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MODULE DEVELOPMENT WITH PROBLEM BASED LEARNING (PBL) MODEL BASED ON ENVIRONMENTAL WETLAND TO INCREASE STUDENTS' LEARNING OUTCOMES

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ABSTRACT

Research has been carried out on the development of modules with the Problem Based Learning (PBL) model based on wetland environments on the topic of acid-base solutions. This study aims to determine: the validity, practicality, and effectiveness of module development. This study used a research & development design of a 4-D development model that was modified into 3-D; the data collection techniques used a test of student learning outcomes and a questionnaire. The research was conducted at a high school in Banjarmasin, with a sample of 10 participants, 3 participants for small-scale trials, 24 participants for limited-scale trials, and 2 class of eleven grade in Science program with a total of 74 participants in a wide scale. Validity can be seen based on the results of the validation, the practicality of the students' responses, and the effectiveness of the students' learning outcomes. The results showed that the module was tested valid with an average score of 146.4 and a percentage of 91.58% (very valid). With a percentage of 82.90% (good), effective with an average N-gain score of 0.84 (high), the average N-gain value is 0.87 (high) for class 1 and 0.86 (high) for class no 2. The results of this study indicate that the module with the Problem Based Learning (PBL) model based on the wetland environment on the topic of acid-base solutions is declared valid, practical, and effective for use as a learning resource for students.

***Keywords**: modules, problem-based learning, wetland environment, acid-base solution*

INTRODUCTION

Education plays an important role in the development of a nation. Various efforts have been made by each country to improve the quality of education. Indonesia itself has implemented the 2013 curriculum, which aims to improve the quality of education [1]. In essence, the learning process is not only limited to conveying knowledge from educators to students, but students are required to be active in seeking, processing, and constructing knowledge so that learning can be centered on students (student center learning) [2,3,4].

The module is an alternative teaching material so that the learning process can be centered on students and makes it easier for students to find concepts and develop the learning process [5,6,7,8]. Modules are

teaching materials arranged systematically and attractively, which include material content, methods, and evaluations that can be used independently and are more objective [9,10]. Learning by using modules that aim to make students able to learn independently, the role of the teacher is not dominating and not authoritarian in learning, and can accommodate various levels and learning speeds of students [11].

Based on the results of the research, in module development, it is essential to pay attention to the choice of the model because this is the main point so that the developed module can make students more active, student-centered learning, and students easily understand the module [12].

One of the modules that can help students in training independence is a module with a problem-based model or known as the Problem Based Learning (PBL) model. PBL based modules are proven to have a positive impact on independence, motivation, interest, strengthening concepts, improving cognitive and affective aspects of students [13, 14, 15,16, 17]

However, in using Problem Based Learning, it is necessary to improve how to present the correct initial problem so that students understand what is being done, the initial problem presented is not a problem in the form of a question, but a problem that occurs in the life of students [18, 19].

The presentation of real and authentic problems that exist around students in the module will make it easier for students to find concepts and construct their knowledge so that learning can be centered on students [20,21].

One of the topics that exist in the student's life that can be used as a learning resource is one of the wetland environment. Wetlands are areas of brackish, swamp, peat, or water, either natural or artificial, permanent or temporary (temporary), with flowing or still, fresh, brackish or salty water, including areas with seawater which is resonant at high tide. Low (low tide) does not exceed 6 meters [22]. By presenting authentic problems in the form of a wetland environment, it can also foster love and conservation of the wetland environment as one of the local wisdom of South Kalimantan. Wetlands have many advantages and benefits for the surrounding community in both formal and non-formal education [23].

So that the development of modules with the PBL model based on the wetland environment is a necessity not only to provide teaching materials that can make the learning process centered on students (student center learning) but also as a means of introducing local wisdom in the area so as to foster a sense of love and preserving the wetland environment as one of the local pearls of wisdom of South Kalimantan, this module with the PBL model also provides an innovation because the problems presented are very close to the lives of students so that students can easily find concepts and construct their knowledge.

METHODS

The method used in this research is the R & D (Research and Development) method with a 4-D floating model [24]. 4-D development has four stages, define, design, development, and dissemination. In this

study, only up to the development stage, for the dissemination stage, namely the spread of the area, further research will be carried out.

The research was conducted at a high school in Banjarmasin for three months from December 2017 to February 2018. The research object is a module with a wet land-based PBL model which is validated by 6 validators. The research participants were eleven grade students in a school in Banjarmasin, which consisted of five students in individual trials, ten students in small group trials, twenty-four students in limited trials. Students in scale trials and seventy-four students in broad-scale trials. We provide class codes for trials class code PMIA 1 for the first class and PMIA 2 for class Second Class

The research instruments used were test and non-test. Non-test instruments include validity and response questionnaires. In comparison, the test instrument includes test questions following the indicators. The data analysis technique used is descriptive and inferential analysis techniques. Descriptive analysis is used to describe the module and to describe the validity and practicality of the modules made. The inferential analysis used includes normality, homogeneity, t-test, and N-gain to test the effectiveness of the module.

RESULTS AND DISCUSSION

The resulted development product is a module with a wetland environment-based PBL model with the topic acid-base solution. The advantages of this product are that it is creative, innovative, and makes learning learner-centered. This module is also presented with issues related to one of the local wisdom of South Kalimantan, the wetland environment. The module contains material equipped with a quiz time, a chemistry web, a glance of info, an independent assignment, a formative test, and a motivation column.

1. Validity Test

The validity test is used to determine the validity level of the module made. Four lecturers conducted the validity test at ULM Banjarmasin and two subject chemistry teachers at a high school in Banjarmasin. The validity test consists of aspects of content, aspects of presentation, and aspects of language. The following is Figure 1 of the module validity score:

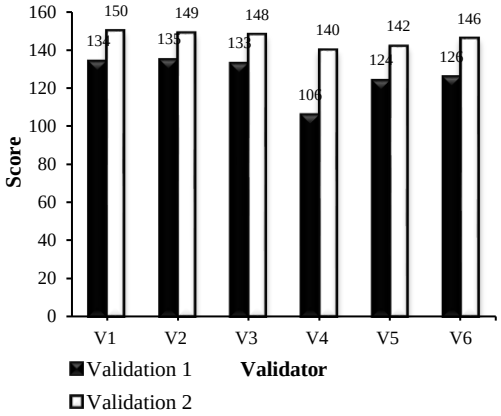

Figure 1. Results Score of Validity Test

The validity test was carried out twice because, in the first validation, the language aspect with a percentage of 65.3% in the category was less valid, so it needed to be done a second validation. In the second validation, language aspects get a percentage of 85.4% with a very valid category without the need for further revisions. The first validity test was in the content aspect, with a percentage of 78.61% in the valid category, and some corrections needed to be done. In

comparison, for the second validation with a percentage of 94% in the very valid category, so there was no need for further revisions. The first validity test of the presentation aspect was 83.6% is included in the valid category and needs correction in several parts based on the validator's suggestion. At the same time, the results of the validation of the two presentation aspects get a percentage of 96.8% with a very valid category without the need for further revision. The results obtained are following similar studies when the validity is above> 70%; it can be categorized that the developed module is valid [25, 26].

2. Small Group Trial

A small group trial was conducted by ten students of Eleven grade in the Science Program. In this trial, students were given orientation and information about the modules they would use. Furthermore, guided exercises and evaluation of learning outcomes are carried out. The average achievement of the five students' indicators ranged from 73-87%. The results of achieving the average indicators can be seen in Figure 2 below.

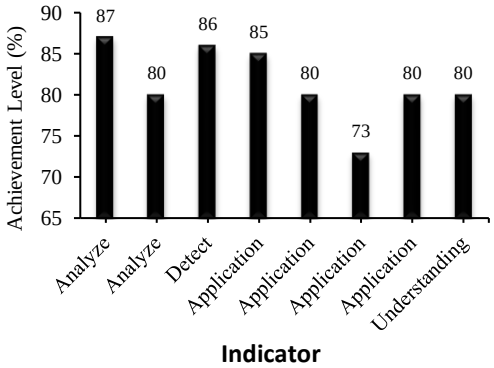

Figure 2. Average achievement of small-scale trial indicators.

Based on the above figure in indicator one about analyzing (C4) the relationship between acid/base strength in the concept of daily life, the percentage of achievement level is 87%. This result is because students in the learning process use modules based on problems that exist in everyday life, especially the wetland environment, making it easier for participants to find concepts and construct their knowledge. These results are supported by research, which states that the learning outcomes obtained by students are inseparable from the influence of the given module, where the modules presented using problems that exist in the surrounding environment can help students by describing an abstract concept. Complex material can be thoroughly explained by the module and flow according to the level of thinking of students so that it becomes easier to understand [27, 28, 29, 30].

In this trial, a module readability questionnaire was also given; this questionnaire aims to determine the clarity and ease of understanding the module. This readability questionnaire contains 15 questions, and the result is an average percentage of 82.90% with an excellent category. These results indicate that the teaching materials developed are quite easy to understand. There are several suggestions from students to improve covers, add pictures, and improve writing. The results obtained are following the learning outcomes which state that the module with student responses > 60% means that the module is practical [31, 32]. The results of the readability data, with a total of 15 students can be seen in Figure 3 below:

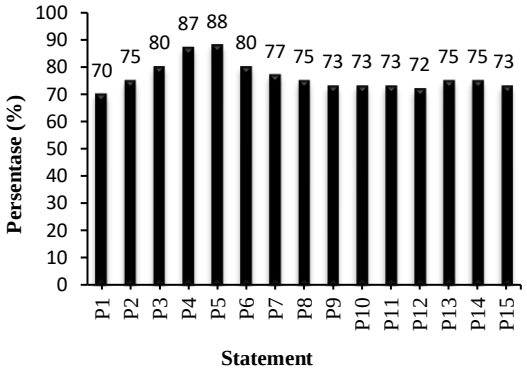

Figure 3. Readability of the module in Limited trials.

Limited product trial occurred on one class consisting of 24 students other than those who had participated in the small group test. Before learning, students were given a pretest to find out the students' initial abilities. The pretest data showed the lowest score of 16.67, and the highest score was 37.50, with an average of 28.30. After four meetings, the learning process used modules with the PBL model based on land environment wet then a learning outcome test (post-test) was carried out to determine the development of students. The post-test data showed the lowest score of students, namely 62.50, the highest score of students was 95.83. Meanwhile, the average student was 88.54. The following is Figure 4 Average of Indicator achievement

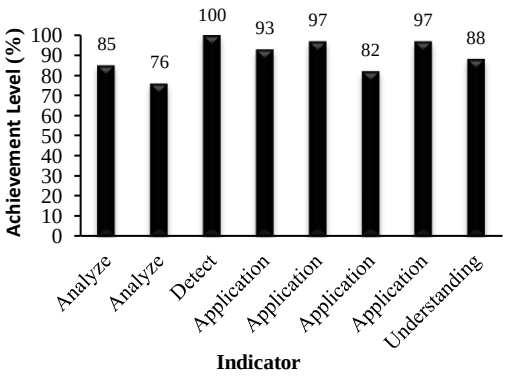

Figure 4. Average achievement of limited trial indicators

Indicator 3 on detecting (C4) acid and alkaline properties with various indicators obtained a percentage of 100%. This score shows that the results of these students are very good because students know fully about how to detect acid and alkaline properties with various natural indicators that exist in the wetland environment. This is in line with the results of the study, which states that learning using modules with local wisdom can improve students' understanding and learning outcomes because the material being studied is linked to the daily life environment of students [33, 34].

To find out whether there is a difference or not between the pretest and post-test, the t-test can be done. The results of calculations using t count are greater than t table (Ho is rejected). This means that there is a significant difference in the pretest and post-test scores. The difference between the pretest and post-test data can be seen through the N-gain. After calculating the N-gain value, an N-gain of 0.84 is obtained, which indicates that there is a large difference between the pretest and post-test values. The N-gain value is included in the high criterion.

3. Trial the Broad Area

The trial, the Broad Area, is a continuation of the limited trial. The classes used in the broad trial were group PMIA 2 and PMIA 1. The research procedure is the same as a limited trial only done on a larger scale. The pretest results can be seen in Table 1. This value is classified as a very low value, which indicates that the initial ability of students in both classes is very low.

Table 1. Data on pretest class PMIA 2 and PMIA 1

Class	PMIA 2	PMIA 1
Lowest score	00.00	00.00
Highest score	29.17	25.00
Average (X)	10.47	10.02
Standard Deviation (SD)	6.63	6.83

After four meetings, a post-test was held. The results of the post-test from the two classes can be seen in Table 2. When compared with the pretest data, at a glance, there is an increase in student learning outcomes, which indicates the development of students.

Table 2. Data on post-test class PMIA 2 and PMIA 1

Class	PMIA 2	PMIA 1
Lowest score	66.67	58.33
Highest score	95.83	95.83
Average (X)	87.95	88.29
Standard Deviation (SD)	7.905	8.439

Results of the pretest and post-test between the two classes are as follows: perform an N-gain Test. The results of the calculation of the N-gain value can be seen in Figure 5 below.

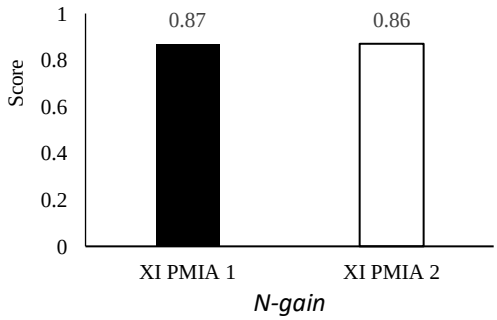

Figure 5. Comparison of the N-gain value in class of PMIA 2 and PMIA 1

The N-gain value in the two classes shows that there is a significant difference between the pretest and post-test. This value is included in the high criteria so that the module material with the PBL model based on the wetland environment on the topic of the acid-base solution is effectively used as a module for high school students and can improve learning outcomes. Test the effectiveness of the module using t-test, t-test to test whether there are differences before and after being treated. T-test results in the data pretest and post-test both classes can be seen in Table 3.

Table 3 Results of the pretest and post-test of data on extensive trials

Kelas	Md	n	Xd^2	t_{table}
PMIA 1	120.66	37	16788.76	2.028
	T_{count}	33.989		
PMIA 2	119.44	37	14773.48	
	T_{count}	35.869		

Based on the t-test on the pretest and data of the two classes, the t-count value of the two classes was greater than the t-table (Ho was rejected). Therefore, it can be said that there is a significant difference in the pretest and postest scores obtained in class PMIA 1 and class PMIA 2, which indicates the development of learning outcomes using modules with a wetland environment-based PBL model. The following is Figure 6 Average achievement of the Indicators:

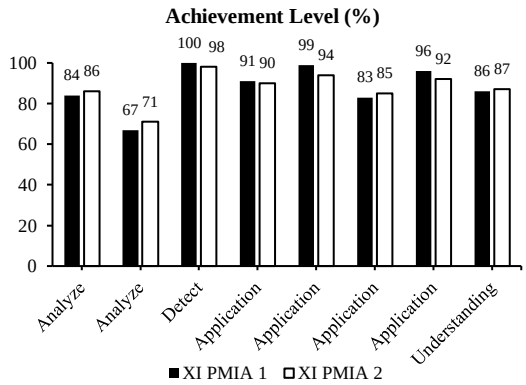

Figure 6. Average achievement of broad trial indicators

Indicator 3 on detecting (C4) acid and alkaline properties with various indicators obtained a percentage of 100% and 98%. This percentage shows that the results of these students are very good because students know fully about how to detect acid and alkaline properties with various natural indicators that exist in the surrounding environment. This is because the module with the wetland-based PBL model presents authentic problems that exist around students. These findings are by the opinion that the use of the environment can increase the reasoning power and critical thinking skills of students because students are faced directly with the problems that exist in their surrounding students [33, 34, 35].

Indicator 2 (C4) analyzes the properties of acids and bases according to acid-base theory, obtaining a percentage of 67% and 71%. This score shows that the results of these students are quite good because students understand the understanding of acid and base properties according to acid-base theory. Even though there are still some students who are still confused, by using this module students can be helped to understand the material on these indicators

CONCLUSION

Based on the results of the analysis, it was found that the development of a chemical module with a wetland-based PBL model was declared valid based on the validity of the validator. Practice-based on the results of the student readability/response questionnaire declared fit for use. They were providing effective products based on the results of the t test, which states that there are differences in student learning outcomes before and after using modules in learning in classes PMIA 1 and PMIA 2.

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