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Feasibility Analysis of Learning Devices with the Science Environment Technology Society (SETS) Model Based on Science Literacy on the Subject of Ecosystems

Tia Hidayah Sani[1]✉, Nugrahaningsih WH[1]

[1]Biology Department, Faculty of Mathematics and Natural Sciences, Universitas Negeri Semarang, Indonesia

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Abstract

The purpose of this study is to describe feasibility of learning device with the SETS model based on science literacy on the subject of ecosystem. This study use the R&D method which adopts the modified ADDIE model consisting of analysis, design and development. At the analysis stage, a needs analysis and curriculum analysis are carried out to determine learning needs, what will be taught and the competencies that students must be mastered. At the design stage, researchers designed learning device to be developed based on the results of previous analyzes in the form of RPP, teaching materials and assessment instruments as well as collecting references. The last stage, the development stage is the stage of creating the product design into a product that is ready to be implemented, at this stage a product validation instrument used to validate learning device is also arranged. The data collection technique was carried out by collecting data on the results of RPP, teaching materials and assessment instruments validation by four experts which was carried out at the development stage. The results showed that the score given by the validator to the RPP was 3.45 on the "valid" category, the score given to the teaching materials was 3.52 on the very "valid" category and the score given to the assessment instrument was 3.45 on the "valid" category. Based on the research results, it can be concluded that the learning device developed are suitable for use.

✉Correspondence Address:
D6 Building 1st Floor Jl. Raya Sekaran Gunungpati Semarang
E-mail: tiahidayahsani@gmail.com

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INTRODUCTION

Science education has an important role in preparing students to enter the world of their life. Science education is a tool for increasing knowledge, skills, attitudes, values and is a forum for building citizens who pay attention to the environment and responsible to society, nation and state as well as believing and fearing God Almighty. Learning science is related to how to systematically find out and understand nature, so that science is not only the mastery of a collection of knowledge in the form of facts, concepts, and principles but also a process of discovery. Science education is expected to be a tool for students to learn about themselves and their surroundings (Gusfarenie, 2013). Therefore, students need a learning method that can prepare students to have good competence and be literate in science and technology, able to think logically, critically, creatively, argue correctly, communicate and collaborate. Literate in science and technology can be termed scientific literacy ability (Yuliati, 2017).

The ability of scientific literacy is defined as a person's ability to identify scientific facts from a variety of information, recognize and analyze the use of scientific investigation methods and the ability to organize, analyze, and interpret quantitative data and scientific information (Gormally *et al.*, 2012). Science literacy is a form of assessment that is real, meaningful for students, is able to develop high-level thinking skills and contains scientific dimensions, namely concepts, processes, contexts and provides an understanding of science concepts and methods, the impact of technology and science on the environment (Astuti *et al.*, 2012). The importance of scientific literacy is related to how students are able to appreciate nature by using the science and technology they have mastered (Nisa'*et al.*, 2015).

Based on the interviews results with biology teachers at SMA N 12 Semarang regarding the condition of students, it was found that students did not care about the surrounding environment, this could be seen from the condition of the class which was often dirty due to garbage that was not thrown in its place. Students are also less concerned with their social environment, due to the implementation of full day school where students spend most of their time at school, namely for five days and giving assignments at school makes students focus more on assignments than socializing with their surroundings. Students have not been able to use the knowledge obtained at school to be applied in everyday life and are more focused on completing tasks given at school. This is in line with the results of a survey on the scientific literacy skills of students in Indonesia, which showed that the scores were still far below the international standard scores set by the OECD institution in the last few surveys.

Students need learning process that not only learn about concepts, but learning that can prepare students to have good competence and be literate in science and technology, able to think logically, critically, creatively, argue correctly, communicate and collaborate. So that students can use the knowledge of science and technology they master for the benefit of development without putting aside the environment later. Seeing these conditions, it is necessary to have an alternative learning model that is suitable and integrated with scientific literacy so that students are able to use the knowledge of science and technology they master for development purposes without setting aside the environment later. Improvements and enhancement the quality of the learning process and learning outcomes require harmonization of the learning process that is supported by the device by developing learning tools (Jaya & Sadia, 2014).

Research by (Ristina *et al.*, 2019) on the effectiveness of SETS learning to improve students 'scientific literacy, it was concluded that SETS learning was effective in improving students' scientific literacy in each category. Other research related to the implementation of SETS on student scientific literacy conducted by (Retno & Marlina, 2018) obtained the same results, namely that SETS learning can improve students' scientific literacy. Based on these two studies, the development of learning device in this study will use the SETS model which is integrated with scientific literacy.

The SETS (Science, Environment, Technology, and Society) learning model is an implication for technology and the integration of the scientific concepts studied and their application to society (Binadja, 2008). The Science, Environment, Technology, and Society (SETS) model focuses on the use of science and technology that affect society and the environment in science learning. This model can be used to improve

students' ability to use their scientific knowledge to understand the relationship between what they learn in class and what happens in their daily life and it also makes science learning meaningful (Pedretti and Nazir, 2011).

Based on the background of the study, this research will describe about the feasibility analysis of learning device with the SETS (Science, Environment, Technology, and Society) based on scientific literacy on the subject of ecosystems.

RESEARCH METHOD

This type of research is R&D (Research and Development). The learning device development model with the SETS (Science, Environment, Technology, and Society) model based on scientific literacy used is the modified ADDIE model where research is carried out up to the development stage, because this research was conducted during the Covid-19 pandemic, where learning in schools switched from offline to online systems, making it impossible to carry out the implementation and evaluation stages. The learning device developed were RPP, teaching materials and assessment instruments. At the analysis stage, a needs analysis and curriculum analysis are carried out to determine learning needs, what will be taught and the competencies that students must be mastered. At the design stage, researchers designed learning device to be developed based on the results of previous analyzes in the form of RPP, teaching materials and assessment instruments as well as collecting references. The last stage, the development stage is the stage of creating the product design into a product that is ready to be implemented, at this stage a product validation instrument used to validate learning device is also arranged. The data collection technique was carried out by collecting data on the results of RPP, teaching materials and assessment instruments validation by four experts which was carried out at the development stage. Validation was carried out by four validators who were high school teachers in the Semarang city. Data from expert validation were analyzed using a formula adopted from (Trianto, 2015). The learning device is said to be feasible when the average validation value from the experts is $1.5 \leq V < 2.5$.

RESULTS AND DISCUSSION

The purpose of this study was to describe the feasibility of learning device with the scientific literacy-based SETS model on the subject of ecosystems. Learning device are developed with the modified ADDIE model consisting of analysis, design, and development. The learning device is said to be feasible if the results of the validator's assessment of all learning devices show that the overall value of the minimum aspects is in the fairly valid category, with an average value of validity ranging from $1.5 \leq V < 2.5$.

Learning Device Development

The development of learning device with the scientific literacy-based SETS model was developed with the ADDIE model which consists of five steps, namely: analysis, design, development, implementation, and evaluation (Gafur, 2012). In this study, the ADDIE model used was the modified ADDIE model where the research was carried out until the development stage, this is because this research was conducted during the Covid-19 pandemic, where learning in schools had just switched from offline to online systems, making it impossible to carry out the implementation and evaluation stages. The generated product in this study were learning device in the form of a Learning Implementation Plan (RPP), teaching materials and scientific literacy assessment instruments for class X high school students.

At the analysis stage, the researcher conducted a needs analysis and curriculum analysis. A needs analysis includes an analysis of learning needs, what will be studied, and what competencies are students expected to master after learning. Curriculum analysis is carried out by identifying Core Competencies and Basic Competencies in the ecosystem material to determine the indicators of learning objectives that are used as the basis for developing the learning tools to be compiled. The next stage is the design stage. At this stage, the preparation of the lesson plan material design, compiling the design of teaching materials, drafting

instruments and making references. At the development stage, researchers develop lesson plans, teaching materials, and instruments in accordance with the designs that have been compiled at the design stage, and compile reports that validate the products. Then the learning device was consulted with the supervisor then validated the learning device. Validation was carried out by four expert validators who were high school teachers in the Semarang city. At this stage, data on the feasibility of learning devices that have been developed are obtained. Finally, the researcher made the final revision of the learning device based on the input obtained from the validation sheet.

The Level of Validity of Learning Devices

The learning device that has been designed by the researcher is then assessed by the validator. The validator consists of four teachers who teach in high schools in the city of Semarang.

The learning implementation plan (RPP) developed by researchers in this study has met the valid criteria. This is based on the data analysis of the validity of the RPP to achieve a total average score of 3.45 which is in the "valid" category ($2.5 \leq V < 3.5$) can be seen in table 1 the average score for each aspect is "valid"-very "valid" category with a range score 3.31-3.58.

Table 1 Experts Validation data of RPP

Assessment Aspects	Validator 1 Average	Validator 2 Average	Validator 3 Average	Validator 4 Average	Overall Average	Category
Construction Feasibility	3.29	3.53	2.88	3.53	3.31	Valid
Feasibility Presentation	3.33	4	2.83	3.67	3.46	Valid
Language Eligibility	3.33	4	3	4	3.58	Very Valid
Average	**3.32**	**3.84**	**2.90**	**3.73**	**3.45**	**Valid**

RPP compiled in each meeting include preliminary, core activity and closing activities. In the core activity, a learning scenario is designed which contains the steps of the SETS learning model that refers to (Lau, 2013), namely motivation, exploration, brainstorming, and decision making. Each syntax is integrated with scientific literacy indicators developed by (Gormally *et al*., 2012) which consists of: 1) identifying scientific arguments; 2) evaluate the validity of sources; 3) evaluation the use and misuse of scientific information; 4) reading and interpreting data; 5) solve problems using quantitative skills, including basic statistics; 6) justify inferences, predictions, and conclusions based on quantitative data.

Based on table 1, it can be seen that the RPP with the SETS model based on scientific literacy on the subject of ecosystems is worthy of being the final product to be used in the learning process. The RPP generated have met the validity criteria, but still need to be improved based on expert input. Expert validation of the lesson plan also produces qualitative data, in the form of comments, suggestions, and input from expert validation. Some notes and suggestions for improvement by experts on the lesson plans developed, namely: RPP is adapted to the conditions of students; core competencies/ basic competencies should use Permendikbud No. 37 of 2018; concentration of important concepts discussed; use general themes for examples of problems discussed so that the material can be understood by students with various backgrounds; the formulation of learning indicators is adjusted to the competencies to be achieved; the formulation of the learning objectives of the sentence is formulated by referring to the audience, behavior, condition, and degree; and correct typos.

Assessment of teaching materials can be seen in table 2, based on table 2 of the teaching materials developed by researchers in this study have met very "valid" criteria. This is based on the data analysis of the

validity of the RPP to achieve a total average score of 3.52 which is in the very "valid" category (3.5≤ V <4).

Table 2 Experts Validation Data of Teaching Materials

Assessment Aspects	Validator 1 Average	Validator 2 Average	Validator 3 Average	Validator 4 Average	Overall Average	Category
Construction Feasibility	3.33	3.83	2.83	3.83	3.46	Valid
Feasibility Presentation	3.56	4	3	4	3.64	Very Valid
Language Eligibility	3.4	3.8	3	3.4	3.4	Valid
Component of Cohesion	4	4	2.25	4	3.56	Very Valid
Average	**3.57**	**3.91**	**2.77**	**3.81**	**3.52**	**Very Valid**

Based on table 2, it is known that the average score for each aspect is "valid"-very "valid" category with a score range of 3.4-3.64. This shows that the teaching materials that have been developed are suitable for use and implemented in the classroom because they have fulfilled the existing components. Expert validation of teaching materials also produces qualitative data, in the form of comments, suggestions, and input from expert validation. Some notes and suggestions for expert improvements to teaching materials, namely: image composition with text on some pages, the image size should be enlarged; some pages seems to prioritize text but lack of image support; complete and good; the cover should be printed on glossy paper to make it more attractive; between the concept of material ecosystem components with discourse on activity 1 (the dilemma of oil palm, a source of foreign exchange or an environmental destroyer) does not support understanding the concept of ecosystem components, please look for appropriate supporting materials language needs to be adapted to the level of students understanding, can use deductive or inductive thought lines.

The assessment instrument is designed to measure students' scientific literacy skills by referring to the indicators developed by (Gormally *et al*., 2012) which consist of: 1) identifying scientific arguments; 2) evaluate the validity of sources; 3) evaluation the use and misuse of scientific information; 4) understand the elements of the research design and how they impact the findings / conclusions; 5) create graphical representations of data; 6) reading and interpreting data; 7) solving problems using quantitative skills, including basic statistics; 8) understand and interpret basic statistics; 9) justify inferences, predictions, and conclusions based on quantitative data.

The analysis of the questions carried out in this study is a qualitative analysis (review of items). Qualitative analysis is carried out before the items are tested and analyzed empirically. The aspects that are considered in a qualitative study are the aspects of material, construction, and language / culture which are analyzed based on predetermined rules (Kartowagiran, 2012). Validation of the assessment instrument by experts is done using the instrument validation sheet. The assessment aspect of the assessment instrument includes an assessment of the material domain, construction aspect and language aspect. Expert validation data on the assessment instrument are presented in Table 3.

Table 3 Experts Validation Data of Assessment Instrument

Assessment Aspect	Validator 1 Average	Validator 2 Average	Validator 3 Average	Validator 4 Average	Overall Average	Category
Material Domain	3.6	3.8	3.2	3.6	3.55	Very Valid
Construction	3.09	3.55	2.82	3.36	3.2	Valid

Aspect Language						
Aspect	3.8	3.8	3	3.8	3.6	Very Valid
Average	**3.50**	**3.72**	**3.01**	**3.59**	**3.45**	**Valid**

Based on table 3, it can be seen that the assessment instrument developed by the researcher in this study has met the valid criteria. This is based on the data analysis of the validity of the validity instrument reaching a total average score of 3.45 which is in the "valid" category ($2.5 \leq V < 3.5$) and the average score for each aspect is in the "valid"-very "valid" category with a range a score of 3.2-3.6. Expert validation of the assessment instrument also produces qualitative data, in the form of comments, suggestions, and input from expert validation. Some notes and suggestions for improvement from the developed teaching materials, namely: keeping in mind the rules of writing the questions, namely the short length of the answer choices / homogeneous; there are unclear / multiple interpretation questions; discourse must be displayed on every question that requires discourse, not only displayed once; questions that have a choice of numbers, sorted from smallest to largest; questions should use examples of organisms that exist in Indonesia; be careful with printed pictures / graphics, pay attention to legibility.

The results of data analysis on the validity aspect show that in general the quality of the learning device developed is good. Some of the drafts still do not meet the standards and are revised through notes / comments and suggestions and input from the validator, both written on the assessment sheet and written directly on the draft of learning tools. The revision process aims to produce higher quality learning tools that are suitable for use.

CONCLUSION

Based on the results and discussion, it was concluded that the learning device of the SETS model based on scientific literacy on the subject of the ecosystem developed, RPP with an average value of 3.39 were in the "valid" category, teaching materials with an average value of 3.52 were in the very "valid" category and the assessment instrument with an average value of 3.45 were in the "valid" category. So that the resulting learning devices can be used or utilized in learning activities in class, both by teachers and students.

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