



Development of Physics Modules with Science, Environment, Technology, and Society (SETS) Approaches to Motion and Force Material

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ABSTRACT

Purpose of the study: The goal to be achieved in this research is to produce a physics module with an approach (SETS) on motion and force material with valid, practical, and effective product quality.

Methodology: This research is research and development (R&D), with the 4D development model developed by Thiagarajan Semmel and Semmel. The validity test includes the validity of a questionnaire by 3 lecturers. Furthermore, for the physics module with the validity SETS approach by 5 lecturers. The practicality test of the physics module using the SETS Approach can be seen from the practicality questionnaire sheet by 2 science educators and 29 class VIII junior high school students. The effectiveness test included the effectiveness of the student reading interest questionnaire on the physics module using the SETS Approach, completed by 32 students in class VIII of junior high school.

Main Findings: The result of this research is to produce a physics module using the SETS Approach with valid, practical and effective product quality. It can be concluded that the physics module with the SETS approach to motion and force material for class VIII students meets the valid, practical, and effective criteria.

Novelty/Originality of this study: Producing physics modules with Approach (SETS) on motion and force material.

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1. INTRODUCTION

Modules are printed teaching materials designed to be studied independently by learning participants. Modules are printed teaching materials designed to be studied independently by learning participants [1]–[3]. Modules are also called media for independent learning because they include instructions for self-study [4]–[6]. This means that readers can carry out learning activities without the direct presence of the teacher. Like language, patterns, and other completeness properties contained in this module are arranged so that it seems as if it is a "teaching language" or the language of educators who are teaching students. So because of that modules are often called independent instructional materials, because educators do not directly teach or teach something to students face to face, but simply with modules.

In terms of use, modules can be divided into two types, namely: modules for students and modules for educators. First, a module for students. Modules intended for students contain learning activities carried out by students. Second, a module for educators. The module intended for educators contains educator instructions, a final module test, and an answer key for the final module test. Therefore, modules for students should meet the criteria for good and interesting modules so that they are effective and easily understood by students. Students can control their learning abilities and intensity individually, so learning with modules can develop high processing skills for students.

Process skills are all directed scientific skills (both cognitive and psychomotor) that can be used to discover a concept or principle or theory, to develop previously existing concepts, or to refute an invention/classification [7]–[10]. In other words, this skill can be used as a vehicle for discovery and development of concepts/principles/theories. Process skills are skills obtained from practicing fundamental mental, physical and social abilities as drivers of higher abilities [11], [12]. Process skills taught in science education (science) emphasize thinking skills that can develop in students [13]–[15]. Natural science (science) is systematic and formulated knowledge and is related to material phenomena, especially observation and deduction [16]–[18]. Science studies the universe of objects that exist on the surface of the earth, in the bowels of the earth and beyond space, both observable by the senses and not observable by the senses. In general, science covers three major scientific fields, namely biology, physics and chemistry [19]–[21]. Physics is a science that studies the answers to the questions why, wherefore, and how natural phenomena can occur [22]–[24].

In essence, physics is a science that studies phenomena through a series of processes known as scientific processes which are built on the basis of a scientific attitude and the results are realized as scientific products which are composed of the three most important components in the form of concepts, principles and theories that apply universally [25]–[27]. In addition, physics is a field of science that plays an important role in the development of science and technology [28], [29]. Science and technology are interconnected, because technology is born from science while technology supports the development of science [30]–[32]. From the explanation above it can be seen that the Science Environment, Technology, and Society (SETS) are interconnected in forming students who are creative, independent, and knowledgeable [33]–[35].

Science is a way to know Allah SWT precisely, and because of that throughout history, a number of scientists have made a big contribution to humanity to believe in Allah SWT [36]–[38]. Science offers a way to find love for God's creation, namely by observing the universe and all the creatures in it and conveying the results to mankind [24], [39]. Religion encourages science, making it a tool to study the majesty of Allah's creation [33]. Religion not only encourages scientific study, but also makes scientific research conclusive and effective, because it is supported by the truth expressed through religion [40]. The reason is that religion is the sole source that provides definite and accurate answers, for example, for statements about how life and the universe came into being.

Learning physics will be more meaningful when students are able to develop the experience gained from learning physics to understand the real world, use scientific principles and processes to make decisions, be involved in discussions of science and technology, which of course increases feelings of gratitude for the greatness of God's creation SWT[41]–[43]. One of the important keys in learning physics is when students are able to give examples and apply the theories learned in class in everyday life. The Science, Environment, Technology and Society (SETS) approach is an inseparable integration between science, environment, technology and society [44], [45]. The Science, Environment, Technology and Society (SETS) or Science, Technology and Society (STS) approach is a learning strategy that combines the understanding and use of science, technology, and society, with the aim that science concepts can be applied through skills that are beneficial to students. and society [46]. The SETS learning approach is learning for students to have integrated abilities in four elements: science, environment, technology and society. The SETS approach can encourage students to study science in its entirety, the relationship between the use of scientific theory in technological applications, its impact on the environment, and the influence it has on the development of society. So this research aims to produce a physics module with a science environment technology and society (SETS) approach on effective motion and force material for class VIII students of junior high school.

2. RESEARCH METHOD

This research is development research (research and development). In this research, the product developed is a physics module with a science environment technology and sociality (SETS) approach to vibration and wave material for class VIII SMP N 1 Tigo Nagari. The development design is a physics module with a science environment technology and sociality (SETS) approach using a 4D development model developed by Thiagarajan Semmel and Semmel. Product testing consists of validity, practicality and effectiveness stages. The test subjects at the validation stage of the validity, practicality and effectiveness questionnaire instruments were 3 lecturers. The media validators in this research were two material experts, two media experts, and one

language expert with a total of 5 lecturers as validators. The media validator was carried out by Sarvar Q. Muminov and Deborah TA Obafemi. The test subjects at the practicality stage were 2 science educators at SMPN 1 Tigo Nagari and 29 students at SMPN 1 Tigo Nagari. The test subjects at the effectiveness stage were 32 students at SMPN 1 Tigo Nagari.

The types of data in this study are qualitative and quantitative. Quantitative data, namely, data taken from the results of validation of the physics module using the SETS approach carried out by the validator, practicality data from educators and students, as well as effectiveness data taken from the results of students' interest responses through the effectiveness sheet of the physics module using the SETS approach. Qualitative data was obtained from interviews with physics educators, as well as suggestions and input from 5 validators, suggestions and input from practical results, and suggestions from the results of the effectiveness of the physics module using the SETS approach that has been developed. Data analysis techniques consist of validity analysis and effectiveness analysis using a Likert scale.

3. RESULTS AND DISCUSSION

The result of this research is to produce physics modules with the SETS approach with valid, practical and effective product quality. The results of the validation of the physics module with the SETS approach in the material aspects by 2 validators obtained 81 results with very valid categories, the results of media validation by 2 validators were 98.88 with very valid categories, the results of language validation by 1 validator were 92 with very valid criteria, based on the three aspects of validity, the results of product validity are obtained, namely with very valid criteria. The results of product practicality by 2 educators were 97.14 with very practical criteria. The result of practicality by 29 class VIIIb students was 92.6 with very practical criteria. The test results for the effectiveness of use by 32 class VIIIg students were 91.24 with very effective criteria. It can be concluded that the physics module with the SETS approach to motion and force material for class VIII students meets the valid, practical, and effective criteria.

The value of each Physics module indicator using the science environment, technology, and society (SETS) approach can be determined from the average value of all statements. The three indicators of the Physics module with a science environment, technology, and society (SETS) approach include: 1) language components, 2) material feasibility, 3) media appearance, can be shown in table 1:

Table 1. The Average Value of the Physics Module Validation with the Science Environment, Technology, and Society (SETS) approach for each indicator

No.	Indicators	Average value of indicator %	Category
1	Discussion component	92	Very valid
2	Material eligibility	80.90	Very valid
3	Media display	98.88	Very valid
	% mean	90.59	Very valid

Judging from the validation results, it can be stated that the three indicators of the Physics module with the science environment, technology, and society (SETS) approach are in a very valid category. The results of the validation analysis by the validator obtained the validity value of the Physics module with the science environment, technology, and society (SETS) approach. Based on the validation results, it can be revealed that the Physics module with the science environment, technology, and society (SETS) approach is very valid.

The results of the responses of two science educators at Junior High School 1 Tigo Nagari to the Physics module using the science environment, technology, and society (SETS) approach are processed in the form of data on practical results in table 2.

Table 2. Results of Practical Science Educators at Junior High School 1 Tigo Nagari on the Physics module using the science environment, technology, and society (SETS) approach

No.	Statement	Average value of indicator %	Category
1	Learning using the physics module with the Science Environment, Technology and Society (SETS) approach can help educators overcome time constraints in learning	100	Very practical
2	Using the physics module with the Science Environment, Technology and Society (SETS) approach in learning can make it easier for educators to explain material to students	100	Very practical
3	Using the physics module with the Science Environment, Technology and Society (SETS)	100	Very practical

	approach in learning can help educators add insight into students about the relationship between Islam and science		
4	The material in the physics module with the Science Environment, Technology and Society (SETS) approach is detailed and clear.	80	Very practical
5	Examples of questions contained in the physics module with the Science Environment, Technology and Society (SETS) approach can assist educators in applying physics concepts to students	100	Very practical
6	The exercises contained in the physics module with the Science Environment, Technology and Society SETS approach can assist educators in testing students' abilities	100	Very practical
7	Discussion and answer keys for exercises can assist educators in providing feedback on student achievement	100	Very practical
% Average Total Score		97.14	Very practical

Judging from the results of practicality by 2 science educators on the Physics module with the science environment, technology, and society (SETS) approach to the material of motion and force, the average value of 7 statements was obtained. The results of the practicality analysis by practitioners obtained the practicality value of the Physics module with the science environment, technology, and society (SETS) approach of 97.14. Based on the results of these practitioners, it can be revealed that the Physics module with a science environment, technology, and society (SETS) approach is very practical.

Data on the scores of 29 class VIIIb students of Junior High School 1 Tigo Nagari for each statement in the Physics module practicality questionnaire using the science environment, technology, and society (SETS) approach can be seen in table 3.

Table 3. The Average Value of Student Practical Results for the Physics module with the science environment, technology, and society (SETS) approach

No.	Statement	Indicator average value %	Category
1	I can learn to use the physics module with the Science Environment, Technology and Society (SETS) approach at school even though there are no educators to guide it	85.51	Very practical
2	I can study at home using the physics module with the Science Environment, Technology and Society (SETS) approach	95.17	Very practical
3	Learning to use the physics module with the Science Environment, Technology and Society (SETS) approach can add to my insight about the relationship between Islam and science	95.86	Very practical
4	The material in the physics module uses a detailed and clear Science Environment, Technology and Society (SETS) approach so that it makes it easier for me to understand the material	93.79	Very practical
5	Examples of questions presented in the physics module with the Science Environment, Technology and Society (SETS) approach can help me apply physics concepts	90.34	Very practical
6	The exercises contained in the physics module using the Science Environment, Technology and Society (SETS) approach can test my thinking skills	94.48	Very practical
7	Discussion and answer keys for exercises can help in measuring my ability to understand the material	93.1	Very practical
% Mean		92.6	Very practical

Table 3 shows the average value of the practical results of 29 students with 7 statements. Judging from the practicality of the 29 students in the Physics module using the science environment, technology, and society

(SETS) approach to the material of motion and force, the average value of 7 statements was obtained. The results of the practicality analysis by students obtained the practicality value of the Physics module with the science environment, technology, and society (SETS) approach of 92.6. Based on the results of these practitioners, it can be revealed that the Physics module with a science environment, technology, and society (SETS) approach is very practical.

Data on the scores of 32 class VIIIg students of Junior High School 1 Tigo Nagari for each statement on the effectiveness questionnaire on the interest of Physics module students using the science environment, technology, and society (SETS) approach can be seen in table 4.

Table 4. The Average Value of the Effectiveness of the Physics module with the science environment, technology, and society (SETS) approach by Students

No.	Statement	Indicator average value %	Category
1	I am interested in reading physics material using the Physics Module with the Science Environment, Technology, and Society (SETS) approach	87.5	Very effective
2	I am interested in reading verses related to the physics material contained in the Physics Module with the Science Environment, Technology, and Society (SETS) approach	90.62	Very effective
3	I am interested in reading Muslim physicists contained in the Physics Module with the Science Environment, Technology and Society (SETS) approach	91.87	Very effective
4	I enjoy solving physics problems in the Physics Module using the Science Environment, Technology and Society (SETS) approach	91.87	Very effective
5	Learning physics feels more enjoyable by using the Physics Module with the Science Environment, Technology, and Society (SETS) approach	93.75	Very effective
6	I spend time for the Physics Module using the Science Environment, Technology, and Society (SETS) approach every day to make it easier to understand the material	93.12	Very effective
7	I became more active in class to answer educator questions because I often read the Physics Module using the Science Environment, Technology and Society (SETS) approach.	95.62	Very effective
8	I became more active in class to solve physics problems because I often read the Physics Module using the Science Environment, Technology and Society (SETS) approach.	95	Very effective
9	I get used to reading the Physics Module using the Science Environment, Technology, and Society (SETS) approach every day	78.12	Effective
10	I get used to discussing the physics questions contained in the Physics Module using the Science Environment, Technology, and Society (SETS) approach.	95	Very effective
% Average Total Score Sum		91.24	Very effective

Table 4 shows the average value of the results of the effectiveness of 32 students in the physics module using the science environment, technology, and society (SETS) approach to the material of motion and force, resulting in an average value of 10 statements. The results of the effectiveness analysis by students obtained the effectiveness value of the Physics module with the science environment, technology, and society (SETS) approach of 91.24. Based on the effectiveness results, it can be revealed that the Physics module with a science environment, technology, and society (SETS) approach is very effective.

The validity value of the physics module with the science environment, technology, and society (SETS) approach for class VIII students is the average result obtained from the feasibility of the content, completeness and graphics of teaching materials, and use of language. Judging from the feasibility of the content in the physics module using the science environment, technology, and society (SETS) approach for class VIII students, the validity result is (80.90) in the valid category. This shows that the material contained in the physics module with the science environment, technology, and society (SETS) approach for class VIII students is in accordance with the science environment, technology, and society (SETS) approach and pays attention to the achievement of core competencies and basic competencies and learning indicators.

Judging from the completeness and graphics of the learning media related to the general assessment of the physics module with the SETS approach for class VIII students. From the results of the assessment, it was obtained that the validity value for the completeness and graphics of the physics module with the SETS approach was 98.88 with a very valid category. This shows that the physics module with the SETS approach for class VIII students meets the requirements as a good learning module and the appearance, size of the writing and design of the physics module are good. The physics module with the SETS approach, subject to motion and force, was given to 32 class VIIIg students at SMPN 1 Tigo Nagari to test its effectiveness. From the results of the effectiveness test, it was found that the physics module with the SETS approach of motion and force material by students with an effectiveness value of 91.24 was in the very effective category.

This means that the physics module with the SETS approach to motion and force material is in demand by students so that it can increase interest in reading and the desire to study physics material. Interest is attention, liking (inclination of the heart) to something, then interest in reading is the attention or liking (inclination of the heart) in reading [47], [48]. Previous research conducted by Umar et al., produced a SETS-based physics module on global warming symptoms for class XI SMA/MA which was valid, practical and effective [49]. In line with this research, this research was conducted. The difference is that in the current research the module is intended for junior high school students with the subject matter of physics of motion and force. The implication of this research is to provide and add teacher references to improve the quality of learning through the resulting module products. The resulting product is a physics module using a science environment, technology and society (SETS) approach to the subject of motion and force. This physics module contains a flat shape method which aims to make it easier for students to understand physics material so that it can increase students' interest in reading.

4. CONCLUSION

The results of the research and discussion that have been carried out concluded that the Physics module with a science environment, technology, and society (SETS) approach to the material of motion and style for class VIII Junior High School 1 Tigo Nagari can be classified into; Very valid after fulfilling the expert assessment criteria which stated that the Physics module with a science environment, technology, and society (SETS) approach on motion and force material for class VIII Junior High School 1 Tigo Nagari obtained a score of 90.59 in the very valid category. Furthermore, it was very practical after fulfilling the practitioner's assessment that the Physics module with a science environment, technology, and society (SETS) approach on motion and style material for class VIII Junior High School 1 Tigo Nagari was categorized as very practical with the score obtained from educators being 97.14 in the very practical category. Meanwhile, the assessment of students who stated that the Physics module with a science environment, technology, and society (SETS) approach to the subject of motion and style for class VIII Junior High School 1 Tigo Nagari was categorized as very practical with a score of 92.6. Then it was very effective after fulfilling the effectiveness assessment stating that the Physics module with a science environment, technology, and society (SETS) approach on motion and force material for class VIII Junior High School 1 Tigo Nagari was categorized as very effective with a score of 91.24.

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