful learning to occur. Students can relate newly learned content to previously acquired knowledge because they can apply what they have learned to their immediate environment.

Ethno-STEAM integrated e-module incorporates elements of culture and local wisdom into learning materials. As part of the learning

process, it is expected to design learning experiences and environments that incorporate culture, science, technology, engineering, mathematics, and art. Additionally, it can help students develop their scientific literacy abilities by conceptualizing, assessing, verifying data, and resolving various issues associated with the subject.

What's new in this research is the development of an integrated ethno-STEAM e-module that can be applied to various media and linked to problems in the surrounding environment. This ethno-STEAM integrated e-module is focused on improving students' scientific literacy skills. The use of ethnoscience integrated e-modules is an effective alternative medium for increasing students' scientific literacy (Atmojo et al., 2019). The ethno-STEAM integrated e-module in the form of problems related to the surrounding environment on pollution material has not been researched much. Learning that collaborates community original science and scientific science is able to increase students' understanding of scientific science concepts and make learning more meaningful (Damayanti et al., 2017; Oktaviani et al., 2020; Pujiati, 2020)

Based on this explanation, science learning using the Ethno-STEAM approach is crucial in 21st century learning. The use of smartphone-based E-modules can also support the learning process in the 21st century. Therefore, this study aims to describe students' initial knowledge and learning, the use of teaching materials in science learning, students' scientific literacy abilities, and the need for developing e-modules with an ethno-STEAM approach to increase scientific literacy. In order to boost students' scientific literacy, an E-module with an ethno-STEAM approach might be created from this.

METHOD

This type of research is descriptive research to describe the current learning situation. Descriptive research is carried out by focusing on a problem at the time the research is conducted, then presented as it is (Sudjana, 2005). The subjects in this study were 64 students grade X and four science teachers at Takhassus Al Qur'an Vocational High School Wonosobo. This research was conducted from October to November 2020.

Data collection instruments were questionnaires, interview guides, and scientific literacy ability test questions. The Google form is used to distribute the Ethno-STEAM integrated e-media requirements questionnaire on pollution material in order to enhance scientific literacy. Interviews were conducted directly with science teachers to gather initial information about problems in learning science, the learning that was carried out, and students' scientific literacy. The ability of students' scientific literacy is measured by giving test questions in the form of multiple choices. The data obtained were then analyzed in a quantitative descriptive manner.

RESULT AND DISCUSSION

Preliminary studies in this project include teacher-led learning, students' scientific literacy abilities, and development needs Ethno-STEAM integrated e-media on pollution material to increase scientific literacy.

Science Learning Process

Analysis of the learning process carried out by the teacher was obtained from the results of interviews with science teachers and student needs questionnaires. The results of interviews that have been conducted with science teachers regarding the learning that has been carried out so far are presented in Table 1.

Based on Table 1, science learning is mostly done using the discourse method. The discourse method is used because the teacher can explain a lot of material in a short period of time (Nida, 2017). In addition, teachers are used to teaching with the discourse method because this method is considered the easiest method to use. In pollution material, teachers usually use the school environment as the object that is most easily observed. Thus, it is necessary to have a variety of learning media, such as pictures or learning videos, to increase students' understanding of pollution. The use of pictures and learning videos was chosen because they are easy for the teacher to operate and can help present the material (Hidayati et al., 2019). Abstract concepts can be understood by students by utilizing the use of learning videos that are presented with an emphasis on real-life examples (Jundu et al., 2020). Through video, students can see real action from the content contained in the video. This is able to stimulate motivation and enthusiasm for student learning (Jundu et al., 2020; Permatasari et al., 2019). Pictures and learning videos on pollution material can be put in the form of e-modules to attract students' learning interest (Rusli & Antonius, 2019). So as to increase activity and student learning outcomes (Hendri, 2018).

Teaching materials that have been used by teachers in delivering material are presented in Figure 1. Teachers more often deliver learning

Table 1. Results of interviews with science teachers regarding to science learning

Question Component	Answer
Preliminary information of teachers and students on learning science	Learning is carried out in schools according to predetermined competency standards, KI and KD. Submission of material is mostly done with lectures referring to the textbooks provided by the school.
Response and learning process before using ethno-STEAM integrated e-media	Have never used ethno-STEAM integrated e-media. They do not understand about STEAM or ethno-STEAM. Learning about pollution is only limited to the school environment which is easily observed.
Barriers and expectations in science learning.	Some of the obstacles in learning science are that students cannot concentrate because the class is crowded, so they are unable to understand pollution material in detail. In addition, material is only conveyed using readings, without any real picture. Students need examples and physical descriptions related to the application of pollution materials. The desired hope is that there is a complete learning media that provides an understanding related to pollution by linking the environment that students can observe, so that students can know the potential of the environment as a tool for learning science.
Teachers' knowledge of ethno-STEAM and scientific literacy	Learning with Ethno-STEAM has not been implemented because of the teacher's lack of knowledge about regional potential and the application of Ethno-STEAM in learning. Some teachers understand scientific literacy and have sought scientific literacy in students in science learning. However, the literacy level of students is still low.

materials using science books published by the government and institutions. Only a small proportion make teaching materials independently. It is important for teachers to make teaching materials independently (Parmin et al., 2016) to solve problems in learning by adjusting the competencies that students must achieve (Suarman et al., 2018). So as to create quality teaching materials (Prins et al., 2018).

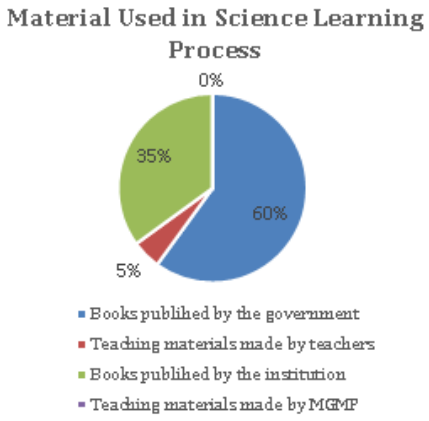

Figure 1. Teaching materials used by teachers in learning science

The use of teaching materials in accordance with the characteristics and learning environment of students is one of the keys to the success of learning science (AA Kurniawati et al., 2017). In addition, teaching materials commonly used by teachers in learning science enable students to be active in using scientific knowledge, identifying material and making conclusions in learning. E-book-based teaching materials can train students to go deeper into the material independently so as to make it easier for teachers in the learning process(Cheva & Zainul, 2019). There are several other factors that support the level of student activity in learning and using scientific knowledge.

In addition to teaching materials, the availability of adequate facilities can improve the quality of the teaching and learning process(Mela & Joko, 2019; Saeed et al., 2019; Siswanto & Hidayati, 2020)Available school facilities have not been able to support learning activities optimally. Especially the facilities used in science learning, some of the facilities were damaged and needed repairs. Facilities are only used when needed. Learning facilities affect student learning achievement, with complete learning facilities students can study well, as well as facilitate and speed up the student learning process independently(Puspitasari, 2016). Facilities in the form of teaching materials are one of the important factors to increase scientific literacy. Where the teaching materials used contain literacy aspects and materials that are in accordance with competency bills and an analysis of the needs of 21st century students(F. Fidiani, Kusmiyati, 2020).

Students' Science Literacy Ability

Scientific literacy is the ability to implement scientific knowledge through facts that are used to identify and make conclusions in the process of understanding(Prastiwi et al., 2020). Scientific literacy is also defined as knowledge

and understanding of scientific concepts and processes needed in making decisions (Holbrook & Rannikmae, 2009).

Scientific literacy ability is measured based on three scientific competencies. The three scientific competencies are identifying scientific issues, explaining scientific phenomena, and using scientific evidence. Based on scientific competence, nine indicators of scientific literacy are produced. The scientific literacy ability instrument used in this study in the preparation of the questions refers to the three scientific literacy competencies with pollution material.

Based on the analysis of students' scientific literacy abilities, it is known that the scientific literacy ability of most students is lacking, with a percentage of 39% in Table 2. Classically, the average value of each indicator is calculated and the result is that the indicator "identifies keywords to obtain scientific information" the most answered correctly by students, while on the indicator to recognize the features of scientific inquiry "the fewest answered correctly by students.

Table 2. Recapitulation of students' initial scientific literacy abilities

Score Range	Information	Percentage of Student Score (%)
80 - 100	Very good	0
76-85	Good	12.5
60-75	Enough	30
55 - 59	Not enough	39
≤ 54	Very less	18.5

The indicator "identifying keywords to obtain scientific information" was most answered correctly by students in Table 3 because in this test questions students were asked to look for keywords related to problems regarding pollution in reading materials. Identifying is an attempt to recognize something based on what has been found. In identifying this test, students are asked to find keywords related to water pollution. The indicator "recognize the features of scientific investigation" was at least answered correctly by students because of the lack of students' knowledge of the technology used in tackling pollution problems in the environment. Even though the teacher has provided learning with the right method, the absence of real application in learning will make it difficult for students to understand learning.

Based on the results of the study, the scientific literacy ability of most students is low. The low scientific literacy of students is influenced by several factors, including the education system and curriculum, teacher teaching methods and models, infrastructure, teaching materials, and inadequate learning facilities in the 21st century learning process(Kurnia et al., 2014). So it is necessary to have learning that can improve students' scientific literacy skills. To increase students' scientific literacy, the teacher can start by introducing and providing material with various strategies that can train scientific literacy skills, for example by providing material through experiments that can stimulate students to think at a higher level.

Scientific literacy skills can also be improved by developing practicum activities in accordance with the research that has been done (Winata, 2018). In addition, students' scientific literacy can be increased through ethnoscience-based learning (Atmojo et al., 2019; Nisa et al., 2015; Pertiwi & Rusyda Firdausi, 2019; Utami & Murti, 2019). Ethnoscience learning is learning that utilizes elements of local culture and the en-

Table 3. Percentage of students' scientific literacy indicators

Indicator	Percentage of Student Answers (%)	
	Correct	Wrong
Identify problems that can be investigated scientifically	57.5	42.5
Identify keywords to obtain scientific information	71	29
Recognize the features of scientific investigation	42	58
Apply scientific knowledge in a given situation	59	41
Interpret scientific phenomena and predict change	53.5	46.5
Identify appropriate descriptions, explanations and predictions	64	36
Interpret scientific evidence and make and communicate conclusions	46	54
Identify assumptions, evidence and reasons behind conclusions	68.5	31.5
Reflecting on the social implications and developments of science and technology	63	37

vironment as learning resources so as to produce more meaningful learning for students (Nuroso et al., 2018).

Media Development Needs

Learning media is used as a tool to convey material in learning(Ntobuo et al., 2018). The learning media used can facilitate students in processing the information obtained (Soeprapto, 2020). Good learning media should have practical value that can overcome problems that are limited to student experience. In addition, the media used can overcome the limitations of the classroom and the media can be used to present learning material that is too difficult for students to understand in a straightforward manner.(Utomo et al., 2020). Such as learning on pollution material. Based on questionnaires and interviews, students have difficulty understanding the material and the application of pollution in everyday life. Meanwhile, teachers experience difficulties in delivering material, applying, and applying media that are appropriate to pollution material. As many as 61% of students agree if pollution material is delivered using learning media as presented in Figure 2. This makes the need for good learning media to provide material and students' understanding of pollution material.

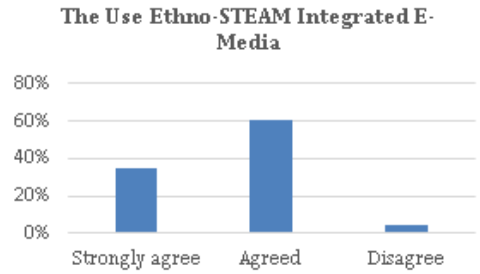

Figure 2. Use of ethno-STEAM integrated e-media on Pollution material

The media used in learning must be in accordance with the curriculum, teaching materials (Sari, 2019)and conditions of students, so that students can understand the material well (Aji & Setiyadi, 2020). Teachers and students agree that learning on Pollution material is delivered using integrated ethno-STEAM learning media, which is developed in a PDF e-book as presented in Figure 3. The use of the PDF form is easier for students to apply. In addition, media using PDF is not fixated on writing, but interesting motion animations, videos, and audio can be included in it, so that learning is not monotonous.(Sriwahyuni et al., 2019).

Teachers and students also stated the need for the development of ethno-STEAM integrated e-media as an alternative learning media on pollution material. The need for ethno-STEAM integrated e-media development is presented in Figure 4 with the percentage of needs for ethno-STEAM integrated e-media of 84%. Teacher and studen suggest that E-STEAM integrated e-media uses Indonesian which is easy to understand, includes examples and applications in real life, uses colorful images so that students are more interested in learning, and is arranged in the form of an ebook on each topic or subject, so that the discussion will be deeper.

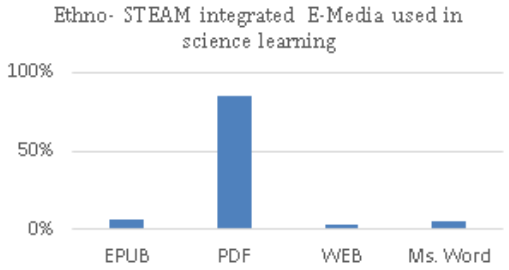

Figure 3. Ethno-STEAM integrated e-media in science learning

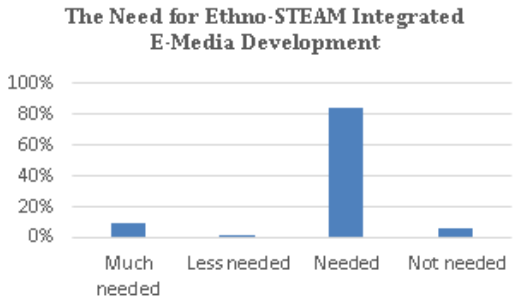

Figure 4. The need for ethno-STEAM integrated e-media development

Ethno-STEAM integrated e-media to increase scientific literacy, which is compiled in the form of an e-book that does not only contain text, but is accompanied by pictures, tables, practice questions, and some information about local potential that is packaged in an attractive way using good and correct Indonesian. E-media in the form of PDF is expected to become e-media that can be accessed easily. In addition, some students already understand the use of PDF, so this e-media can be utilized as an alternative media that supports the learning process and increases students' scientific literacy. This preliminary study is expected to provide alternative learning media that are appropriate for the learning materials for use by teachers and students in the teaching and learning process.

CONCLUSION

The results of the questionnaire and interviews revealed that the teacher's challenges with teaching the material about pollution were the students' lack of focus and the difficulty the teacher had in accurately presenting the material and describing how pollution is applied. This is because students only make observations in a limited school environment. Students' scientific literacy ability is still lacking, with a percentage of 39%. In the indicator "identifying keywords to obtain scientific information," most of the students answered correctly with a percentage of 71%, while in the indicator "knowing the features of scientific investigation," only 42% of students answered correctly due to a lack of student knowledge regarding the use of technology. Based on the results of the teacher and student questionnaire analysis, it states that Ethno-STEAM integrated E-media is required for development with a percentage of 84%. The learning media are expected to increase students' understanding of their environment and improve their scientific literacy abilities.

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