THE DEVELOPMENT OF MATHEMATICS MODULE OF QUADRILATERAL AND TRIANGULAR BASED ON PROJECT-BASED LEARNING MODEL

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ABSTRACT

Learning media is a set of information that is necessary for the implementation of learning. Teachers and students in need of additional media materials in the form of modules to facilitate delivering quadrilateral and triangular, besides the varied learning model, add to the range of learning processes with a level of understanding. This research aims to develop learning modules media math subject quadrilateral, and triangular-based model of learning project-based learning for students of Junior High School grades VII and find out the feasibility of modules in terms of material and media and knowing the student response against the math module. This type of research is research development. This study used Research and Development to identify the Potential and problems, collect information, design products, validate product design, product design, revisions to the test stage, try the product, product revisions, and test the product. This research is the State Junior High School (SMPN) 4 Wonosari and Junior High School (SMP) Muhammadiyah 1 Wonosari students. The type of data used, namely, data qualitative and quantitative data. They are using data collection techniques interviews and are now conducted before product development. The research instrument used is a question form and interview guidelines to assess the modules developed—the data analysis technique using quantitative analysis, which is then converted into the qualitative Likert scale analysis. Based on the research results obtained from the expert assessment of the material with an average score of 103.33 belongs in the category of excellent, expert assessment of the media with an average score of 109.33 belong in the category, and the response of the students against the module with an average score of 112.49 belong in the category. Based on the research of expert material, media experts, and student response towards developing the media learning modules on the subject of quadrilateral and triangular-based model of learning project-based learning for students of Junior High School grades VII feasibility in the learning process.

Keywords: module, the quadrilateral, and triangular, project-based learning.

INTRODUCTION

Education is a very important human need because education is tasked with preparing human resources for national and state development. In Indonesia, education is divided into three channels, namely formal education, informal education, and non-formal education. Formal education is education carried out directly by teachers and students in schools. In Indonesia, formal education must be taken 9-year compulsory education that starts from primary education to high school education. The notion of learning has evolved in line with the development of the outlook and experience of scientists. The notion of self-study can be defined by the philosophical values held by scientists or experts in learning their students. Learning is a business process carried out by someone to obtain a new change in behavior as a whole, both the results of his own experience in interactions with the environment (Slameto: 2015).

There are several types of teaching materials used in the learning process, one of which is a module. One of the materials by Core Competence in Permendikbud No. 24 of 2016 is rectangular and triangular material, so that rectangular and triangular material can be mastered well by students, adequate learning resources are needed, some teaching materials include textbooks, student worksheets, modules, and so on. Learning resources that are considered capable of increasing student learning creativity are modules. Modules are a form of teaching materials packaged in a whole and systematic manner so that their use can be with or without the facilitator/teacher's guidance. The module contains a set of learning experiences planned and designed to help students achieve specific learning goals. (Ministry of National Education: 2008).

Determining the learning model used can be reviewed directly by paying attention to what material will be delivered, whether applying the learning model will increase students' creativity. Rectangular and triangle material is one material that requires relatively high creativity. Therefore, learning models that can be used to develop student creativity, one of them is the Project-Based Learning (PBL) learning model. PBL or project-based learning is a learning method that uses projects or experiments to gather and integrate new knowledge based on experience in actual activities. Project-based learning is designed to be used in complex problems that students need to investigate and understand. Therefore the PBL model is expected to increase the level of creativity of students. According to the results of observations made in two schools, namely SMPN 4 Wonosari and SMP Muhammadyah 1 Wonosari on November 6, 2017, both schools' learning resources are the same, namely in the form of textbooks. The textbooks used by mathematics teachers in the two schools are the same.

Some of these things underlie researchers to develop mathematical modules as teaching material. The module developed is a module based on Project Based Learning (PBL) learning model for seventh-grade junior high school students. This module was chosen because of the contents' appearance in writing and illustrated images to help students learn independently.

Based on this background, the following problems can be formulated: 1) What is the process of developing the mathematics module on the subject of rectangles and triangles based on the PBL learning model for seventh-grade junior high school? 2) How to test the feasibility of a mathematics module on rectangles and triangles based on the PBL learning model for seventh grade junior high schools in terms of validity and practicality?

The objectives of this research are: 1) Develop a mathematics module on rectangles and triangles based on the PBL learning model for seventh-grade junior high school. 2) It was knowing the feasibility and practicality of good modules on squares and triangles based on the PBL learning model for seventh-grade junior high school.

METHODS

This research is a type of research and development (Research and Development). Development research is a research method to develop a new product or improve existing products and can be justified. The product produced in this study is teaching material in the form of instructional media in the subject of quadrilateral and triangles based on the Project-Based Learning (PBL) learning model for seventh-grade junior high school students. The development of teaching materials in the mathematics module subject to quadrilateral and triangles based on the Project-Based Learning (PBL) learning model about the Research and Development development model with the following steps.

1. Potential and Problems
   Research and development begin with the existence of Potential and a problem. Sugiyono (2015: 409) states Potential is everything that, when exploited, will have growth value. Problems arise when deviations occur between what is expected and the reality of facts that occur in the field
2. Gathering Information
   After the potentials and problems can be demonstrated factually and up to date, it is necessary to gather various information to be used as material for planning module products expected to solve the problem. The collection of information in this study was conducted by interviewing mathematics teachers in school.
3. Product Design
   According to Syaodih (2006: 175), the products produced in research and development are various. In education, the products produced are expected to be relevant to the needs and improve education quality. Product design must be realized in the form of initial products.
4. Design Validation
   Validation is a process that must be passed to assess whether the product design is feasible or not to be tested. Validation activities in this research development involve material experts and media

experts. Material experts and media experts assess product design to identify weaknesses and weaknesses. Also, media experts and material experts are asked to provide input to improve the product's design.

5. Design Revision
   Design revisions are made after media experts, and material experts have validated the product design. The design revision is based on material experts and media experts' input to overcome the product design's weaknesses and shortcomings.
6. Product Testing
   In product trials, researchers gather information for product improvement, that is, with a limited trial of the product to students, their task is to assess whether the product made is suitable for use as teaching material or not. If not, then the task of the researcher is to revise the teaching material made.
7. Product Revision
   Product revisions are made based on product trials results to students who aim to overcome these products' deficiencies. The results of the product revision will later be used in a trial run.
8. Usage Trial
   After testing the product successfully, the product revision results can be tested on VII grade junior high school students who will use it.

This study's data analysis technique analyzed each item of the questionnaire, both the material expert questionnaire, the media expert, and the questionnaire for students who had been quantified through the following stages.

1. Quantifying Data
   Data obtained through a questionnaire by material experts, media experts, and student responses in quantitative scores will be converted into a cumulative value on a Likert scale, as in Table 1 below.

Table 1. Likert scale

Information	Score
SS (Strongly Agree)	5
S (Agree)	4
CS (Quite Agree)	3
TS (Disagree)	2
STS (Strongly Disagree)	1

Sugiyono (2011:135)

From the data collected, the average is calculated using the formula:

$$\bar{X}_i = \frac{\sum_{i=1}^{n} Y_i}{m}$$

Information:

$\bar{X}_i$: Average score per item

$\sum_{i=1}^{n} Y_i$: Average number of scores per item

M: Number of item criteria

Furthermore, the data obtained from material experts, media experts, and students are converted into qualitative values based on the ideal assessment criteria, as in Table 2 below.

Table 2. Criteria for Ideal Rating Categories

No	Quantitative Score Range	Calculation	Qualitative Category
1	$\bar{X} > \bar{X}_i + 1{,}80\ SB_i$	$\bar{X} > 100.8$	Very good
2	$\bar{X}_i + 0{,}60\ SB_i < \bar{X} \leq \bar{X}_i + 1{,}80\ SB_i$	$81.6 < \bar{X} \leq 100.8$	Well
3	$\bar{X}_i - 0{,}60\ SB_i < \bar{X} \leq \bar{X}_i + 0{,}60\ SB_i$	$62.4 < \bar{X} \leq 81.6$	Enough
4	$\bar{X}_i - 1{,}80\ SB_i < \bar{X} \leq \bar{X}_i - 0{,}60\ SB_i$	$43.2 < \bar{X} \leq 62.4$	Less
5	$\bar{X} \leq \bar{X}_i - 1{,}80\ SB_i$	$\bar{X} \leq 43.2$	Very less

Widoyoko (2017:238)

Information:

$\bar{X}_i$= Ideal average

$\bar{X}_i = \frac{1}{2} \times$ (ideal maximum score + ideal minimum score)

SB_i= ideal standard deviation

$SB_i = \frac{1}{6} \times$ (Ideal Maximum Score - Ideal Minimum Score)

$\bar{X}$ = Empirical score (Average score)

Ideal maximum score = number of criteria items × the highest score

Ideal minimum score = number of criteria items × the lowest score

RESULTS AND DISCUSSION

The trial data in developing the learning media for the mathematics module of the rectangular and triangular subject based on the Project-Based Learning (PBL) learning model for seventh-grade junior high school students was obtained based on the steps in the Research and Development method and components of the learning process with a scientific approach, namely gathering information, data collection, product design, design validation, design revision, product trials, product revisions, trial usage. Based on the data analysis technique used, the data was obtained from three assessments: material experts, media experts, and student responses.

1. Material experts carry out module quality analysis in terms of material. H. Edi Prajitno, M.Pd. is a lecturer in Mathematics Education at Ahmad Dahlan University, AM Suprantya, S.Pd. MM as a grade VII mathematics teacher at SMPN 4 Wonosari and a mathematics class VII teacher at SMP Muhammadiyah 1 Wonosari, namely Yoes Ettex, S.Pd. The calculation of the quality of e-modules by material experts can be seen in Table 3 below.

Table 3. Results of the Eligibility Questionnaire Calculation for Material Expert

No	Evaluator	Score	Average	Module Quality Categories
1	Drs.H. Edi Prajitno, M.Pd.	103	103	Very good
2	AM Suprantya, S.Pd. MM	107	107	Very good
3	Yoes Ettex, S.Pd. Si	100	100	Good
	Amount	310	103.3	Very good

From Table 3, it can be seen that the average score of material expert judgments is 103.3. These results indicate that modules developed in terms of material are included in the Very Good category. Based on the assessment of material experts, all aspects of the module have very decent criteria. However, the PBL learning model's feasibility aspects get the highest assessment compared to the linguistic aspects, presentation aspects, and graphic skills of 89.63%.

2. Analysis of the quality of e-modules in terms of appearance was carried out by media experts, namely Syariful Fahmi, M.Pd. who is a lecturer in Mathematics Education at Ahmad Dahlan University, Puji Purwanto, S.Pd as a teacher in the field of computer network engineering study in class VII SMPN 4 Wonosari, and a teacher in mechanical engineering study class VII in SMP Muhammadiyah 1 Wonosari namely Rian Hidayatullah. The calculation of the module quality by media experts can be seen in Table 4 below.

Table 4. Results of the Eligibility Questionnaire Calculation for Media Experts

No	Evaluator	Score	Average	Module Quality Categories
1	Syariful Fahmi, M.Pd.	116	116	Very good
2	Puji Purwanto, S,Pd.	111	111	Very good
3	Rian Hidayatullah	101	101	Very good
	Amount	328	109.3	Very good

From Table 4, it can be seen that the average score from the assessment of media experts is 109.3. This shows that the module developed is included in the "Very Good" category. Based on the assessment from the media experts, all aspects of the module have very decent criteria. However, language eligibility gets the highest rating compared to the presentation feasibility aspect, and the graph worthiness of 94.67%.

3. Module quality analysis in student responses was conducted by students of SMPN 4 Wonosari and SMP Muhammadiyah 1 Wonosari. The results of calculations of the quality of modules by student responses can be seen in Table 5.

Table 5. Calculation of Student Response Questionnaire

No	Activities	Average score	Category
1	Product Trial of SMPN 4 Wonosari and SMP Muhammadiyah 1 Wonosari	113.25	Very good
2	Trial Use of SMPN 4 Wonosari and SMP Muhammadiyah 1	111.72	Very good
	Average	112.49	Very good

Table 5 shows that the students' responses to the Very Good module are shown by the average score on the product trials of 113.25, including the Very Good category and the trial use of 111.72, including the Very Good category. From the two tests conducted, it can be concluded that the modules developed in the category of Very Good are shown with an average score of 112.49 and are suitable for use in learning. Based on the assessment of students' responses to product trials and usage trials, all aspects of the module have very decent criteria, but the linguistic aspect gets the highest rating compared to the aspects of presentation, graphics, and usefulness that is equal to 95.02%

CONCLUSION

Based on the results of this research and development, it can be concluded that:

1. This research and development produce teaching material in the form of a rectangular mathematics subject module and a triangle-based model of project-based learning for class VII students. The steps taken to produce teaching materials are as follows: a) Potential and problems, b) Data collection, c) Product design, d) Design validation, e) Design revision, f) Product trial, g) Product revision, h) Test usage. The module's material consists of 4 sub materials: a) Types and Properties of Squares, b) Area and Circumference of Squares, c) Types and Properties of Triangles, d) Perimeter and Area of Triangles. In each material, students are asked to be actively involved in learning. The developed module is also equipped with competency test questions at the end of learning for evaluation.
2. Based on the validation of material experts and media experts, it can be seen the results of the validation of material experts are 103.33 or very feasible, and the results of the validation of media experts are 109.33 or very feasible. The calculation results from the questionnaire students' responses to the module developed in product 1 trial were 113.25 or very feasible, and the results in product 2 trial were 111.73 or very feasible. Overall the modules developed showed very appropriate responses to the learning process.

3. Based on the assessment of grade VII students of SMPN 4 Wonosari and SMP Muhammadiyah 1 Wonosari on the module, it can be concluded that the mathematics module of the rectangular and triangular subject based on the project-based learning model of learning that has been developed is categorized as very suitable for use in the learning process. There are also the results of assessing teaching materials in modules by students who obtained an average score of 111.73 with a very decent category. So, this module can be used in the process of learning mathematics.

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