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Development of Integrated IPA E-Module Webbed Type to Improve Science Literacy of Physics Education Students in Online Lectures in The Pandemic Era

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ABSTRACT

Online learning in the Covid-19 pandemic era is a challenge for lecturers and students. The thing that needs to be considered for lecturers is how to create media that is able to overcome student boredom in doing online learning while at the same time being able to improve student literacy, because currently the scientific literacy of students in Indonesia is very low. Therefore, it is necessary to develop an E-module in the Integrated Science course with the Webbed type that is able to answer these problems. The method in this study is Research and Development with a 4D model. Validation was carried out both on material experts and media experts. The product trial was carried out on UAD Physics Education study program students who were taking an Integrated Science course. The result of this research is that an Integrated IPA E-Module has been successfully developed with 'very good' quality. Based on the test results, it was found that the Integrated Science E-Module that was developed could significantly improve students' scientific literacy with an average score of 7.2 increasing to 8.9.

Keywords: *E-Module*, integrated science, scientific literacy

INTRODUCTION

Learning in the Era of the Covid-19 Pandemic has made many universities around the world switch quickly to online classes. In Indonesia, traditional classes are still seen as "real" education, that is, they do not think that online classes can help students' education [1]. Online learning in Indonesia itself still demands various innovations and creativity because it has not become a habit. There are various obstacles faced in online learning, including limited internet quota and internet connection instability [2]. In addition, other obstacles are the limitations of the media and the lack of mastery of technology [3]. Online learning during the Covid-19 pandemic has in fact led to various responses and changes to the learning system that can affect the learning process and the level of development of students in responding to the material presented [4]. The basic ability of learning management systems and multimedia software to support online learning is also one of the barriers to online learning. Therefore, efforts are needed to create learning media that can facilitate student learning but can still be accessed online.

Basically, science is a process to teach students to understand the nature of science which includes: products, processes, and the development of scientific attitudes as well as realizing the values that exist in society to develop attitudes [5]. Science is a science process capability, namely the assimilation of various intellectual skills that can be applied to the learning process [6]. In order to achieve some of the abilities that exist in the science process, in science learning, teachers/lecturers must be smart to innovate in the method and process of delivering learning [7]..

Science seeks to shape patterns of thought, behavior, and build human character so that they care and are responsible for themselves, society, and the universe. By studying science, humans can shape their behavior and character to become responsible

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individuals. However, what needs to be understood today is that the use of science and technology is not only to understand the universe. Scientific literacy is needed in this case. According to the facts of the 2015 PISA (Program for International Students Assessment) results, the average value of science in OECD (Organization for Economic Co-operation and Development) countries is 493, while Indonesia has only achieved a score of 403 [8]. This indicates that the scientific literacy of our students is very low [9]. Based on observations made to students, especially the UAD Physics Education study program, the desire and ability of scientific literacy is still low. New literacy will be carried out if it is required during lectures and get grades from the lecturer, so this has not become a habit.

Efforts to improve scientific literacy are actually common in learning. Nevertheless, continuous efforts are still needed so that the increase in students' scientific literacy can increase significantly. Based on research that has been done before, that the scientific literacy of students is better when learning is carried out by inquiry compared to conventional learning / lectures [10]. In order to increase students' scientific literacy skills, besides requiring student motivation, teachers also need to consider learning strategies that are in accordance with the conditions and potential of students. The learning process should focus on providing direct experience and the application of the nature of science [11]. Teaching materials that are in accordance with the characteristics of students and can provide direct experience to students are what are needed to improve scientific literacy. Research on the development of teaching materials has been carried out and can successfully improve students' scientific literacy compared to when students use teaching materials given from school [12].

The success of the learning process is influenced by one of the factors, namely teaching materials. Teaching materials in the form of science books in circulation are still rarely packaged in a topic or theme [13]. Meanwhile, learning will be maximized if science is packaged in a theme related to everyday life or in accordance with the environment where students live [14]. If students study science based on a theme that they usually encounter in everyday life, they will master science experience, and problem solving science which are some of the abilities in science process skills. Thus, they will really learn science according to what is needed today and not only learn theory or formulas.

In studying science, the concept of student knowledge will become a single unit if it is studied in an integrated manner. The condition of Integrated Science in Indonesia still needs attention, because there are not many teaching materials developed [15]. One type of integrated science learning is the Webbed type. In the Webbed type of Integrated Science, the approach taken is thematic and integrates the subject matter. This thematic Webbed characteristic is able to attract the attention of students to improve their scientific literacy [16]. Webbed-type Integrated Science Learning in Indonesia has a positive impact on student learning outcomes. Learners are able to understand Integrated Science, participate actively in the learning process, and increase mastery of concepts [17]. Meanwhile, previous research that has developed an Integrated Science module with a scientific approach has been able to improve students' critical thinking skills [18]

The module is one of the sources of information used by students to increase their knowledge and motivation to learn [19]. Electronic-Module (E-Module) is an online learning media that is needed at this time where with the pandemic, 80% of learning is still done online. Research that has been done before, namely the development of an E-Module Science based on Problem Based Learning is able to improve students' scientific literacy [20]. Likewise, research on the development of Interactive E-Modules can improve student learning outcomes [21].

The E-Module was chosen in the Integrated Science course because it is expected to improve students' understanding of concepts and scientific literacy, especially the UAD Physics Education study program. This E-Module contains Webbed-type Integrated Science content in which the material is written based on suggestions/inputs from students according to their daily life conditions/experiences. Thus, it is hoped that students will be more interested and motivated to read the E-Module, which will have an impact on increasing their scientific literacy. Based on this background, research was carried out on the development of the Webbed-type Integrated Science E-Module to improve

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the scientific literacy of UAD Physics Education students as an alternative media during online learning during the Covid-19 pandemic.

RESEARCH METHOD

The research method used in this research is Research and Development (R & D). The development model in this study is 4-D (Four D). The 4-D development model consists of four main stages, namely: Define, Design, Develop, and Disseminate.

The development procedure carried out includes the following stages:

a. Defining Stage

The purpose of this stage is to determine and define the needs in the learning process. Things that must be considered include the conditions of Integrated Science learning and the Integrated Science E-Module aspects to suit the needs.

b. Designing Stage

The design phase is focused on designing an E-Module. This design stage begins with conducting a material review to formulate learning objectives and collecting materials or references used to create an E-Module.

c. Developing Stage

This development stage aims to develop the initial E-Module product which begins with preparing and reviewing the collected references. Then the module is assessed and given input by media, material, and user experts. Based on this assessment and input, the E-Module was revised.

d. Disseminating Stage

At this stage, the final product is distributed to UAD Physics Education students.

The instrument used to collect research data is a questionnaire in the form of a checklist and input sheets or suggestions from the validator about the quality of the developed E-Module and student response questionnaires. Aspects of E-Module quality assessment include:

1) Aspects of the suitability of the material with the Integrated Science Syllabus and RPS.
2) Aspects of language suitability with enhanced spelling rules, communicative and interactive sentences, and ease of understanding.
3) The presentation aspect in the module is arranged in a systematic, logical, simple and clear manner, and relates one concept to another concept.
4) Aspects of the principles of Integrated Natural Sciences development in accordance with the Webbed type.

Research data in the form of qualitative and quantitative data. Qualitative data in the form of suggestions and input from material and media experts as material for improving the E-Module. Meanwhile, quantitative data are in the form of product assessments by experts and student scientific literacy assessments. The questions used to measure students' scientific literacy are adjusted to the indicators of scientific literacy ability as proposed by PISA (Program for International Students Assessment) 2015 [8].

In the E-module assessment questionnaire, the scale used is a five level scales consisting of five categories. From the results obtained, then converted into a Likert scale, namely: Very Good (SB) = 5, Good (B) = 4, Enough = 3, Less (K) = 2 and Very Poor (SK) = 1 [22]. The final score is the total score divided by the number of assessment items.

$$Final\ score = (skor\ total)/(jumlah\ butir\ penilaian)$$

Then the final score is stated in the conclusion of the quality of the module assessment as shown in table 1. below.

Table 1. Normality test result

Category	Average Score
Very Good	3,2-5,0
Good	2,4-3,19
Enough	1,6-2,39
less	0,8-1,59
Very Less	0,00-1,79

RESULT AND DISCUSSION

The results obtained in this study are:

1. Defining Stage

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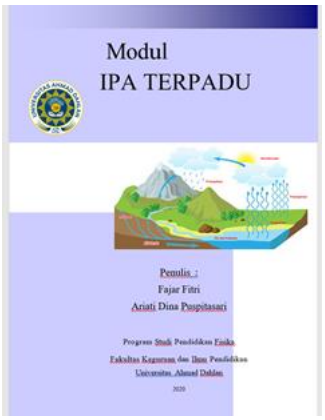
This stage generates the requirements in designing the E-module, namely by setting themes that are in accordance with the Syllabus and Semester Learning Plans (RPS). The themes determined in the module are: Photosynthesis, Water for Life, Air Pollution, Body Temperature, Global Warming and Acid Rain, and Natural Disasters.

2. Designing Stage

This stage resulted in the design of modules by reviewing themes related to learning objectives and formulating questions to be able to measure scientific literacy. At this stage, the necessary references are also collected for compiling the E-Module. The E-Module cover display is shown in Figure 1.



Gambar 1. Integrated Science E-Module Developed

3. Developing Stage

This stage produces an initial E-Module product, which is in the form of an Integrated Science E-Module of the Webbed type. The module assessment criteria are based on the material feasibility indicators:

a. Material truth
b. The suitability of the material with the Base syllabus
c. Systematic according to the learning structure
d. Communicative language
e. Understandable terms used
f. Use clear terms and symbols

E-Module assessment criteria are based on media eligibility indicators:

a. Accuracy of color and font selection
b. Clarity of image shape and size
c. Precise structure of E-Module
d. Learning objectives and clearly stated
e. Language using proper spelling
f. Simple and easy understand language

The results of the average scores of assessments by media experts and material experts are shown in table 2.

Tabel 2. Average Expert Score

Experts	Material Expert	Media Expert
1	3,8	3,4
2	3,4	3,2
Average	3,6	3,3

Based on the average score of the assessment, the quality of the material is 3.6 and the quality of the media is 3.3 with the 'Very Good' category.

4. Disseminating Stage

At this stage, a final product is produced which is then tested and distributed to fifth semester students of the Physics Education Study Program at Ahmad Dahlan University who are taking an Integrated Science course.

After testing the students, the measurement of scientific literacy was carried out. The scientific literacy assessment criteria used are:

a. Identify questions
b. Explain scientific phenomena
c. Taking conclusion on a fact
d. Understand the characteristics of science
e. Engage and care about science related issues

on the assessment of the scientific literacy criteria above, the best average score for students is on criteria a. (identifying questions) while the lowest is on criterion e. (engage and care about science-related issues). In general, the average value of student scientific literacy is shown in table 3.

Table 3. Student Scientifics Literacy Score

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Abilities	Pretest	Posttest
Scientifics Literacy	7,2	8,9

Based on table 3. it can be seen that there is an increase in students' scientific literacy before and after learning using the Webbed Integrated Science E-Module that has been developed.

The Webbed-type Integrated Science E-Module that has been developed can be a teaching material for students to add references during lectures, especially in this Pandemic Era. The Webbed type is attractive to students because besides studying science from the point of view of a theme, it is also very directly related to natural phenomena and the environment in which they live, it makes students not feel bored when reading the E-Module. Moreover, the themes taken in this E-Module are in accordance with input from students related to the themes in their neighborhood, their favorite themes, or their interest in the themes in the media articles they have read.

The questions in the E-Module are also able to stimulate students to be able to understand the content of the modules they read. In addition, these questions can also motivate students to write down what they understand after reading the E-Module. Therefore, the Webbed-type Integrated Science E-Module that was developed is very useful for students taking Integrated Science courses as well as being able to improve their abilities in scientific literacy. The research results obtained are also in line with previous relevant research where the development of a PBL-based Science E-Module is able to increase scientific literacy [20]. The results of this E-Module development can then be used as an alternative learning media in the pandemic era and as an additional reference for students who are taking Integrated Science courses.

CONCLUSION

It has been successfully developed in this research the Webbed type Integrated IPA E-Module with "very good" quality. The average score of assessment by material experts is 3.6 and the average score of assessment by media experts is 3.3. The Integrated Science E-Module that has been developed can improve students' scientific literacy with an initial scientific literacy assessment score of 7.2 and a final assessment score of 8.9.

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