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Development of Biology module based on SETS (Science, Environmental, Technology and Society) in ecosystem material

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Abstract
The development of biology modules for learning Ecosystem Material based on SETS (Science, Environmental, Technology, and Society) is expected to be able to develop students' abilities in connecting science with the environment, technology, and society in everyday life, so as to improve students' understanding of Ecosystem Materials. The facts obtained from the field are that the teaching materials used by teachers in the learning process are still inadequate and the learning that takes place is still monotonous, so that students find it difficult to understand the concept of Ecosystem Material. The purpose of this study is to design a SETS (Science, Environmental, Technology and Society) based module on Ecosystem Material and to determine the feasibility of a SETS (Science, Environmental, Technology and Society) based module on Ecosystem Material. The SETS-based module refers to the development model developed by Alessi and Trollip, which consists of 3 stages including (1) Planning Stage, (2) Design Stage, and (3) Development Stage. The product produced from this study is a SETS (Science, Environmental, Technology and Society) based module on Ecosystem Material. The number of validation results from material experts was 87.25% and the validation results from media experts were 86.75%, with an average percentage score of 87% so that it was declared very feasible to be used as a learning medium.

Keywords: Module, SETS (Science, Environmental, Technology and Society), Ecosystem.

1. Introduction

Education is a channel of communication between educators and learners, wherein educators impart knowledge, ideas, and values to pupils. The study of biology is one among them. Three natures are related to biology, a science that investigates living things. The primary goal of biology is to give pupils scientific and technological knowledge and abilities (Dedi, 2018). It is anticipated that high school biology instruction will help students develop their environmental responsibilities, knowledge, abilities, and attitudes. Biology classes are not just mastery of factual collections but also a process of discovery because biology is tied to the methodical discovery and understanding of nature and living things (Arifin, 2013). As a result, biology lectures should be directly experienced by students.

The SETS learning approach connects science to the world around us, including society, technology, and the environment. The SETS learning paradigm consistently presents issues with concepts that include aspects of science and technology that are evolving in our surroundings, including society, technology, and the environment (Arsyad, 2013). The five phases of the SETS learning model are concept generation, application, consolidation, assessment, and initiation. In order to create an integrated relationship, the SETS approach links what is learnt with suitable elements of science, the environment, technology, and society (Aulia & Yurnetti, 2020). SETS can increase the value of learning since it exposes kids to authentic and natural scenarios.

When used to environmental materials, SETS is highly appropriate. An attempt to address environmental issues can be made using the SETS model. In order to provide meaningful learning, the SETS learning model, which is a biology learning process, encourages students to apply aspects of science, environment, technology, and society to solve the problems (Lekman, 2020). Through the use of scientific principles acquired through technology, the SETS model will guide students to think holistically while solving challenges for the good of society and its effects on the environment. The SETS model teaches students, both individually and in groups, to take responsibility for societal issues and environmental preservation (Nugraha et al, 2013).

According to preliminary observations at Darussalam Superior High School Labuhanhaji, the infrastructure and facilities are more than sufficient; however, practicums are rarely conducted due to the laboratory's lack of infrastructure and equipment. Teachers carry out phases of preparatory activities during the learning process, but they never carry out these activities while communicating learning objectives. Teachers are highly skilled at understanding the subject matter, guiding students through learning exercises, and giving real-world examples.
Based on the results of an interview with one of the Biology teachers at Darussalam Superior High School Labuhanhaji, it was said that there had been no SETS-based Biology module used at the school before. The development of a SETS-based biology module was created to invite students to directly learn from actual phenomena in everyday life and integrated with the SETS approach. With the development of SETS-based biology, students are expected to be able to carry out learning activities by providing good initiatives or responses both individually and in groups. Based on the description above, the author wants to study more deeply about the development of SETS-based biology modules, so the research "Development of SETS-Based Biology Modules (Science, Environmental, Technology, and Society) on Ecosystem Material" was conducted.

2.0 Materials and methods

In this study, the researcher used a juridical-empirical approach method. In a juridical perspective, it is intended to explain and understand the meaning and legality of laws and regulations that regulate law enforcement on public health insurance issues. Development research, often known as research and development, is the methodology employed. One research strategy used to create specific items and evaluate their viability is research and development. Research is necessary to evaluate the product since it is utilized to generate unique products that benefit the larger population. The measurement of the feasibility of the developed teaching module is by using a Likert scale in the form of a score that presents the characteristics, attitudes, opinions and perceptions with their respective weights, namely, 4 (Very Feasible), 3 (Feasible), 2 (Less Feasible), 1 (Not Feasible).

3.0 Results and Discussion

The study's findings demonstrated that the ecosystem-based SETS (Science, Environment, Technology, and Society) module created during the planning, design, and development phases was deemed highly feasible for use in instruction, with an average feasibility percentage of 87% based on validation by media and material experts.

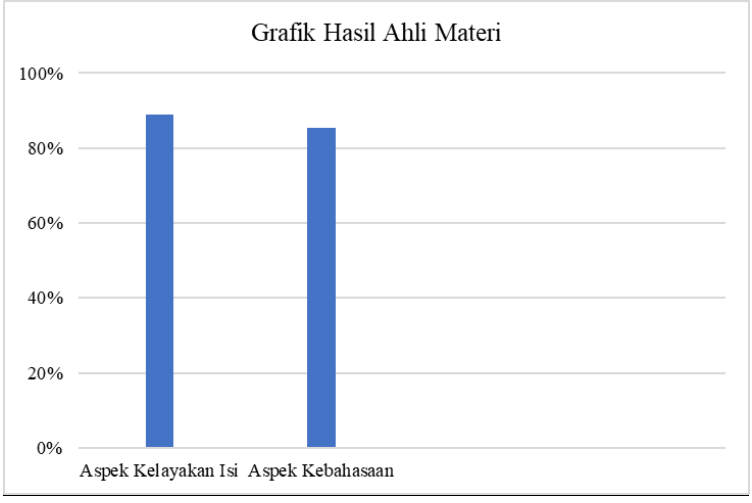


Figure 4.1 Material expert validation results graph

The feasibility test of the material contained in the SETS-based module was assessed by two expert lecturers consisting of Mrs. Eva Nauli Taib, S.Pd., M.Pd. and Mrs. Nurlia Zahara, S.Pd., M.Pd. who are lecturers from the Biology Education study program, Faculty of Tarbiyah and Teacher Training, Ar-Raniry State Islamic University Banda Aceh. The experts provided an assessment according to the assessment points attached to the validation sheet, the results of the data can be seen from table 4.1. from the table, the results show that the SETS-based module that was developed was reviewed starting from the aspect of assessing the feasibility of the content/material and the aspect of linguistic feasibility, the percentage of feasibility can be seen in Figure 4.1:

Based on the graph above, the results of the validity of the SETS-based module material developed are worthy of use. When viewed from the aspect of content feasibility with a result of 89% and the aspect of linguistic feasibility of 85.5%, then the total percentage obtained is 87.25% with very worthy criteria. Then for the feasibility of the media contained in the SETS-based module, it was validated by Mrs. Lina Rahmawati, S.Si., M.Si. who is a lecturer from the Biology Education Study Program, Faculty of Tarbiyah and Teacher Training, Ar-Raniry State Islamic University Banda Aceh. The experts gave an assessment according to the assessment points attached to the validation sheet, the results of the data can be seen from Table 4.2. Based on the results of the table, it was found that the SETS-based module that was developed was reviewed from the aspect of display feasibility and programming feasibility, the percentage of feasibility can be seen in Figure 4.2:

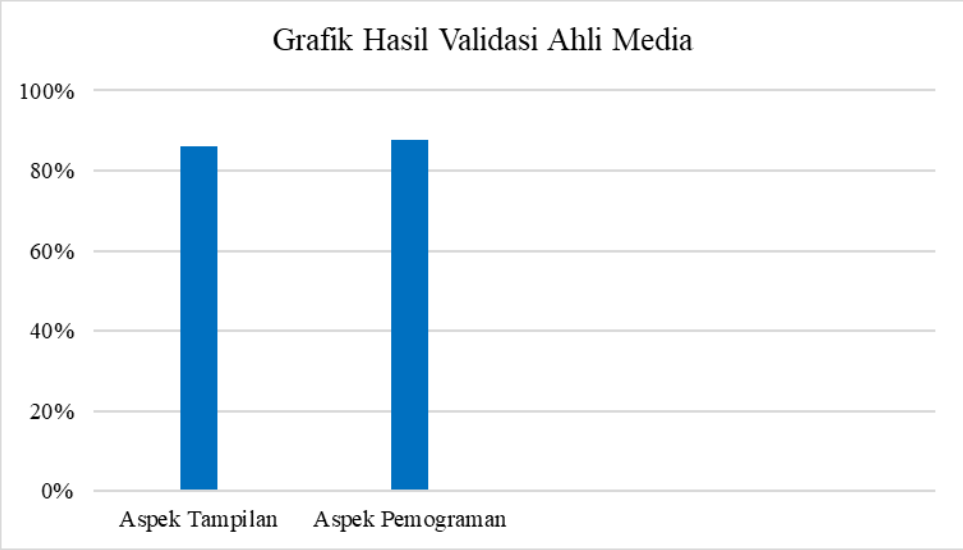


Figure 4.2 Media validation result graph

Based on the graph above, the results show that the SETS-based module developed is feasible to use. When viewed from the feasibility aspect, which is 86% and programming 87.6%, the total percentage obtained from the results of the media validity test is 86.75% with very feasible criteria. Based on the results of the two tables, the overall percentage results of the feasibility of the SETS-based module can be seen as follows:

Table 4.1 Validator Percentage Data

No	Validators	Percentage	Criteria
1	Subject Matter Expert	87.25%	Very Worth It
2	Media Expert	86.75%	Very Worth It
Average Score		**87%**	**Very Worth It**

The average percentage of all generated modules is 87%, according to the findings of validation tests conducted by media and material specialists. This demonstrates that the produced modules meet extremely practical requirements for application in the educational process. The developed module also received some suggestions for improvement, in order to produce a good and interesting module that can be used in learning activities. Some of these suggestions are to add a concept map, with the aim of being able to see the connection between one material and another and improving the material that is still lacking so that it needs to be added again so that readers understand this material.

The three-stage Alessi and Trolip development model was used to create the Ecosystem Material-based SETS (Science, Environment, Technology, and Society) modules. These stages include planning, design, and development. The end result of several phases of module development is an Ecosystem Material module based on SETS (Science, Environment, Technology, and Society). In contrast, Reed (2024) emphasized technology's standalone impact on environmental education. This finding agreed with prior studies linking societal engagement with scientific understanding, promoting holistic approaches in ecosystem education and sustainable practices.

The planning stage is the stage where researchers carry out several stages in it, such as identifying the characteristics of students known by conducting observations and interviews at Darussalam Superior High School Labuhanhaji. Based on the results of the observations and interviews, it is known that the problems in the school are inadequate teaching materials and monotonous learning, on the other hand, the school still carries out the classical learning process, where all students will write the material, then get an explanation from the educator and evaluation questions at the end of the learning. In conditions like this, students do not understand the material being studied. a study by Febrianti, (2017) found that integrating interactive materials improved student engagement and understanding. Similarly, this finding agreed with Martínez-Casanovas et al, (2022), who highlighted that active learning approaches enhance students' critical thinking and retention compared to traditional methods.

The next stage is determining the scope of the study which is also carried out by means of interviews. Interviews are conducted with educators regarding what material is considered difficult for students and has not been effective in its delivery. Based on the results of interviews regarding the difficulty of the material, it can be seen that the material considered difficult by educators and students is ecosystem material, this is because students are less able to understand the concept of this material, and the learning carried out is very monotonous and boring. this result is related to that of Raja et al (2021) who found that using interactive media improved students' comprehension of abstract ecosystem concepts.

And the final stage is the stage of determining and collecting sources and materials that will be included in the SETS-based module to obtain complete materials, learning video links selected from YouTube as well as RPP and LKPD included in the SETS-based module which are first assessed by expert lecturers in their fields. The next stage is the design stage, at this stage the researcher also carries out two stages in it, namely, the idea development stage which is carried out by uniting the components contained in the SETS-based module, the components contained consist of materials, images, LKPD, learning activities, links, and several other components. The next stage is to create flowcharts and storyboards. A flowchart is a section or diagram that shows how a program runs or flows which is contained in a SETS-based module. In other words, a flowchart is a tool used to analyze program components and sequences, as well as to provide information.

The next stage is the development stage. The developed module will be tested for feasibility by the validator. The validator consists of two material expert validators and one media expert validator, which aims to see the feasibility and provide suggestions for improvement in order to produce a better, more interesting and suitable product for use as material in the learning process. Based on the assessment results from the material expert validator and the media expert validator, the results obtained that the SETS (Science, Environment, Technology and Science) based module on the ecosystem material is very feasible to use and can be used as teaching materials in the learning process. The validation results from the material expert obtained a percentage of 87.25% with very feasible criteria, and the validation results from the media expert obtained a percentage of 86.75% with very feasible criteria and the average percentage obtained was 87% with very feasible criteria for use. This study is in line with research that has been conducted by (Mariska, 2023) with a total percentage obtained of 96.83%. The difference between previous research and this research is in the form of the place and location of the research, the material developed, and the products produced. The previous product produced was in the form of an E-module where to access it must use electronic devices such as laptops, smartphones and internet networks, So in this study the researcher created a SETS-based module product that is more flexible to use.

The SETS (Science, Environment, Technology and Society) based module on the Ecosystem material is equipped with a table of contents, concept maps, module characteristics, general information, specific information, assessment instruments, trigger questions, meaningful understanding, learning outcomes, learning objectives, module usage instructions, learning video links, materials, images, LKPD, competency tests, enrichment, assessments, summaries and glossaries so that they are very suitable for use in the learning process.

4.0. Conclusion

The results of this study indicate that the design of the SETS (Science, Environment, Technology, and Society)-based module on ecosystem material was successfully developed through three main stages, namely the planning stage, the design stage, and the development stage. This process produces a product in the form of a module designed to support learning of ecosystem material with an approach that integrates science, environment, technology, and society. The feasibility of this module is assessed through validation by material experts and media experts. The validation results show that the module obtained a feasibility percentage of 87.25% from material experts and 86.75% from media experts, with an overall average reaching 87%. This percentage categorizes the module in the "very feasible" criteria for use in the learning process, so it is expected to increase the effectiveness and quality of students' understanding of ecosystem material.

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