



The Development of an Environment Problem Based Module on Environmental Change Material for High School Students

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Abstract

This research aims to analyze the validity, the readability, and the effectiveness of the *environment problem based module* on environmental change subject for high school students. This research was conducted at SMA Negeri 3 Brebes on the second semester in the Academic Year of 2019/2020. The design of this research is *Research and Development (R&D)*. The population of this research is the class of X MIPA 5 SMA Negeri 3 Brebes. The sample of this study is 10 students of X MIPA 5 class that was chosen by using *purposive sampling* technique. The result of this study showed that the average of the validity value of the *environment problem based module* by subject and media experts is 90,71 with the criteria is very valid. The readability value by the teacher is 96,25 and by the students is 87,25 with the criteria is very good. The accumulated effectiveness test score of 83.5 is included in the very effective category. The effectiveness test of cognitive aspects showed that 90% of the students have a score above 70, the result of the psychomotor aspects showed that 7 students have a very good problem solving skills and 3 students have a good problem solving skills, and the result of the affective aspects showed that 70% of the students have a very high environmental care attitude and 30% of the students have a high environmental care attitude. The conclusion of this study is the *environment problem based module* is feasible and effectively used to help the students learn independently and as a source of additional learning for students.

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INTRODUCTION

The right learning model accompanied by adequate and effective learning resources will make it easier for students to understand a material. Learning resources can be found anywhere, such as, from phenomena that occur in our environment, events, people, data, and so on. A phenomenon can be processed to become a contextual teaching material, so that students' analytical skills can be developed. This learning resource can be used to achieve the learning objectives expected by teachers and students. The results of the observations showed that the learning resources used by the students at SMA Negeri 3 Brebes when they are at home are limited to notebooks and worksheets, while printed books are borrowed by the students from the school library and then returned if the biology learning has been done. This worksheet also does not contain data on environmental changes, especially those in the environment around students. Apart from that, due to a limited time, the material for environmental change which is the last material in the second semester is passed and the students are asked to learn the material independently while the learning resources for students is still limited. The students tend to learn independently using worksheets because they are easy to memorize. This is not in accordance with the objectives of the basic competency of environmental change because the students are required to reach the level of analysis.

The use of environmental problems related to appropriate material can encourage the students to find out more, think critically, and understand the material. A learning model that can take the advantage of the environmental problems is *Problem Based Learning* (PBL). PBL is a learning model that requires students' mental activity to understand a learning concept through the situations and problems presented at the beginning of the lesson with the aim of training students to solve the problems using a problem-solving approach (Kono *et al.*, 2016). PBL aims to train the students to use a knowledge and critical thinking in explaining an incident or problem (Adiga & Adiga, 2015; Zhang *et al.*, 2015; Mansor *et al.*, 2015) and increase the enthusiasm of learning (Masek, 2015).

One of the presentations of the environmental problems as a learning resource can be packaged in module form. According to (Hoffman *et al.*, 2016) a module specially prepared to discuss a certain material can be an alternative learning source besides the textbooks, the student worksheets, and the teacher explanations. Module is an independent learning package coring a series of learning experiences that are planned and designed systematically to help the students achieve their learning goals (Zulfadli, 2017). The existence of a module in Biology learning can support and help the students in the learning process (Rufii, 2015; Cruz, 2015). The advantages of the module are the students can learn without having face to face learning with the teacher, the students can learn according to their time and speed of learning, the students can find out the weaknesses and strengths in achieving the competencies in the module (Susilawati *et al.*, 2016).

The PBL learning model is one of the learning models that leads to critical thinking skills and encourages the students to solve problems in their environment (Noviar & Hastuti, 2015). Research (Atikasari *et al.*, 2012) showed that the application of PBL has a positive effect on students' analytical skills because the application of PBL can create a sense of student curiosity so that the students are motivated to solve the problems and can encourage the students to think optimally, especially thinking analysis. According to (Afza, 2016) there are five steps in the PBL model, namely student orientation to problems, organizing students to learn, discussing individual and group investigations, developing and presenting work, analyzing and evaluating the problem solving process.

The material for environmental change is contained in the 2013 curriculum at KD 3.11, namely analyzing data on environmental changes, causes, and impacts on life and KD 4.11, which is to formulate ideas for solving problems of environmental change that occur in the surrounding environment. Environmental change is the material for grade X of the second semester of high school education. When studying environmental change material, it is hoped that the teacher can present environmental problems that occur in the environment around the students. This aims to make the students understand better the real conditions that exist in their environment. The most important understanding in environmental change

material is that the students can analyze the data on environmental changes, causal factors, impacts, and ideas for solutions to the problems with environmental changes that occur in their area.

Based on the description of the problems above, the research was carried out on the development of an Environment Problem Based Module on Environmental Change Material for High School Students. The module contains data on environmental changes that have occurred in Brebes Regency and includes environmental conditions in Brebes, equipped with self-reflection tables so that the students can measure the units they have understood and those that have not yet understood. This module uses an ecological paradigm which explains that living things and other abiotic objects related to one another.

RESEARCH METHODS

This research was conducted at SMA Negeri 3 Brebes in the second semester in the Academic Year of 2019/2020 from February to June 2020. The subjects of this study were the students and biology teachers of class X in the second semester in the Academic Year of 2019/2020 at SMA Negeri 3 Brebes. The population was 1 class and the sample used was 10 students who were taken by purposive sampling technique. The research design for developing the module is a modification of the research design (Sugiyono, 2010).

The data collected was in the form of potential and problem identification data using an interview guide instrument, module validity data using a validation questionnaire instrument by material and media experts, the module readability data using a readability questionnaire sheet instrument by teachers and students, and the module effectiveness data by students in terms of aspects. The cognitive aspect using student activity sheet instruments and evaluation questions, the psychomotor aspects using psychomotor assessment sheet instruments, and the affective aspects using questionnaire instruments caring attitudes to the environment.

The data analysis method in this research is the identification of potentials and problems related to the teaching materials used by the teachers and the students, the descriptive analysis for the validity of the module by material and media experts, as well as the readability of the module by teachers and students, the analysis of difficulty levels, distinguishing power, validity, and the reliability for analysis of environmental change evaluation questions and the descriptive analysis for student effectiveness data from the cognitive, psychomotor, and affective aspects.

FINDINGS AND DISCUSSION

Validation of *Environment Problem Based Module on Environmental Change Material for High School Students*

The results of module validation were carried out by material and media experts. The module is assessed using the standard of feasibility of teaching materials according to the BSNP 2016 which includes four aspects of feasibility, namely content, language, presentation, and graphics. Material experts provide an assessment of the aspects of content, language, and presentation. Media experts provide an assessment of the presentation and graphic aspects. The results of the validation assessment are used to correct existing deficiencies so that this module can be said to be suitable for use in biology learning. According to (Farihah *et al.*, 2016) said that validated learning resources can minimize errors in the material presented so that it can reduce misconceptions of student material. The validation results are shown in Table 1.

Table 1 The Validation Result of *Environment Problem Based Module*

Feasibility Components	Score	
	Material Experts	Media Experts
Content	15	-
Language	13	-
Presentation	20	28
Graphics	-	18
Achieved Score	48	46
Maximum Score	56	48
Value	85,71	95,83
Average	90,77	
Criteria	Very Valid	

The results of the assessment of the *Environmental Problem Based Module* validation by material experts get a total value of 85.71. This value falls into the very valid criteria. The input from the material experts can be described that the administration department often uses conjunctions as the beginning of sentences. The expert input from this material is used to improve the *Environmental Problem Based Module*.

The results of the assessment of the *Environment Problem Based Module* validation by media experts got a total value of 95.83. This value falls into the very valid criteria. As for corrections from the media experts, it can be described that the images on the cover are better if the images are the results of their own exploration so that they are more contextual for students, the illustrations in the images in the text of the module need the author's original images, and add independent assignments in the module which can be in the form of *browsing* results that is relevant to the material or the idea of designing certain activities related to the material with teacher guidance.

The validity of the *Environment Problem Based Module* based on the average score of material experts and media experts is 90.77 with a very valid criteria. This shows that the developed *Environment Problem Based Module* is very feasible to be used as an additional learning resource for students in environmental change material.

The feasibility aspect of the contents of the *Environment Problem Based Module* is in accordance with the applicable curriculum, which is in accordance with the basic competencies and indicators to be achieved so that it can guide students in learning. The depth of the material is adjusted to the level of competence to be achieved, the facts and concepts presented are taken from references to journals, articles, and news in electronic media.

The linguistic feasibility aspect of the *Environment Problem Based Module* achieves good assessment results so that the arranged sentences make it easier for students to understand the material. This is in accordance with the opinion stated by (Itaristanti, 2015) that the use of good language can help students in learning.

The feasibility aspect of presenting the *Environment Problem Based Module* has qualified the requirements for the preparation of the module so that when it is used, it does not confuse the students. The module contains a map of environmental change material, a general profile of Brebes Regency, instructions for using the module, a description of environmental change material, student activity sheets, summaries, bibliography, glossary, and author profiles.

The feasibility aspect of the *Environment Problem Based Module* graphic achieves good assessment results. The cover display has shown relevance to the content in the module. The images or illustrations in the module are also proportionally and interestingly sized to support the material being discussed. The writing of the module has used the appropriate type and size so that it is easy to read. The entire data presented supports the material, and has clear information.

Readability of *Environment Problem Based Module* by Teacher and Students

The readability test aims to determine the responses of teachers and students to the *Environment Problem Based Module*. The trial was carried out on the biology teacher of class X and 10 students of class X MIPA 5 who were selected by purposive sampling technique. The results of the readability of the *Environment Problem Based Module* are shown in Table 2.

Table 2 Readability Results of *Environment Problem Based Module* by Teacher and Students

No	Questions	Score	
		Teacher	Students (n=10)
1.	The font type used is appropriate and easy to read	4	3,6
2.	The font size used is easy to read	4	3,5
3.	The font color used is appropriate and easy to read	4	3,3
4.	Error less than 10 words	4	3,4
5.	The words in the module are in accordance to everyday life	4	3,5
6.	The sentences used are logical and easy to understand	4	3,6
7.	Between paragraphs or between sentences are related to each other	4	3,2
8.	The sentences are clear and do not cause much meaning (ambiguous)	4	3,6
9.	The sentence structure is appropriate and coherent	3	3,6
10.	The foreign language in the module is italicized	3	3,4
11.	Rigidity of term is appropriate	4	3,2
12.	Spelling accuracy according to PUEBI	3	3,3
13.	The cover presented is in accordance with the theme of the material	4	3,7
14.	Figures/tables/graphs are proportionally sized and easy to read	4	3,7
15.	Images have vivid colors	4	3,3
16.	The data presented describe the occurrence of the environmental change phenomena	4	3,6
17.	Modules have contents in accordance with basic competencies	4	3,3
18.	The module has contextual examples and deals with environmental changes that occur in the environment	4	3,7
19.	Delivery of material is concise and clear	4	3,6
20.	Modules can be used as references and additional learning resources for students	4	3,7
	The number of scores obtained	77	69,8
	Maximum scores	80	80
	Total value	96,25	87,25
	Criteria	Very Good	Very Good

The readability test of the *Environment Problem Based Module* by Biology teacher had a total score of 96.25. This value is in very good criteria. These results indicate that the use of the type, size, and color of the letters used is appropriate. The writing and delivery of the material are also good. The presentation of the *Environment Problem Based Module* also has an attractive appearance, contextual, and in accordance with environmental change material. In addition, the *Environment Problem Based Module* can be used as a reference and additional learning resource for students, but there is a need for improvement in the module, namely using waste recycling activities as an independent task so that the students can carry out real activities after observing environmental problems.

The results of the *Environment Problem Based Module* readability test by 10 students of class X obtained a mean score of 69.8 with a maximum average score of 80, so that a score of 87.25 was obtained which was included in the very good criteria. The results of the assessment by these students shows that the indicators of letter suitability, word selection, sentence suitability, linguistic aspects, suitability of images and covers, presentation of material in the *Environment Problem Based Module* have very good responses so that they are feasible to be applied for learning.

The Effectiveness of the *Environment Problem Based Module* from Cognitive, Psychomotor, And Affective Aspects

The effectiveness test of the *Environmental Problem Based Module* was conducted by 10 students. This test aims to determine the effectiveness of the module in terms of three aspects, namely cognitive,

psychomotor, and affective aspects. In this effectiveness test, students work on student activity sheets, evaluation questions on environmental change material, and fill out questionnaires for caring attitudes to the environment. The following is a diagram of the value of student effectiveness from the cognitive, psychomotor, and affective aspects.

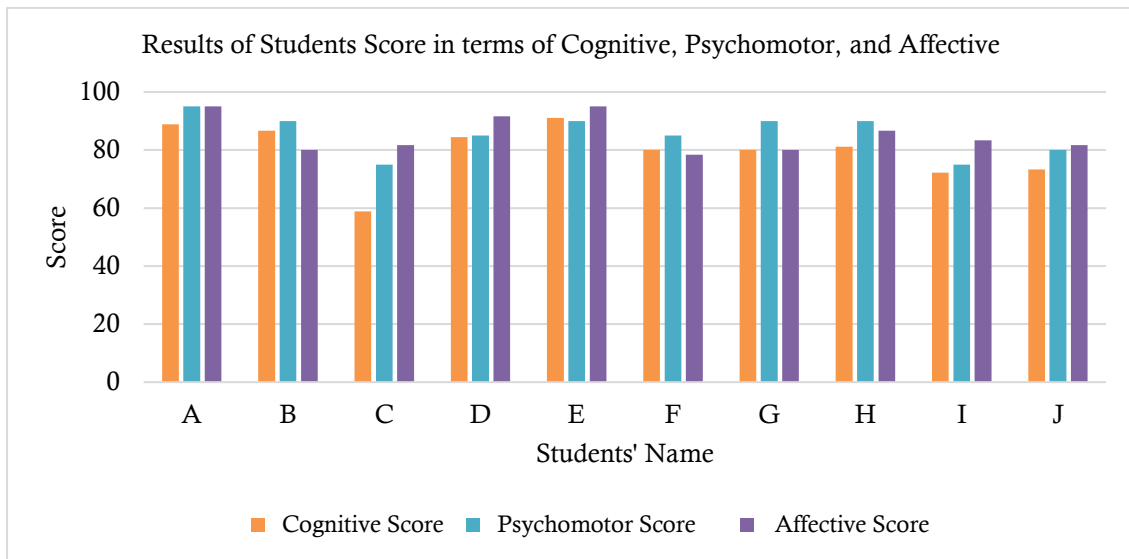


Figure 1 Results of Students Score in terms of Cognitive, Psychomotor, and Affective

The results of students' scores on cognitive, psychomotor, and affective aspects are further clarified through Table 3.

Table 3 The results of students' scores on cognitive, psychomotor, and affective aspects

No	Students' Name	Cognitive		Psychomotor		Affective	
		Score	Criteria	Score	Criteria	Score	Criteria
1.	A	88,89	Very Good	95	Very Good	95	Very High
2.	B	86,66	Very Good	90	Very Good	80	High
3.	C	58,89	Not Good	75	Good	81,67	Very High
4.	D	84,44	Very Good	85	Very Good	91,67	Very High
5.	E	91,11	Very Good	90	Very Good	95	Very High
6.	F	80,03	Good	85	Very Good	78,33	High
7.	G	80,03	Good	90	Very Good	80	High
8.	H	81,11	Good	90	Very Good	86,67	Very High
9.	I	72,22	Good	75	Good	83,33	Very High
10.	J	73,33	Good	80	Good	81,67	Very High
Accumulated effectiveness value		83,5				Very Effective	

The effectiveness of the *Environment Problem Based Module* for the cognitive aspects is very effective in being used as a source of additional student learning, as evidenced by 9 students who get a final score above 70 and only 1 student who gets a score below 70. This means that if in percentage, 90% of students are completed and only 10% of students are not completed. The existence of complete and incomplete

students is because each student has different thinking abilities so that not all of the students are able to achieve the targets that have been set. According to (Kurniahtunnisa et al., 2016) thinking is an ability that must be trained and cannot be obtained instantly. In addition, the speed of understanding of students in studying the *Environment Problem Based Module* material on environmental change also varied.

The effectiveness of the *Environment Problem Based Module* on psychomotor aspects showed that 7 students had excellent psychomotor abilities and 3 students had good psychomotor abilities. These results indicate that the *Environment Problem Based Module* is effectively used to measure psychomotor aspects, namely problem-solving abilities, as evidenced by the results of student scores being in good and very good criteria, no students who are in bad criteria. Students can provide ideas for solutions to environmental change problems according to the questions they are working on. The solutions they provide allow it to be applied in everyday life. A research from (Meiulianawati & Priyono, 2019) stated that problem solving ability is an ability that must be trained in the learning process. This is because problem-solving skills can train students to identify problems and provide effective solutions to the problems that occur in the environment and in the surrounding community by making correct and logical decisions.

The effectiveness of the *Environment Problem Based Module* on affective aspect showed good results because in the category of caring attitudes towards the environment, 70% of students are in very high criteria and 30% of students are in high criteria. In addition, there are no students who have a low caring attitude towards the environment. The results of the questionnaire for a good environmental care attitude are also supported by the students' knowledge of environmental change material so it is hoped that it can have an impact on the habit of caring for the environment. The *Environment Problem Based Module* used the PBL model base which contains an environmental change material. This PBL-based module provides data on environmental changes, causes, and impacts resulting from environmental problems, especially in Brebes Regency so that it is more contextual for students. According to research (Marlina et al., 2015) said that one way to motivate students to understand and care for the environment is by developing a learning resource such as modules.

Environment Problem Based Module is a contextual module that makes the students more familiar with the environment in Brebes Regency, even though there are several limitations in this study, that is the sample used is only 10 students due to the Covid-19 outbreak, this makes the researcher experiences difficulties in collecting data, whereas the amount of samples affects the validity of the data results so that the researches using similar themes hoped that the researchers can increase the number of samples so that the data results are more valid. In addition, this research was conducted online due to the covid-19 outbreak so that the results of the data when it is taken online could be different with the data are taken directly at school, this module is not suitable to use in schools that are outside Brebes Regency due to the different environmental conditions so that this module can only be used as a reference when other researchers want to do research with a similar theme, but in a different area.

Some of the limitations that have been mentioned in this study are expected to be suggestions for other researchers who want to use a similar theme for the studies so that there are various kinds of environmental change modules containing environmental conditions in various regions and with a larger number of samples so that the data results become more valid.

CONCLUSION

Based on the results of the data analysis and the discussion of the research results, it is concluded that the *Environment Problem Based Module* on environmental change material for high school students is feasible and effective to be used to help students learn independently at home and as a student additional learning resource as indicated by the results of module validation by material and the media experts are very valid criteria, the results of the readability of the module by the teacher and students are very good criteria, and the effectiveness of the module from the cognitive, psychomotor, and affective aspects obtained a good to a very good results.

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