The validity of science e-module based on the authentic problem

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Abstract. The ability of scientific literacy and self-efficacy needs to be increased by students because students in the era of society 5.0 are required to have various skills. The availability of students' books also has limitations in the presentation of material. To solve this problem, it needs to develop the integration of a supplement of teaching materials with the situation in the 21st century. An e-module (electronic module) with authentic problems was helped students learned independently. The purpose of this research is to produce a valid to authentic problem-based science e-module. Assessment for product advisability is assessed by experts and practitioner, where the evaluation is carried out using questioners form. This research and development design uses a 3D model (an adaptation of Thiagarajan, Semmel, Semmel). Based on the result, it can be conducted that the average total value was 85.12, which is categorized to very valid. Therefore, e-module based authentic learning is valid to be used to improve scientific literacy and self-efficacy for science teaching in junior high school.

1. Introduction

Globalization has resulted in changes in the overall life of society, including the education sector. Learning science in the 21st century requires a variety of adaptive competence in the era of industrial revolution 5.0. However, in practice, there are various problems in learning science, among others: (1) low capacity of scientific literacy of students in science subjects [1]; (2) the lack of teaching materials science-based electronic media [2,3]. However, not only the strategies in learning that needs to be fixed but also the ability of educators in developing learning materials. Educators must compose their materials that match the characteristics of the students, environment and science materials to achieve the goal of education in science learning [4].

Learning outcomes in the 21st century in the era of the 5.0 industrial revolution which encourages innovation and optimal use of technology, the teaching materials developed are e-modules based on authentic problems that emphasize the latest issues that are encountered in real life and are complex [5,6]. E-module or electronic module is an independent study material presented in an electronic format such as a computer or android equipped with multimedia, systematically arranged into the smallest learning unit that aims to achieve learning goals [7-9]. Authentic problems have the characteristics of using issues, scientific phenomena or issues that lead to habituation of using topics in learning so that it will be easier to increase scientific literacy skills. Authentic problems presented in the e-module can not be separated from the local wisdom of the people of South Borneo. The use of teaching materials will affect self-efficacy because they can develop better performance in teaching science and technology [10]. Also, the leadership competencies needed in the 5.0 industrial revolution era require students to have a high sense of self-efficacy. The other reason to develop e-module was coronavirus pandemic. Colleges around the world forced to move their classes online. The rapid transition of coronavirus remote teaching, educators received professional development to teach
online. The purpose was to help educators to design and teach online courses, which can take a few months [6].

The development of e-modules based on authentic problems can improve students' scientific literacy and self-efficacy. They have the same characteristics, namely using issues, scientific phenomena or issues that cause the habit of using cases in learning, so it will be easier to increase scientific literacy skills. The learning approach of students which is based on authentic problems causes students to be able to compile their knowledge, develop higher skills, become independent of students and increase self-efficacy. Good scientific literacy skills are one of the achievements of students who have an understanding of science concepts and self-efficacy. Also, students who have scientific literacy skills and high self-efficacy will have increased motivation in achieving careers in science [11].

The results Seruni et al. [12] showed that the development of biochemical e-modules on lipid metabolism material had reasonable interpretations from material, language, and media experts with a percentage of 83% to 85%. The use of problem-based learning e-modules can increase scientific literacy by 21% [10]. Also, the results of the interactive e-module development research [13] showed that the validation results obtained an average percentage of 90% with the very feasible category, and the practicality test results obtained a value of 95% in the very feasible. The application of problem-based learning e-modules can increase literacy by 20% [14]. This study aims to determine the validity of e-modules based on authentic problems. Students are prepared to have scientific literacy skills and good self-confidence to face the era of society 5.0. Authentic problem-based e-modules were also developed to assist teachers in providing appropriate teaching materials and helping students learn independently during the Covid-19 pandemic.

2. Research Method

The design of research and development is the 3D model [adapted 15]. This research includes the stages of define, design, and development. The research object is an e-module based on the authentic problem. The study was conducted from January to November 2020.

The define stage, the researcher, examines various information related to e-module based on authentic problems and its relation to the era of society 5.0. The results show that one of the appropriate topics for learning based on authentic problems is additive and addictive materials for junior high school. An outline of the additive and addictive material taught in e-module based on authentic problems is presented in Table 1.

| Learning Materials | Authentic Problem |
|--------------------|-------------------|
| a. Types of additives based on their origin | a. The use of rhodamine B in foods |
| b. Observation: Identification of additives in food and drinking packaging | b. The impact of excessive use of MSG on food |
| c. Types of additives based on their function | c. The use of turmeric, rice and whiting in the tradition of "Kapidaraan" in Banjar society |
| d. How additives work in the human body | d. Tradition "manginang" in society Banjar |
| e. The impact of using addictive substances for health | |
| f. Efforts to prevent addictive substance abuse | |

The design stage, the researcher, prepares an initial e-module design based on authentic problems that are attractive and makes it easier for learning science. This stage has produced an initial draft of an e-module based on the authentic problem, as shown in Figure 1. The development stage, this stage is restricted to validation activities by five reviewers consisting of 3 experts and two practitioners. The purpose of the validation by the validators is to assess and see the validity of e-module is a good learning resource used by students. The data collection was used in the questionnaire method. The questioners form given to 3 validators, and then the final score from validators are measured using a Likert scale. Interpretation of the validity of the learning module is determined by the criteria: 85 x \leq 100 \text{ (very valid)}, 70 x \leq 85 \text{ (valid)}, 50 x \leq 70 \text{ (less valid)}, and x \leq 50 \text{ (not valid)} [15].
Figure 1. The layout of e-module based on the authentic problem
3. Result and Discussion
The developed e-module has various features which are expected to improve scientific literacy, including (1) let's learn; (2) let's do it; (3) science in life. The main feature that would raise the literacy skills of science is "science of life" because there is the interaction between science, environment, technology and society also includes the social problems that arise in the community related to science learning.

Table 2. The validation results

| Aspects of assessment | Practitioner | Experts | Average | Category |
|-----------------------|--------------|---------|---------|----------|
| Content               | 74.12        | 93.53   | 83.82   | Valid    |
| Media                 | 80           | 92.86   | 86.43   | Very valid |
| Total of average      | 77.06        | 93.19   | 85.12   | Very valid |

Based on the validation result in Table 2, it is found that the total average is 85.12, which is categorized to very valid. The average score for aspects content is 83.82, which is indexed is valid. Validation of e-module content includes relevance, accuracy, completeness of presentation and basic concepts of material in the e-module. This aspect consists of the e-module suitability with the competencies that students want to achieve, such as self-efficacy and scientific literacy. The e-module content can encourage students to interact and build their knowledge. It is also by the demands of the curriculum and the latest developments in science. Through authentic problem content, students are also required to understand the local wisdom in their environment. The real evidence is the traditions of the Banjar people related to scientific content, such as the tradition of "Managing" and "Kapidaraan."

The learning approach of students which is based on authentic problems causes students to be able to compile their knowledge, develop higher skills, become independent of students and increase self-confidence [16]. Constructivism learning theory states that experience is not something that has been given from nature, but knowledge is the result of active human constructions. The philosophy of constructivism learning is to reflect on experiences to build, construct knowledge and understanding [17]. The materials in e-module using problem-based learning model, description of material and examples given which are relevant and attract students attention. PBL is a learning model that more activities do base on phenomenon [18]. It also contains explanations to support students understanding science in real life. For example (the use of rhodamine B and monosodium glutamate in foods). The other results showed that the development of a biochemical e-module on lipid metabolism material using Flip PDF Professional had reasonable interpretations from material, language, and media experts with a percentage of 83.35% to 85.00% [19]. The use of problem-based learning e-modules can increase scientific literacy by 20.60% [14].

Table 2 show that the average score for aspects media is 86.43, which is categorized is very valid. The media validation is colour composition, the use of words and language, screen display, presentation, animation and sound. This aspect includes colour combinations, image design and layouts arranged in such a way as to support students to be involved in learning. E-modules also use language adapted to the teaching material and students' thinking levels. Rochintaniawati et al. [20] said that language that used communicative and motivates learners to do the work.

This research is still at the expert appraisal stage, so future research is needed to test the practicality and effectiveness of e-module based on authentic problems in science learning. Validators also provide suggestions for adding content or local issues in the e-module presentation. Given the development of scientific literacy and self-efficacy as competencies in society 5.0; then the fundamental implication of the results of this study is that e-module based on authentic problems can be applied on a wide scale in the world of education as an alternative to preparing the competence of students in society 5.0. Students are trained as creators, technologists, collaborators, and communicators who are useful for society and the surrounding environment.

4. Conclusion
This research produces an e-module based on authentic problems which are valid to prepare students in society 5.0. E-modules with authentic problems can be recommended to use in online learning, especially in coronavirus pandemic, to improve student's scientific literacy and self-efficacy. Students
can be more independent in learning science. Further research needs to test the practicality and effectiveness of e-module based on authentic problems in learning science in the classroom.

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