

Development of Science, Environmental, Technology, and Community Based on E-Module in Science Subject to Improve Learning Outcomes

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ABSTRACT

To find E-Modul for Science subject based on SETS to increase the students learning outcome at Class VII Junior High School SMPN 3 Pulau Rakyat. This type of research is oriented towards research and development (R&D) research that produces products. The steps for the development research used are the Addie development model developed by Dick and Carey. Development of E-Modules based on SETS in Science Learning to Improve Learning Outcomes of Class VII Students of SMPN 3 Pulau Rakyat which were developed valid research and entitled to be used as learning tools for science lessons in class VII. It is also in Science Learning to Improve Learning Outcomes of Class VII Students of SMPN 3 Pulau Rakyat which were developed effectively in improving student learning outcomes in class VII students. E-Modules based on SETS in Science Learning to Improve Learning Outcomes of Class VII Students of SMPN 3 Pulau Rakyat which were developed effectively in improving student learning outcomes in class VII students.

KEYWORDS

E-Modul; SETS; science subject

INTRODUCTION

The results of the questionnaire analysis related to the learning process and learning resources carried out on science teachers in SMPN 3 Pulau Rakyat show that learning materials such as textbooks available in schools are less interesting to read and do not meet the understanding of concepts for students. The results of observations of students in the school also show that students do not like to read the science books provided, because too many explanations, the language is difficult to understand, lack of images and monotonous. This is in line with the opinion of Anggi, Harahap, and Lenni (2020) who say that sometimes the book writing is still not good and its contents are difficult to understand by some students. On this basis, the ability of educators in designing and compiling a teaching material he needs and learning resources for students play an important role in determining the success of the learning process (Depdiknas, 2008).

According to Rasiman and Pramasdyahsari, A.S. (2014) Module is an independent learning package that is made in a structured manner and contains a series of planned learning experiences to help students achieve learning goals. The module function is as a learning tool that can help students to be able to learn independently in accordance with the speed of their own understanding (Sinaga, M., Situmorang, M. & Hutabarat, W, 2019). The use of teaching materials in the form of electronic modules (e-modules) can also help educators so that students are more active and independent (Rosmawati, R., Mutaqin, A. & Ihsanuddin, 2020). Research conducted by Sofan, A. & Ahmadi, L. K. (2010) provides a conclusion that the developed modules need to be given to students one week before learning takes place so that students can learn at home. This view originated from the saturation of

students in the science learning process which was conveyed conventionally and was less associated with daily life.

One of the businesses that can be done to deal with boredom in learning is to develop teaching materials in accordance with student needs and attract students (Sofan, A. & Ahmadi, L. K, 2010). This results in students not knowing the benefits of learning science in daily life with technological advances (Widiantini, N. Ny. A. S., Putra, M & Wiarta, I. W, 2017). In addition, Subkhan, E. (2020) also said that science learning in schools is still dominated by information from the instructor, giving examples and practice questions. As one of the objectives of learning science at the high school level according to BNSP in Vitrianingsih, D., Aulianingsih, I & Yuliani. (2021) is expected that students are able to understand the concepts, principles, laws, and theory of science and their relationships and their implementation to solve problems related to technology and everyday life.

In addition, the purpose of each science content in junior high school is studied in depth to investigate the scope of science material and its relationship with daily life (Zoller, 2013). One approach that is considered to be in line to realize the learning objectives of science and in accordance with daily life is SETS (Pedretti, E. & Nazir, J, 2011).

According to Suranto, J. D., Sajida & Scianto. (2018) the learning approach SETS is an approach that connects science, technology, environment and society as a whole in the matters of daily life. According to Binadja (2008) Science learning has a SETS variety emphasizing the relationship between the concept of science being discussed with the existence of technology, the environment and the community and its implications for the field. The use of the sets in the learning process is also considered important given the existence of technology that is growing rapidly. Therefore, it takes a learning that links science with the application of technology and its impact on the environment and society. So students are expected to have knowledge of science that is integrated with other fields of science (Borg and Gall, 1983).

One of the science subject matter that is useful in daily life and related to the elements of SETS is the colligative nature of the solution. Learners need to study each concept of four colligative properties through various reading sources, water phase diagrams, and other important information related to the colligative nature of the solution (Zoller, 2013). The colligative nature of the solution not only contains the concepts and theory of science, but also includes its application in everyday life. As one of the basic competencies that must be achieved by students in learning colligative nature is to be able to present the results of information search related to the application of the principle of colligative nature of the solution in daily life. Based on these competencies, students are expected to be able to imply applied the concepts of the colligative nature of the solution into the application of technology and their impact on the environment and the community so that students have broad insight. Based on the problems that have been presented, research is needed in developing learning resources in the form of sets-based e-modules in the material of colligative properties.

In addition, based on recommendations from previous research also said that further research was needed in developing teaching materials by enriching illustrations, technological developments, the impact of the environment and community life related to the material taught by being made in an interesting manner (Bencze, L., Pouliot, C., Pedretti, E., Simonneaux, L., Simonneaux, J. & Zeidler, D, 2019). E-modules developed are expected to encourage students to be more enthusiastic, easy and independent in learning, and know the interaction between science, technology, environment, and community (Mahlianurrahman, 2017).

RESEARCH METHODS

This type of research is oriented towards research and development (R&D) research that produces products. The steps for the development research used are the Addie development model developed by Dick and Carey which consists of 5 stages (1) Analyze; (2) design; (3) Development; (4) Implementation and (5) Evaluation (Sugiyono, 2010). The types of products produced are e-modules based on SETS approaches (science, environment, technology, and society). The implementation of online e-modules and project tasks is done directly. This research will be conducted at SMP Negeri 3 Rakyat Island. In research on the development of SETS-based Natural Sciences. The population in the study is all class VII students who are taught with the Merdeka Learning Curriculum. The sample to be examined was only students from one school, the number of students was sufficient to meet the number of samples needed, namely 32 students the location of the school was easily accessible to transportation and the principal allowed the implementation of this research at the school and the subject teacher of the researcher himself. Research on the Development of Addie by Dick and Carey (1978), then the procedure for the development of the interaction of living things with the environment based on SETS using WA.

RESULTS AND DISCUSSION

Analysis Stage

The results obtained at this stage are as follows:

Analysis of teaching materials and student learning outcomes

The analysis phase of needs aims to the extent to which science learning in class VII SMP Negeri 3 Pulau Rakyat is carried out. At this stage the researcher conducted an interview with a science teacher and observation in one class VII. The interview was held on March 30, 2023 with the resource person Mrs. Sri. Based on interviews obtained by speakers, information was obtained that SMP Negeri 3 Rakyat Island in the school year 2022/2023 began to use the independent curriculum. Ms. Sri revealed that it was still difficult to implement teaching and learning activities in accordance with the independent curriculum. As we know that the independent curriculum is a student center, which means that learning activities are centered on students. But in its application it is difficult. Ms. Sri revealed that there were 2 factors that caused the problems above. The first is the lack of active students in learning activities. Ms. Sri added that if students were told to look for material in the library, then they were not reading textbooks but other books. So that learning seems one - way and less than optimal.

The second factor is the teaching material used. Ms. Sri explained that the module used was published by outside publishers. The contents of the module are too long and not coherent, so students are confused using the module. To expedite learning activities, Ms. Sri summarizes the material to be taught so that students can receive more concise material. But this is still effective. Because based on the previous daily test many students get grades under the KKM. The KKM on Natural Sciences is 75. On the sidelines of the interview, the researcher gave an idea about the development of learning e-modules, Mrs. Sri, was very supportive with the innovation, because as stated before the module used at this time was still found various weaknesses. Ms. Sri also gave an idea that the module developed later was detailed, dense, and coherent so that students were not confused using it. For classes that can be used by researchers at the implementation stage, Ms. Sri suggested using the class that the researcher needs. Based on this, researchers chose class VII.

The selection is based on the characteristics of students in class VII has a heterogeneous ability and there are some students who are superior and active in learning science. Based

on what was found in the field, it is necessary to develop teaching materials in the form of science-based e-modules, the environment, technology, and community in science learning that can facilitate students to be more active in mastering concepts. Based on this, researchers develop science-based e-modules, environment, technology, and community in learning science in the material interaction of living things with their environment.

Analysis of learning achievements and indicators of living materials with living things with their environment

Analysis conducted related to the learning required by students. The learning material chosen to be developed in this learning media is material in learning: interaction of living things with their environment. The results of instructional analysis in the development of this learning media are as follows.

Table 1. Basic Competencies and Indicators of Living Creatures with their environment

Basic Competencies	Indicator
3.7. Analyzing the interaction between living things and their environment and population dynamics due to these interactions	3.7.1 Finding a form of interaction between components making up the ecosystem. 3.7.2 Formulate ecosystem problems related to the interaction of living things with their environment.
4.7 Present observations of the interaction of living things with the surrounding environment.	3.7.3 Analyzing the impact of the interaction of living things with their environment. 3.7.4 Categorize and give arguments for how to overcome and prevent impacts that occur on the environment.

Based on indicators of the competency achievement that has been determined, then it is reduced to the learning objective. The learning objectives formulated are as follows: (1) Through learning activities using e-modules, students are able to explain the concept of the environment and its components correctly, (2) through learning activities using e-modules, students are able to make environmental observations and Identify biotic and abiotic components carefully, (3) through independent observation activities, students are able to analyze the understanding and patterns of interaction appropriately, (4) Through group discussions in learning using e-modules, students are able Live appropriately, (5) Through learning activities using e-modules, students are able to mention the difference between food chains and food networks, the eating chain and tritus with the right grass food chain, (6) through learning activities using e-modules , students are able to observe the environment and identify biotic and abiotic components, patterns of interaction, and interdependence of living things correctly, and (7) through project tasks in e-modules, students are able to present the results of project tasks in the form of miniature ecosystems with Correct.

Design stage (planning)

The second stage of the Addie development model is the design or design stage. At this stage the researcher began to design a learning module to be developed. There are 4 steps in this design stage, including the preparation of the module framework, collection and selection of references, preparation of module design and features, and preparation of learning module assessment instruments.

Following are the results of the design of the learning module with the problem based learning environment:

Preparation of Learning E-Module Frameworks

The preparation of the e-module frame is based on the Class VII Natural Sciences Syllabus. In the module the module will be developed consists of three main parts, namely the beginning, content and end. The initial section contains cover, preface, core competencies and basic competencies, concept maps, and table of contents. The content part contains learning e-modules. The final section contains evaluation questions and bibliography. The following is the e-module framework compiled:

1. Cover
2. Preface
3. Table of contents
4. Competency map
5. Concept Map
6. Learning Activities 1: Environment
7. Learning Activities 2: Things found in an environment
8. Learning Activities 3: Interaction in the system forms a pattern
9. Module Final Test
10. References

Reference and Selection

The following references the researcher selects and uses as a reference in the development of learning e-modules:

- Samiasih , R., Sulton & Praherdhiono, H. (2017). Pengembangan e-module mata pembelajaran ilmu pengetahuan alam pokok bahasan interaksi makhluk hidup dengan lingkungannya. *Edcomtech*, 2(2), 1199-124.
- Rasiman dan Pramasdyahsari, A.S. (2014). Development of Mathematics Learning Media E-Comic Based on Flip Book Maker to Increase the Critical Thinking Skill and Character of Junior High School Students. *International Journal of Education and Research*, 2 (11), 25 -32.
- Retno, R. S. & Marlina D. (2018). Implementasi SETS (Science Environment Technology and Society) pada Pembelajaran IPA SD Berbasis Inquiry terhadap Berpikir Ilmiah Siswa Kelas 4 MI Al- Irsyad Madiun. *Bio-Pedagogi: Jurnal Pembelajaran Biologi*, 7(2), 54-58

Preparation of Design E-Module Designs and Features

Preparation of designs and features of learning e-modules includes the beginning, content, and end. Here is the design of the initial design of the learning module:

1. E-module cover

Attractive cover design is expected to attract interest and cause students' enthusiasm to learn the material presented and learning modules. Here is the cover of the learning module cover

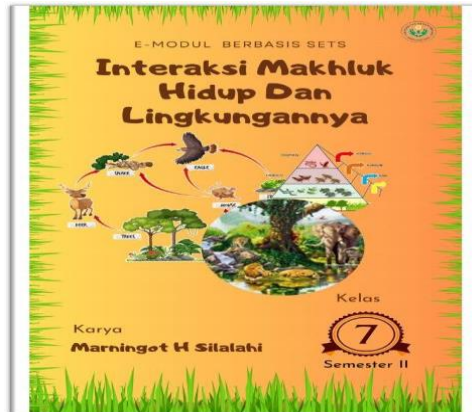


Figure 1. Cover of E-Module Learning

2. Introduction

The word of introduction contains gratitude to God Almighty who has bestowed his gifts and guidance so that the writer can complete the writing of this learning module in a timely manner. The next greeting is given to all parties who help.



Figure 2. Introduction of E-Module Learning

3. Table of contents

Table of contents containing a list of parts of the learning e-module along with the page. Giving a list of contents is expected to help users to find the desired learning e-module parts based on names and pages. The following is a list of contents of learning e-modules developed:

DAFTAR ISI	
Kata Pengantar	30
Daftar Isi	34
Daftar Gambar	34
Daftar Tabel	34
Pendahuluan	
A. Deskripsi Singkat	35
B. Kompetensi Inti & Kompetensi Dasar	35
C. Arahon dan Tujuan	35
D. Penilaian dan Cara Ujian	35
Materi Pokok Pembelajaran	
A. Indikator Pembelajaran	36
B. Analisis Pembelajaran	37
C. Tujuan	37
D. Rangkuman	37
E. Tes Formatif	37
Referensi	
A. Indikator Pembelajaran	38
B. Analisis Pembelajaran	38
C. Tujuan	38
D. Rangkuman	38
E. Tes Formatif	38
Tutup	
A. Indikator Pembelajaran	40
B. Analisis Pembelajaran	40
C. Tujuan	40
D. Rangkuman	40
E. Tes Formatif	40
Lampiran	
Daftar Pustaka	41

Figure 3. Table of Content of E-Module Learning

4. E-module

The learning module developed there are 3 learning materials, namely, Learning Activities 1: Environment, Learning Activities 2: Things found in an environment, and learning activities 3: Interaction in the system forms a pattern. Here is the module contents display.

Preparation of Learning E-Module Assessment Instruments

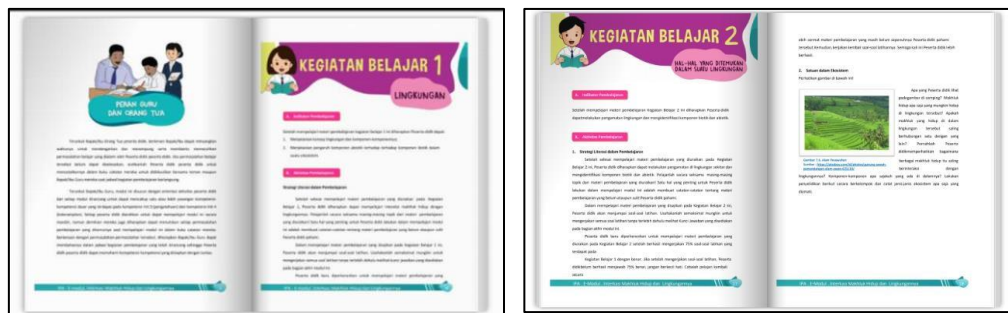


Figure 4. E-Module Learning

Preparation of learning e-module assessment instruments in the form of learning e-module assessments, student response questionnaires, observation sheets of learning implementation, and test questions. Following are the explanation of each Learning Module Assessment Instrument:

1. The preparation of the learning module assessment sheet is made into 3 types.
The three types are distinguished depending on the excitement of the validator. The first validator is a lecturer of material expert, the second validator is a learning design lecturer, and the third validator is a learning media expert
2. Arranging student response questionnaire
The student response questionnaire is arranged based on the feasibility of content, language, and graphics. There is one kind of statement used in the student response questionnaire, namely a statement that is positive
3. Compile test questions
The preparation of test questions is used to determine the effectiveness of learning e-modules can improve student learning outcomes

Development Stage (Development)

The third stage of the ADDIE development model is the development or development stage. This stage aims to see the extent of the feasibility of learning e-modules that have been designed. After getting a feasibility assessment, the learning emotion is revised in accordance with validator criticism and suggestions. Validator consists of 3 lecturers namely material expert lecturers, learning design experts, and the third validator is linguists/learning media as well as assessment by Sciences Subject teacher.

Validation by material experts

Validation of material experts to the development of science, environmental, technology and community-based e-modules in science learning to improve the learning outcomes of junior high school students in class VII SMP Negeri 3 Pulau Rakyat is carried out by Dr. Ashar Hasairin M, SI, is a lecturer at the Medan State University Postgraduate School. The assessment is carried out to get information that will be used to improve the learning

outcomes of junior high school students in class VII SMP Negeri 3 Rakyat Pulau People's Interaction Material living things with their environment in class VII. The results of the validation in the form of an assessment score of the components of the quality of learning material contained in the development product can be seen in table 2

Table 2. Percentage of Assessment Scores by Science, Environmental, Technology and Community E-Module Material Experts

No	Indicator	Average	Percentage
1	Feasibility of content/ material	4	80
2	Aspects of material presentation	5	100
3	Language feasibility	5	100
Total		4,6	93,3

The whole states that the percentage of the average value regarding the contents of the learning material of the indicator is 90% where the range of values is at a score of $80 \leq x \leq 100\%$, the tendency of the assessment of the material is said to be the "very good" category.

Validation by media/language experts

Validation of Media/Language Experts to the Development of Science, Environmental, Technology and Community-Based E-Module in Science Learning to Improve Learning Outcomes Teachers at Medan State University Postgraduate School. The assessment is carried out to get information that will be used to improve the learning outcomes of junior high school students in class VII SMP Negeri 3 Rakyat Pulau People's Interaction Material living things with their environment in class VII. Validation results in the form of an assessment score of the quality components of the media/learning language contained in the development product can be seen in table 3.

Table 3. Percentage of Assessment Scores by Science, Environmental, Technology and Community E-Module Media/Language Expert

No	Indicator	Average	Percentage
1	Linguistic aspects	5	100
2	Graphic aspects	5	100
Total		5	100

From Table 3 above it can be concluded that the results of the linguists' assessment as a whole stated that the percentage of the average value of the contents of the learning material from the indicator is 100% where the range of values is at a score of $80 \leq x \leq 100\%$, the tendency of the assessment of the material is said "Very Good" category.

Validation by Design Experts

The validation of the Ahlidesai to the development of science, environmental, technology and community-based e-modules in science learning to improve the learning outcomes of students of SMP VII Class VII SMP Negeri 3 Pulau Rakyat is carried out by Dr. Zulkifli, MSi, is a lecturer at the Medan State University Postgraduate School. The assessment is carried out to get information that will be used to improve the learning outcomes of junior high school students in class VII SMP Negeri 3 Rakyat Pulau People's Interaction Material living things with their environment in class VII. The results of the validation in the form of an assessment score of the components of the quality of learning design contained in the development product can be seen in table 4.

Table 4. Percentage of Assessment Scores by Science, Environmental, Technology and Society E-Module Design Experts

No	Indicator	Average	Percentage
1	Physical size of the module	5	100
2	Module Cover Design (Module Cover Typography)	5	100
3	Module contents design (Module Contents Typography)	4	80
Total		4,7	93,3

From Table 4 above it can be concluded that the results of the overall design expert assessment state that the percentage of the average value of the contents of the learning material from the indicator is 93.3% where the range of values is at a score of $80 \leq x \leq 100\%$ then the tendency of the assessment of the material is said "Very Good" Category.

Assessment by the IPA lesson teacher

Assessment of the development of science, environmental, technology and community-based e-modules in science learning to improve the learning outcomes of SMP VII students of SMP Negeri 3 Pulau Rakyat is carried out by Mr. Armansyah, S.Pd, is a teacher of science lessons and at the same time the school principal. The assessment is carried out to get information that will be used to improve the learning outcomes of junior high school students in class VII SMP Negeri 3 Rakyat Pulau People's Interaction Material living things with their environment in class VII. The results of the validation in the form of an assessment score of the quality components of the learning e-module contained in the development product can be seen in table 5.

Table 5. Percentage of Assessment Scores by Natural Science Teachers on Science, Environmental, Technology and Society-based E-Modules

No	Indicator	Average	Percentage
1	Content feasibility aspect	4	80
2	Material presentation aspect	5	100
3	Linguistic aspects	5	100
4	Graphic aspects	5	100
5	Material aspects	5	100
6	Learning aspects	5	100
7	Linguistic aspects	4	80
Total		4,7	94,0

From Table 5 above, it can be concluded that the results of the assessment by the science teacher as a whole stated that the percentage of the average value of the learning material of the indicator is 94.0% where the range of values is at a score of $80 \leq x \leq 100\%$ then the tendency of the assessment of the material expert It is said to be the "very good" category.

Implementation Results (Application)

The fourth stage of the Addie development model is the implementation stage. After being declared feasible by the validator, the learning module is applied in class. The implementation of this stage was attended by 32 students and held 3 meetings in class for 6 hours of study (6 x 45 minutes). The following is the implementation of the implementation stage in table 6.

Table 6. Implementation of the implementation stage

No	Activities	Time
1	Learning Activities 1: Environment	2 x 45 minute
2	Learning Activities 2: Things found in an environment	2 x 45 minute
3	Learning Activities 3: Interaction in the system forms a pattern	2 x 45 minute

This implementation activity sees the student's Respond and student learning outcomes by looking at the results of student questionnaire scores for the eligibility and comparing student pretest and posttest values for the effectiveness of e-modules.

Table 7. Student Questionnaire

No	Statements	Average	Percentage	Category
1	E-module based on SETS in learning Natural Sciences	4	80 %	Good
2	The material is presented in detail and coherent	4	80 %	Good
3	E-module based on SETS in this science learning I am eager to learn science	4	80 %	Good
4	I easily understand the questions contained in E-module based on SETS	5	100 %	Very Good
5	By using E-module based on SETS I can discuss well with group friends	5	100 %	Very Good
6	The term used in E-module based on SETS is easy to understand	5	100 %	Very Good
7	The steps given E-module based on SETS help m think in a coherent manner to solve a problem	4	80 %	Good
8	Learning activities on E-module based on SETS make me motivated to improve my learning outcomes.	5	100 %	Very Good
9	Learning activities on E-module based on SETS give me the opportunity to solve the problem using my own way.	4	80 %	Good
10	Learning activities on E-module based on SETS encourage me to make conclusions in a coherent	5	100 %	Very Good
Total (Average)		4,5	90 %	Very Good

While the results of student learning scores from the pretest and post test scores of the student can be detailed in table 8.

Table 8. The value of student learning outcomes at the implementation stage

No	Assessment	Total of Student Score	Average of Student Score
1	Pre test	2435	76,09
2	Post test	2685	83,90

From the calculation results obtained the N-Gain value is 0.32. Where $0.7 \leq n\text{-gain}$, the effectiveness of the emodule is very high, so it can be concluded that $0.7 \leq 0.32$ so that it is categorized as high.

The Level of Validity of The Development of E-Modules Based on SETS In Science Subject to Improve the Learning Outcomes of Class VII students of SMPN 3 Pulau Rakyat

Analysis Data The results of the Validation of the Learning Module are based on the average results of the validation results of 2 Expert Lecturers and 1 Mathematics Teacher. The following is an overall assessment of every aspect assessed by all validators:

Table 9. Analysis Data The results of the Validation of the Learning Module

No	Validator	Score Percentage
1	Material expert	93,3 %
2	Linguist	100 %
3	Desai expert	93,3 %
4	Natural Science T Teacher	9,4 %
Average		95,15 %

Based on the data above, it can be seen that the overall average is 95.15 % with very good criteria. Thus the learning module is declared valid and does not need to be revised. Based on the results of these validations, it can be concluded that the set of settings in science learning to improve the learning outcomes of class VII students of SMPN 3 Pulau Rakyat is Valid and does not require to infinite reshuffle and is suitable for use as a teaching material for science in schools.

Level of Development of Sets-Based E-Module in Science Learning to Improve Learning Outcomes of Class VII Students of SMPN 3 Pulau Rakyat

Feasibility analysis by providing response questionnaires during the evaluation stage. Based on Table 4.7 the practical value with an average (\bar{x}) = 4.5 with the criteria is very good and can be declared feasible. Based on this, it can be said that the set of SETS e-modules in Natural Sciences learning to improve the learning outcomes of class VII students of SMPN 3 Pulau Rakyat is suitable for use as one of the science teaching materials.

The Level of Effectiveness of the Development of Sets-Based E-Modules in Science Learning to Improve the Learning Outcomes of Class VII Students of SMPN 3 Pulau Rakyat

The effectiveness of the SETS-based e-module that is developed can be seen from the percentage of student learning completeness. Student learning completeness comes from the post-test value carried out by researchers at the evaluation stage. Based on Table 4.8 the percentage of student learning completeness is 83.90%. Therefore. This shows that learning by using a learning module with sets-based e-modules in science learning has fulfilled aspects of effectiveness. Based on the analysis there are post-test results it can be concluded that learning using a learning module with sets-based e-modules in science learning is effectively used as one of the science teaching materials.

Based on the third results of the analysis above, it can be concluded that the learning module with sets-based e-modules in science learning is suitable for use as a teaching material that has a valid, feasible and effective qualities.

CONCLUSION

Based on the results and discussion of the research can be concluded as follows:



1. Development of SETS-Based E-Modules in Science Learning to Improve Learning Outcomes of Class VII Students of SMPN 3 Pulau Rakyat which were developed valid research and entitled to be used as learning tools for science lessons in class VII. This is because set-based e-modules can improve student science learning outcomes to learn independently in understanding the material interaction of living things with their environment.
2. Development of SETS-Based E-Modules in Science Learning to Improve Learning Outcomes of Class VII Students of SMPN 3 Pulau Rakyat which are developed feasible in improving student science learning outcomes in class VII students. This can be seen from the results of the response of students with a very good sets based e-module.
3. Development of SETS-Based E-Modules in Science Learning to Improve Learning Outcomes of Class VII Students of SMPN 3 Pulau Rakyat which were developed effectively in improving student learning outcomes in class VII students. This can be seen from the learning outcomes of student learning by comparing the pre-test and post-test values of students using N-Gain with high categories so that SETS-based e-modules can be declared Effectively Improve Student Learning Outcomes in Living Creatures Interaction Material with their environment

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