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Development of Problem-Based Learning (PBL) Biology Module to Improve Learning Competence and Students' Critical Thinking Skills Class VIII Junior High School (SMPN 1) Patamuan

Yanti Elfika Desti[1], Abdul Razak[2]

[1]Master of Biology ,Faculty of Mathematics and Natural Sciences, Padang State University, Padang , Indonesia

[2]Lecturer for Postgraduate Biology Education, Faculty of Mathematics and Natural Sciences, Padang State University, Padang, Indonesia

ABSTRACT: This study aims to produce a valid, practical and effective excretory system biology module to improve students' competence and critical thinking skills. The type of research carried out is development research (R&D) with the Plomp design which consists of 3 stages, namely preliminary research, prototyping and assessment phase. The module validation uses an instrument in the form of a questionnaire. The results of the validation of the PBL-based module are categorized as very valid. The next stage will be the practicality and effectiveness assessment. The results of the practicality assessment by teachers and students showed that the module was very practical to use. the effectiveness of problem-based learning modules using test instruments and observation sheets. The results showed that the module effectively improve the competence and critical thinking skills of students which can be seen from the significant difference in learning outcomes of competence and critical thinking skills between students in the experimental class with the control class. Based on the results of data analysis, the PBL-based module on the developed excretion system material can be declared valid, practical and effective.

KEYWORDS: module, PBL, competence, critical thinking ability.

1. INTRODUCTION

Science learning is a combination of 3 lessons, namely biology, physics and chemistry. Science learning is basically scientific observation of nature, creatures and interactions with the environment. Science observations occur in a complex manner. Science learning activities occur conditionally between teachers and students. Conditional science learning can be achieved with systematic and structured teaching materials. One of the systematic and structured teaching materials is the module.

A module is a set of learning tools aimed at training students to learn on their own. Modules make learning effective. The use of modules in learning is able to increase students' understanding and interest in learning biology. The modules used in the learning process must be in accordance with the demands of the curriculum.

The curriculum is a learning and teaching program based on an educational institution with a learning design that is imposed on students within a certain period of time in order to achieve a certain goal. The curriculum has many functions, including as a means of achieving national education goals

The curriculum used today is the 2013 curriculum. The 2013 curriculum aims to create a generation that is intelligent in knowledge, emotionally intelligent and spiritually intelligent and has life skills. Skills in the 2013 curriculum learning program are adapted to the needs of the 21st century.

The 21st century is marked by the rapid development of technology and information. National education in the 21st century must be able to create a generation that is ready to compete globally. To be able to compete in the 21st century, the younger generation must have the skills needed at this time. 21st century skills that must be mastered by students are communication skills, collaboration, critical thinking and creativity. Facing learning in the 21st century, everyone must have critical thinking skills, knowledge and abilities of digital literacy, information literacy, media literacy and mastering information and communication technology

The development of information in the 21st century makes it easy to spread information whether it is real information or false information, in this case the importance of critical thinking skills to filter that information. Critical thinking is one of the 21st century skills that must be possessed by students. Critical thinking is a directed and clear process that is used in mental activities such as solving problems, making decisions, analyzing assumptions and conducting scientific research.

Every human being is endowed with the ability to think critically, some are strong critical thinking and some are weak critical thinking; . Critical thinking is the main skill that forms the basis for other skills used in education and in the world of work. The ability to think critically also makes students become human beings who are able to compete in facing the challenges of the world of work and have the opportunity to get the job they want in the future. Based on research in various fields, graduates from schools from several countries who do not have high critical thinking skills have difficulty competing globally.

Supporting the creation of a 21st century learning atmosphere, teachers must change the learning model that was originally lecture and teacher-centered to student-centered learning. One learning model that is suitable for use is problembased . The PBL model is a problembased learning model that can improve students' critical thinking skills. The PBL model can be combined with the biology module. Learning activities with PBLbased biology modules have often been carried out in cities, while in villages this is still rarely done.

Based on the results of interviews with science teachers in the Patamuan subdistrict, it was obtained data that students' critical thinking skills were still low, this could be seen from the way students were still passive in discussing and memorizing concepts and the available teaching materials were insufficient. Teaching materials in the form of textbooks and worksheets. Meanwhile, discussion learning is rarely done because the lecture method is still the main alternative used by teachers. This problem has an impact on the results of learning biology on difficult materials which are still below the KKM. One of the materials whose value is below the KKM is the excretory system.

Based on the background that has been stated, it is necessary to develop a PBL-based biology module that is able to improve the competence and critical thinking skills of students.

2. MATERIAL AND METHOD

This research is a type of development research. Development research uses the Plomp design which consists of 3 stages, namely preliminary research (initial investigation), prototyping (development stage) and assessment phase (assessment stage. The data obtained from this study are direct data in the form of questionnaire sheets, observation sheets, cognitive test instruments and critical thinking skills. data analysis using SPSS version 26.

3. RESULTS AND DISCUSSION

3.1. Initial Investigation Stage

The initial investment stage is the initial analysis stage which consists of problem analysis, needs analysis, curriculum analysis and concept analysis. From the problem analysis it was found that the teaching materials were limited in number and still conventional and this made 90% of students who filled out the questionnaire in the Patamuan sub-district need additional teaching materials. Especially on difficult materials such as the excretory system. The next activity is curriculum analysis and concept analysis. This activity is to determine the scope of the material to be developed into a module. The end of the initial stage is a module that is developed according to needs, namely a PBL-based biology module on the excretory system which is expected to be able to improve students' competence and critical thinking skills.

3.2. Development Stage

The development stage consists of 4 steps, namely the development of prototype 1, prototype II. Prototype III and prototype IV. The development stage of prototype 1 produces a product in the form of a PBL-based biology module in the excretory system. The next stage is prototype II where this module is validated. The average value of module validation by experts is that it has a percentage value of 84.51 with very valid criteria (full details in Table 1). Valid biology modules will be tested on students and a one-to-one evaluation practicality test will be carried out by giving questionnaires to 3 students with different abilities.

Table 1. Module Validation by Experts

No.	Aspect	Score (%)	Category
1	Didactic	85.71	Very Valid
2	Construct	82.41	Very Valid
3	Technical	85.42	Very Valid
Average		84.51	Very Valid

The development phase of prototype III is the result of a revision of prototype II. At this stage the PBL-based biology module is evaluated through a small group evaluation to 6 students with high, medium and low abilities. Evaluation is done by distributing questionnaires to 6 students. The purpose of the evaluation at this stage is to determine the practicality of the product. Student assessment at this stage includes aspects of module presentation, ease of use and time efficiency. The average value obtained at this stage is 85.41 with very practical criteria.

The revised result of prototype III is called Protype IV. Prototype IV is the final product of the development stage. Prototype IV will be used in large group field trials. The products produced at this stage will be assessed for their practicality and effectiveness on a large scale.

3.3. Assessment Stage

3.3.1. Practicality Stage

The final stage of development research is the assessment stage. This stage is tested on large groups. The class that is used as the large group trial stage is the experimental class. Learning in the experimental class is done by dividing students into 5 groups. The assessment stage consists of two, namely the practicality assessment and the effectiveness assessment.

The practicality of the PBL-based modules is assessed by teachers and students in stages. The practicality of this PBL-based biology module can be seen from the aspect of presentation, ease of use and time efficiency. The average praticality assessment in all aspects is categorized as very practical.

The final practicality assessment was carried out after the experimental class students used the module in the learning process for 4 meetings. at the final stage of the assessment (Field Test) students of one class who became the experimental class gave an assessment of how practical the modules they used were. According to students, the module is very practical. The presentation of the module is interesting and systematic. The use of the module is easy and helps the learning process of students. Modules also help save students' study time. full details of the practicality assessment by students can be seen in Table 2.

Table 2. Practicality Assessment by Students

No.	Aspect	Score (%)	Category
1	Presentation	85.71	Very
			Practical
2	Ease of use	82.41	Very Practical
3	Time efficiency	85.42	Very Practical
Average		84.51	Very Practical

The practicality assessment was also carried out by 2 science teachers. According to the science teacher, the module is very practical, easy to use and in accordance with the time allocation. The average praticality assessment by the teacher is 89.58 with very practical criteria. The practicality assessment by the teacher can be seen in Table 3.

Table 3. Practicality Assessment by Teachers

No.	Aspect	Score (%)	Category
1	Presentation	91.25	Very Practical
2	Ease of use	90.00	Very Practical
3	Time efficiency	87.50	Very Practical
Average		89.58	Very Practical

3.3.2. Stage Effectiveness

The effectiveness assessment stage is carried out after the module trial to students who are in the experimental class. The trial was conducted for 4 meetings and ended with a final exam. The final exam is a benchmark for learning outcomes because learning outcomes are a process of thinking and experience during the learning process [18].The PBL module trial aims to see the effectiveness of the module in learning. The effectiveness of the module is seen from the results of learning competencies and critical thinking skills.

Learning competencies are assessed on cognitive, affective and psychomotor aspects.

Cognitive assessment and critical thinking skills are obtained from test scores in the form of tests. The psychomotor and affective assessments were carried out by the observer using an observation sheet. The learning competence and critical thinking ability of the experimental class is superior to that of the control class. Complete details of the comparison of learning outcomes between the experimental class and the control class can be seen in the Table 4. After the assessment of learning competence and cognitive ability is carried out, the next step is to analyze the data using SPSS version 26. The analysis phase includes normality test, homogeneity test and hypothesis testing.

Table 4. Comparison of the value of the experiential class and the control class

No.	Competence	Class Grade	
		Experiment	control
1	Cognitive	84.22	79.53
2	Affective	84.42	77.59
3	Psychomotor	86.62	79.69
4	Critical Thinking	75.59	68.91

The cognitive competence analysis stage in the normality test using klomogorov-Smirnov obtained data that was not normally distributed with a sig value of 0.000. in the homogeneity test using the Levene static test, the homogeneity data obtained with a significant value of 0.446 with a significance level of 0.05. Because the data are not normally distributed and homogeneous, the hypothesis test uses the U test (Mann-Whitney Test). Cognitive competence hypothesis test The value of sig (2-tailed) 0.000 <0.05 means that H0 is rejected and H1 is accepted, meaning that there is a significant difference between the learning outcomes of students in the experimental class and the control class.

The cognitive and psychomotor competence analysis stage uses the U test (Mann-Whitney Test) on the grounds that the data are ordinal. Hypothesis testing was found that the value of sig(2-tailed) 0.000 <0.05 means that H0 is rejected and H1 is accepted, so there is a significant difference in affective/psychomotor learning outcomes between the experimental class and the control class.

The critical thinking ability analysis stage includes normality test, homogeneity test and hypothesis testing. The normality test of critical thinking skills was carried out using the KolmogorovSmirnov test because the data sample was more than 30. Normality test in the experimental class. The sig value 0.59 > 0.05 means the data is normally distributed. The sig value for the control class is 0.57> 0.05, meaning the data is normally distributed. To test the homogeneity of critical thinking skills using levene statistics with the results of sig value 0.188>0.05, meaning that the data has a homogeneous variance. Two conditions have been met to test the Independent Samples Test, namely the data are normally distributed and the variance is homogeneous, then the hypothesis is tested using the two-average test (T-Test). Hypothesis test results obtained sig value (2-tailed) 0.000 <0.005 which means H0 is
rejected and H1 is accepted,

4. CONCLUSION

Based on the results of research that has been carried out, it can be concluded several things as follows:
1. The PBL-based biology module developed is categorized as very valid based on the validator's assessment.
2. The PBL-based biology module developed is very practical based on teacher assessmentand student assessment. 3. The developed PBL-based biology module is very effective. The effectiveness of the module can be seen from the improvement of students' learning competence and critical thinking.

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