

Validity of Problem-Solving Based Module in Biology Learning Materials of Biodiversity and Ecosystem for X Grade of Senior High School

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Abstract - During learning process in school, teacher has developed learning materials in form of module. The module used by teacher has some weaknesses. One of them is it only contains explanations of learning materials and evaluations so that the use is not optimal to motivate students in independent learning. Beside that, most of students seem to be not active in learning process, especially in group discussion. Consequently, their critical thinking skill is not maximal in understanding learning material. Considering these problems, problem-solving based module is develop to solve the problems. Purposes of the research were to develop a problem-solving based module and to know its validity criteria. It was a developmental research by using Plomp model. The Plomp model consists of three developmental phases, which are preliminary research phase, development or prototyping phase, and assessment phase. Instrument used was module validity instrument. The problem-solving based module was validated by 3 experts. The finding shows that the score of construction aspect is 81.25 with very valid criteria, the score of content validity aspect is 82.29 with very valid criteria, the score of technical aspect is 81.94 with very valid criteria, and the score of linguistic aspect is 81.67 with very valid criteria. So, it is concluded that problem-solving based module is qualified to be used in learning process because it is in very valid category. Besides that, it is expected to be able to improve students' learning outcomes.

Keywords - Validity, Module, Problem-Solving.

I. INTRODUCTION

One of components that supports development of a country in education. Through education, human beings are successful to realize various developments and advances in all aspects. The science and technology aspect grows very rapidly through various innovations that can be used to make life easier. One of sciences that supports the development is Biology.

Biology is a science that develops from curiosity about living organisms and all aspects related to them. It has some real contributions to support human daily life. Biology learning process which emphasizes on scientific process is

expected to give direct experiences to students so that students' competences and skills can improve.

Based on the result of observation and interview done to Biology teachers in SMAN 1 2X11 Kayutanam and SMAN 1 Rambatan, it was found that there are some constrains in learning process. First, it is related to learning module based on the 2013 Curriculum. Teachers have developed learning material in form of module but it only contains learning material explanations and evaluations. Consequently, the use is same like textbook so that it is not optimal to motivate students to study independently.

Second, most of students are not active in learning, especially in group discussion. Consequently, their critical thinking skill in understanding a learning material has not been optimal yet. Beside that, they feel difficult to link what has been learned to real situation in environment.

Third, according to teachers, all of learning activities and process in students' book have used scientific approach. However, based on analysis of activities in the students' book, it is known that steps in the activities are not clear.

To overcome the problems above, an alternative solution is by developing learning material in form of module. Learning by using module is designed to facilitate students to do independent learning according to their ability without depending on their teacher. As a result, teacher's role changes from the one who provides information to the one who facilitate learning process by providing various learning sources and media which are needed.

The learning by using module has some advantages, which are 1) it can improve learning effectively without having to meet regularly; 2) it determines and sets learning times which are more appropriate to students' needs and learning developments; 3) students' competence achievements can be known gradually through criteria which are set in the modules; 4) teacher can decide which competence is not performed well by students based on the criteria in the module so that s/he can help the students to improve their learning and do remedial learning (Ditjen PMPTK, 2008). Therefore, the use of module in learning process can facilitate students to develop their knowledge and master the set competences. One model that is used to develop a module is problem-solving model.

The problem-solving model is a model which leads or trains students to solve a problem in subjects they are learning. Problem is difference or gap between what is expected and what is in reality so that it raises the desire to solve it and look for right solution in effective way (Rajib, 2013). Beside that, it is a model in which students have to participate actively in learning process (Abayomi, 2008). So, the problem-solving is a learning strategy which enables students to actively participate in learning process. Their role is to find solution of provided problem; while, teacher's role is as a facilitator who will give guidance or suggestions to them as they need (Ajilgoba & Ifamuyiwa, 2012).

Furthermore, Nekang (2013) also states that to solve a problem, it is needed to define the problem and arrange methods to solve it. So, one of the important parts of problem-solving model is students can solve a problem by

using high level thinking skill through exploring the problem in order to get better understanding (Trevathan & Myers, 2013).

The module which is produced will contain problem-solving model syntaxes proposed by Moore (2015), which are a) students in groups define problems clearly; b) students collect data and search relevant information; c) students formulate various alternatives in solving the problem; d) students evaluate the various alternatives, choose the best one and present it in group discussion.

Based on the explanations above, it was done a research entitled "Validity of Problem-solving Based Module in Biodiversity and Ecosystem Learning Materials for X Grade of Senior High School".

II. REVIEW OF RELATED LITERATURES

A. Validity

First aspect to determine the quality of a learning product is validity (Haviz, 2013). The validity determines quality of the developed module. Before using the product, it needs to see its validity based on certain criteria (Arifin, 2012). A product is valid if it is adequate and all of its components are related each other consistently (Rochmad, 2011).

According to Darmodjo and Kaligis (in Widjayanti, 2008), indicators, used to say a product is valid, are as follows:

1. Didactical requirements state about the universal use of module, which is able to be used to high and low ability students.
2. Constructive requirements are the ones related to language use, sentence structures, vocabularies, difficulty level in order to students can understand the module.
3. Technical requirements are related to the presentation of module in form of writings, pictures/ images and layout.

B. Learning Module

Module is a complete unit of learning activities series which is arranged to help students achieve the formulated learning objectives. As a complete measuring instrument, it can function independently and separately, as well as it functions integrative. Beside that, according to Wening (in Parmin & Peniati, 2012), module is effective if it is understandable to achieve certain competence.

C. Problem Solving

Problem solving is a learning model which leads or trains students to be able to solve problems in learned subject. It is an intellectual, logical and systematic method which helps individual to face a problem and looking for some proper solutions and appropriate with the conditions (Lakovos, 2011). Beside that, it is the easiest independent learning method in order to achieve learning objectives (Riasat, 2010).

In addition, it is also a model in which students are involved actively in learning process. Their role is to find solution of the problems; while, teacher's role is to guide them to find the solution or to give them a suggestion when it is needed (Ajilgoba & Ifamuyiwa, 2012). Furthermore, it is also a model in which students are required to ask some questions or to think critically to find solution of the problem in order to increase their understanding and interest during learning process (Abdu, 2012).

Moreover, it has important role for students' future because it can train them to find source of problem and evaluate information carefully so that to solve problems in future, it will be easier (Stevie, et al., 2016). In problem-solving process, a solver should understand situation of the problems. In the most basic level, the solver should determine full access regarding the problems being solved. While, in more complex level, the solver should arrange some plans or strategies to solve the problems, do the plans and think about the result logically (Pagliano & Ansell, 2012).

Another opinion comes from Polya (in Fede, 2010), who states that there are four stages in the problem-solving model. They understand the problem, arranging some plans to solve the problem, doing the plans, and doing reflection by looking back the plans that have been used. In addition, Moore (2015) also proposes some syntax of problem-solving model, as follow: (a) Defining the problem clearly, (b) Collecting data to solve the problem, (c) Identifying obstacles to the goal, (d) Identifying alternatives to solve the problem, (e) Rating alternatives by considering the effects of every choice, (f) Choosing the best alternatives to solve the problem.

So, from the explanation above, it can be concluded that problem-solving is a student- centered learning model in which it trains students to solve a problem by looking for some solutions of the problem either individually or in group through some stages in order to achieve the learning objectives.

III. RESEARCH METHOD

It was a developmental research by using Plomp model. This model consists of three phases, which are preliminary research phase, development or prototyping phase, and assessment phase. Instrument used was validation evaluation sheets to measure the validity of developed product. Validation of the problem-solving based module was done by three experts. Result of assessment was used to revise the module so that it really fulfills the users' needs. The followings are expert validation instruments used in this research.

EVALUATION SHEETS OF PROBLEM-SOLVING BASED MODULE VALIDATION IN BIOLOGY LEARNING MATERIALS OF BIODIVERSITY AND ECOSYSTEM

A. CONSTRUCTION ASPECT

No	Assessed Aspects	Evaluation			
		1	2	3	4
		STS	TS	S	SS
1.	The module presents clear learning indicators and objectives.				
2.	Activities in the module are appropriate to learning materials.				
3.	Learning activities in the module are presented systematically and appropriate with problem-solving stages.				
4.	In learning activities in the module, there is a phase to orient the problems to students by presenting a problem related to learning materials.				
5.	In learning activities in the module, there is a phase to define the problems clearly to students by asking them to study in				

	group.				
6.	In learning activities in the module, there is a phase to collect data or search for relevant information to solve problems.				
7.	In learning activities in the module, there is a phase to formulate various alternatives and to evaluate the alternatives.				
8.	Learning activities in the module give opportunity to choose the best alternative to solve the problems, to discuss in group and to present result of the discussion.				

B. CONTENT ASPECTS

No	Assessed Aspects	Evaluation			
		1	2	3	4
		STS	TS	S	SS
1.	Indicators are explained based on Basic Competence (KD) and Core Competence (KI).				
2.	Learning objectives are explained based on indicators.				
3.	The module contains lists of questions related to concept of learning materials.				
4.	Activities in the module give direct experiences to students.				
5.	Activities in the module give opportunity to students to work together.				
6.	Activities in the module develop				

	students' critical thinking ability by solving the problems.				
7.	Activities in the module have application in daily life.				
8.	The presented images can support the learning materials.				

C. TECHNICAL ASPECTS

No	Assessed Aspects	Evaluation			
		1	2	3	4
		STS	TS	S	SS
1.	Images and compositions in cover reflect the content.				
2.	Images in the module can deliver message effectively.				
3.	Descriptions of images are appropriate with the presented images in the module.				
4.	Colors used in the module are contrast/ sharp enough.				
5.	Colors of images attract students' attention.				
6.	The use of font and its size is appropriate.				

D. LINGUISTIC ASPECTS

No	Assessed Aspects	Evaluation			
		1	2	3	4
		STS	TS	S	SS
1.	The module uses right Indonesian rules.				
2.	The use of punctuations in the module is correct.				
3.	The language used is understandable.				
4.	Using simple and clear sentence structures.				

Analysis of validity was done by using the data of questionnaires filled out by some experts. Data analysis was started by scoring each item. The scoring was done based on Likert scale, like in Table 1 below.

Table 1. Categories and Scores of Validity in Likert Scale

Scores	Categories
4	Very Agree (SS)
3	Agree (S)
2	Disagree (TS)
1	Very Disagree (STS)

Source: Yusuf (2007)

Next, result of scoring was tabulated and percentaged by using the following formula:

$$\text{Validity Score} = \frac{\text{Obtained Score}}{\text{Maximum Score}} \times 100\%$$

Based on the validity score obtained from the calculation, validity criteria of the problem-solving based module were determined based on the conditions in Table 2 below.

Table 2. Validity Criteria of Module

Range (%)	Categories
0-20	Not Valid
21-40	Less Valid
41-60	Valid Enough
61-80	Valid
81-100	Very Valid

Source: Riduwan (2009).

IV. FINDING AND DISCUSSION

A. CONSTRUCTION ASPECTS

Indicators	Validator's evaluation			Average	%	Description
	1	2	3			
1	4	3	3	3,25	81.25	Very Valid
2	3	3	3			
3	3	4	3			
4	3	3	3			
5	4	3	3			
6	4	4	3			
7	3	4	3			
8	3	3	3			

B. CONTENT ASPECTS

Indicators	Validator's evaluation			Average	%	Description
	1	2	3			
1	4	4	3	3,29	82.29	Very Valid
2	4	4	3			
3	3	3	3			
4	3	4	3			
5	4	3	3			
6	4	4	3			
7	3	3	3			
8	3	4	3			

C. TECHNICAL ASPECTS

Indicators	Validator's evaluation			Average	%	Description
	1	2	3			
1	4	4	3	3,28	81.94	Very Valid
2	3	3	3			
3	4	3	3			
4	3	4	3			
5	3	3	3			
6	3	4	3			

D. LINGUISTIC ASPECTS

Indicators	Validator's evaluation			Average	%	Description
	1	2	3			
1	4	3	3	3,27	81.67	Very Valid
2	3	3	3			
3	4	4	3			
4	3	4	3			
5	3	3	3			

Validity of problem-solving based module was assessed by some experts. It consists of four assessed aspects, which are construction, content, technical and linguistic aspects. The validators involved in this validation process were Dr. Darmansyah, ST, M.Pd as a technologist, Dr. Abdurrahman, M.Pd as a linguist, and Dr. Abdul Razak, M.Si as a learning material expert. Overall, the validity assessment done by experts is in 'very valid' category.

First, the score of construction aspects is 81.25%, which is in 'very valid' category. It is caused by the developed module presents clear learning indicators and objectives.

Activities in the module are appropriate to learning materials. Beside that, activities in the module are presented systematically and appropriate with problem-solving stages. Activities in the module are integrated by using problem-solving learning model. Activities in the module are to orient and define the problems to students by presenting a problem related to learning materials. According to Saidah (2014), the presented problem raises students' curiosity. The curiosity will motivate students to learn and construct their knowledge so that they are able to explain the problem.

Second, the score of content aspects is 82.29%, which is in 'very valid' category. It is caused by indicators are explained based on Basic Competence (KD) and Core Competence (KI), learning objectives are also explained based on the indicators, and the module contains list of questions related to the concepts of learning materials. The list of questions in part 3 is to answer questions by using various alternatives or solutions based on learning objectives to be achieved by students. The list of questions will focus students to the learning objectives to be achieved. The content aspect is also based on the activities in the module appropriate with problem-solving phases. It presents a problem related to learning materials so that students are active in learning process. Moreover, activities in the module give opportunity to students to work together in groups. Beside that, in the module, it is presented some images to support learning materials.

Third, the score of technical aspects is 81.94%, which is in 'very valid' category. It is caused by Images and compositions in cover reflect the content of the module. Images in the module can also deliver message effectively. Then, descriptions of images are appropriate with the presented images in the module. Next, colors used in the module are contrast/ sharp enough and do not disturb students' focus when they read it. After that, Colors of images attract students' attention. Last, the use of font and its size is appropriate.

Fourth, the score of linguistic aspects is 81.67%, which is in 'very valid' category. It is caused by the module is designed by using the right Indonesian rules although there are some mistakes in some parts of it. In some parts of the module, there is misuse of punctuations. Beside that, language used is appropriate with students' language level so that they can understand contents of the module. Furthermore, the module also uses simple and clear sentence structures.

Overall, the developed module is in 'very valid' criteria so that it can be used in learning process. According to Arikunto

(2013), if data show that a product is very valid, it gives description about the purpose of its development is right and appropriate with the real condition.

V. CONCLUSION

Based on the research finding and discussion above, it is concluded that the developed problem-solving based module has 'very valid' criteria viewed from construction, content, technical and linguistic aspects. This module can be used in learning process as the learning materials to help teacher and students in understanding the materials and achieving learning objectives in order to improve students' learning outcomes.

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