DEVELOPMENT OF MATHEMATICS MODULE BASED ON GUIDED DISCOVERY ON RECTANGULAR MATERIALS FOR STUDENTS OF CLASS VII SMP

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ABSTRACT

The limitations of materials resulting in learner's optimal learning can not cause learning activities centered on the teacher; this resulted in a low level of self-reliance and active students in learning. This research aims to develop modules, testing the feasibility of modules, and knowing the student response to the development of a module of mathematics based discovery learning on the material in rectangular to Junior High School students of class VII. Procedure for adapting the development of models of research and development (R&D) include the stage of identifying the potential and problems, collect data, crafting products, product validation, revision products, product trials, revision product, trial use, revision of the product, the final product. This is a subject matter expert, media, and student. This research object is a module of mathematical-based discovery learning on the rectangular material of Junior High School (SMP) students of Class VII. Data collection techniques in the form of sheets of interview and question form. With test instruments through the validation and analysis of data using lecturer analysis question form and analysis of a mathematical module's feasibility. Based on the study results, the module's feasibility by the material obtained an average score of 102 with the category very good. The eligibility module by media expert earns an average score of 120,67 with category very good. Now the response of students obtained a scoring average of 131,80 with category very good. So, mathematical modules on a rectangle of material worth for use in learning.

Keywords: Mathematics Module, Discovery Learning, Rectangular

INTRODUCTION

In the learning process, both educators and students become the perpetrators of the implementation of learning objectives. The learning process is not just a transfer of knowledge from educators to students, but a process of activities that is the interaction between learners, educators, students, and students with learning resources. In mathematics, learning teachers play an important role in utilizing learning resources in carrying out mathematics learning activities in the classroom. According to the Ministry of National Education (2008: 6), Teaching materials are all forms of material arranged systematically that can be used to assist teachers/instructors in carrying out learning activities. Teaching materials can be written or unwritten material.

Learning resources that can be used by teachers in conducting mathematics learning activities in class include modules. According to the 2006 curriculum, modules can be used for teaching and learning activities in class. Modules are student guides used for conducting investigations or problem-solving activities. Modules can be guidelines for development exercises or guidelines for learning in experimental or demonstration guides. The module contains a set of necessary activities carried out by students to maximize understanding in the efforts to form a basis by the indicators of achievement of learning outcomes that must be taken. The variety of teaching materials used is still limited, only in worksheets and published books. Teaching materials used are difficult for students to understand. Also, there are no teaching materials available that can help students learn independently. In the learning process, the ability of guided discovery is still relatively low. It is also known that mathematics is difficult to understand, like the rectangular material in the kite section, trapezoid. Students prefer to be

explained by the teacher because the student book used is difficult to understand. And the unavailability of mathematical modules during the learning process.

From the explanation above, it is necessary to have alternative teaching materials to make students learn independently and actively. The teaching material is a module. Modules can be used as alternative teaching materials because the language in the module is easy to understand. By using modules, students can measure the ability to master the material independently. In the module, there are sample questions and practice questions equipped with answer keys. Based on this, the formulation of the problem in this research is how to arrange and develop teaching materials in the form of mathematical modules, how the feasibility of teaching materials by material experts and media experts in the form of mathematical modules, and how the results of student responses from teaching materials in the form of mathematics modules based on guided discoveries on rectangular material for seventh-grade junior high school students.

The purpose of this research is to compile and develop a mathematics module, describe the feasibility of a mathematical module based on a scientific approach to the set material for grade VII students of SMP / MTs by material experts and media experts, and find out the results of students' responses to the mathematics module based on the scientific approach to the set material for grade VII students of SMP / MTs. In Suherman, Erman (2003: 16-17), several mathematical definitions, namely, according to 1) Ruseffendi, states that mathematics is formed as a result of human thought related to ideas, processes, and reasoning. 2) James and James state that mathematics is the science of logic about shapes, structures, quantities, and concepts related to one another with a large amount divided into fields, namely algebra, analysis, and geometry. 3) Johnson and Rising state mathematics is a mindset, an organizing pattern, a logical proof; mathematics is a language that uses terms that are defined carefully, clearly, and accurately, its representation with solid symbols, more in the form of symbols about ideas sound. 4) Reys et al. state mathematics is a study of patterns and relationships, a path or mindset, an art, a language, and an instrument. 5) Kline states that mathematics is not solitary knowledge that can be perfect because of itself. However, the existence of mathematics is mainly to help humans in understanding and mastering social, economic, and natural problems.

From the various views above, it can be concluded that mathematics is a science of thinking based on logical thinking, consistent, innovative, and creative; besides that, mathematics is also a communication tool in problem-solving. According to Suherman, Erman et al. (2003: 55-56), school mathematics is Mathematics taught at school, namely mathematics taught in Primary Education and Secondary Education. School mathematics consists of mathematics parts chosen to grow and develop abilities and form personalities and integrate with science and technology development. School mathematics still has the characteristics that mathematics possesses, namely having abstract objects and deductive thinking. So that in the process of learning mathematics in schools need to have endeavored by the cognitive development of students and concrete abstract mathematical objects so that students easily understand them. Based on the explanation above, it can be concluded that school mathematics is mathematics taught in schools with abstract objects and has a consistent deductive mindset that can foster ability and shape students' personalities in the learning process and solve daily life problems.

According to experts about learning mathematics in Uno, Hamsah B (2007: 130) states that the essence of learning mathematics is mental activity to understand the meaning and relationships in symbols, then applied to real situations. Learning is the effort of students to learn subject material as a result of the treatment of educators. In learning, it is necessary to empower all potential learners to master the expected competencies. According to Gagne in Suherman, Erman et al. (2003: 33), in learning mathematics, there are two objects, namely:

1. Indirect object. Indirect objects include investigating and solving problems, learning independently, being positive towards mathematics, and learning.
2. Direct object. The direct object is facts, skills, concepts, and principles.

In general, from the description above, it can be concluded that learning mathematics is an activity carried out by students in learning mathematics, which includes facts, skills, concepts, and principles to form thought patterns in understanding everyday life.

Learning is a process that must be passed by educators and students to achieve optimal results. According to the concept of communication in the book compiled by Suherman, Erman, et al. (2003: 8): learning is a process of functional communication between students and teachers and students and students, in the context of changing attitudes and thinking patterns that will become habits for those concerned. In mathematics learning, students' success in teaching and learning activities can be measured by students' success. In this study, educators play more roles as mentors rather than informers. Mathematics learning is delivered in stages. There must be a link between student learning experiences and concepts to be taught. This is consistent with spiral learning. Mathematics emphasizes the deductive mindset that embraces contextual truth. Therefore, students must be given more opportunities to make these connections to face changes in daily life. Based on the description above. It can be concluded that mathematics learning is a communication process between students and educators and students and students to change students' mindsets to achieve mathematical learning goals that have been determined. So that student is expected to coordinate mathematics learning can provide the broadest opportunity for students to discover the various knowledge they need according to mathematics learning characteristics.

According to Daryanto (2013: 9): Modules are defined as a form of teaching material packaged in a whole and systematic way, which contains a set of learning experiences that are planned and designed to help students master specific learning goals. The module writing procedure step is as a guide for writing the module. In the Ministry of National Education (2008: 20), to write a teaching material, especially modules, there are several stages, namely:

1. Competency Standards (CS) and Basic Competencies (BC) analysis
2. Determine module titles
3. Providing module code
4. Writing modules

   The module writing can be done with the following steps:

   a. BC formulation that must be mastered
   b. Determine evaluation/writing tools
   c. Arrangement of material
   d. Order of learning
   e. The structure of teaching materials/modules. In the structure of writing module teaching materials, according to the Ministry of National Education (2008: 21-23) that is there is an opening section, a core/content section, and a closing section.

According to Sund in Roestiyah (2008: 20) argues that: The discovery method is a mental process where students can assimilate a concept or principle. What is meant by these mental processes include: observing, making guesses, explaining, measuring, making conclusions, and so on, while what is meant by principles include: metals when heated, will expand. In this technique, students are left to discover themselves or experience the mental process itself; they only guide and give instructions.

According to Heruman (2007: 4): The purpose of the guided discovery method is to acquire knowledge in a way that can train various intellectual abilities of students, stimulate curiosity and motivate students' abilities. While the steps of learning with the guided discovery method revealed by Markaban (2006: 16), namely: 1) Formulate the problem that will be given to students with sufficient data, the formulation must be precise, avoid questions that cause misinterpretation, so that the direction taken by students is not wrong. 2) From the data provided by the educator, participants compile, process, organize, and analyze the data. In this case, the teacher's guidance can be given as far as is needed; this guidance should direct the students to move in the direction they want to go through the questions. 3)Learners compile conjectures (forecasts) from the results of the analysis they do. 4) Educators examine conjectors made by students; this is important to be done to ensure the truth of the students' forecasts to go in the direction to be achieved. 5) If certainty has been obtained about the truth

of the conjecture, then the verbalization of the conjecture should also be left to the students to arrange it. 6) After students do what they are looking for. Educators should provide practice questions or additional questions to check whether the findings are weighty.

METHODS

This type of research includes developmental research (developmental research), namely the development of Modules. According to Sugiyono (2015: 407): Research and Development is a research method used to produce specific products and test these products' effectiveness. To produce specific products used, research that is needs analysis, and test the effectiveness of these products to function on the broader community, research is needed to test these products.

The steps of the R&D research method, according to Sugiyono (2015: 409), namely:

1. Potentials and Problems. The problem is a deviation between what was expected and what happened. SMP Negeri 2 Moyudan and SMP Muhammadiyah 10 Yogyakarta have the potential to have teaching materials in the form of student worksheets with the guided discovery method which is only applied to inclusive students. However, there is no teaching material in the form of modules developed by the teacher. Potentials and problems can be identified in various ways. In this case the researcher conducted an interview. They obtained information that the teaching materials used by students were difficult to understand, the unavailability of mathematics modules, the absence of teaching materials that made students active and independent.
2. Data Collection. The collection of various data that can be used as material for planning certain products that are expected to solve these problems. Data collection is very important to determine the needs of the user community for products that will be developed through research and development.
3. Product Design. The products produced in research and development are diverse. In the field of education, the products produced are expected to be relevant to the needs and improve the quality of education - educational products such as special curricula for certain educational needs, education, text books, modules, etc.
4. Design Validation. Validation is adjusted to the Ministry of National Education (2008: 30): Evaluation is intended to determine whether the teaching material is good or there are things that need to be improved. In this validation / evaluation activity, material experts, mathematics lecturers, and mathematics teachers evaluate the module material and media experts, lecturers who are competent in their fields. The ICT teacher evaluates the module design to identify its weaknesses and weaknesses. They are also asked to provide input to improve the module design.
5. Design Revision. Design revisions are carried out after the material and media experts validate the module. Design improvements are made based on input from material experts to overcome module weaknesses and deficiencies. To further refine design improvements, design improvements were consulted with material experts and media experts. After being declared perfect, the results of the design improvements can be tested on several students who will use them.
6. Product Testing. According to Sugiyono (2013: 414): In education, product design can be directly tested after being validated and revised. Product trials are conducted to determine the feasibility of the module being developed.
7. Product Revisions. Product revisions are made to correct deficiencies found in product trials.
8. Test Usage. After the product has been tested successfully, and there may be minor revisions, the product can then be applied to a wider range.
9. Product Revisions. This product revision is carried out if the use of a wider trial of weaknesses and weaknesses. In usage tests, the product must always be evaluated for deficiencies.
10. Mass Production. The results of this mass production were not carried out due to time constraints, labor costs, the development of a mathematical module based on a scientific approach to the material set for seventh-grade junior high school students was limited to product revisions.

Data obtained through a questionnaire by material experts, the media, and student responses are qualitative data that are then quantified. Provisions for scoring on qualitative data, according to Sugiyono (2015: 135) are as follows:

Table 1. Rules for Scoring

Information	Score
Very Agree (Very Good)	5
Agree (Good)	4
Hesitation (Enough)	3
Disagree (Inadequate)	2
Strongly Disagree (Not suitable)	1

From the data collected according to Soekarjo (2015: 55), an average can be calculated using the formula:

$$\bar{X} = \frac{\sum_{i=1}^{n} X_i}{N}$$

Information:

$\bar{X}_i$: Average score

$\sum_{i=1}^{n} X_i$: Total score

N: Number of assessors

Furthermore, after all the data have become qualitative using the guideline table criteria for the ideal assessment category, according to Sukarjo (2006: 52-53) with the following provisions:

Table 2. Ideal Assessment Criteria

Score Range	Qualitative Criteria
$\bar{X} > (M_i + 1{,}8 \times SB_i)$	Very good
$(M_i + 1{,}8 \times SB_i) < \bar{X} \leq (M_i + 1{,}8 \times SB_i)$	Well
$(\overline{M_i} - 0{,}6 \times SB_i) < \bar{X} \leq (\overline{M_i} + 0{,}6 \times SB_i)$	Pretty good
$(M_i - 1{,}8 \times SB_i) < \bar{X} \leq (\overline{M_i} - 0{,}6 \times SB_i)$	Less
$\bar{X} \leq (M_i - 1{,}8 \times SB_i)$	Very less

Information:

X_i: actual/empirical score

$\bar{X}_i$: ideal average

SB_i: ideal standard deviation

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

$$SB_i = \frac{1}{6} \times (\text{ideal maximum score} - \text{ideal minimum score})$$

After each aspect of the module is assessed by material experts, media experts, mathematics teachers in SMP / MTs, and VII grade students. The module value of each expert is determined, and the average score for the students' responses. The calculated score is then converted to a qualitative module value using the ideal rating category criteria, as outlined in the table above.

RESULTS AND DISCUSSION

Material experts who assess a mathematics module's feasibility based on discovery are guided by rectangular material, namely mathematics education lecturers and mathematics teachers. The results of the calculation of the assessment instruments by the material experts are as follows:

Table 3. Results of the Questionnaire Calculation of Material Expertise

No	Name	Score
1	Dra. Sumargiyani., M.Pd	115

2	Sri Widada., S.Pd	102
3	Maya Oktiani., M.Pd	89
Total		306
Mean		102

The table results show that the material expert lecturers and mathematics teachers' average score is 102 and is included in the very good criteria.

As for the media experts who assess the feasibility of a mathematical module based on a scientific approach to the set material, namely mathematics education lecturers and mathematics teachers. The results of the calculation of the assessment instruments by media experts are as follows:

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

No	Name	Score
1	Dra. Sumargiyani., M.Pd	132
2	Sri Widada., S.Pd	122
3	Maya Oktiani., M.Pd	108
Total		362
Mean		120.67

The above table results show that the average score of assessing media expert lecturers and mathematics teachers is 120.67 and is included in the very good criteria.

Student responses to the mathematics module based on the scientific approach to the set material are known based on the questionnaire results distributed to students in the first try and the second try. The results of calculating student response questionnaires can be seen in the following table.

Table 5. Results of Calculation of Student Response Questionnaire

No	Activity	Average score	Category
1	SMP Negeri 2 Moyudan	129,22	Very Good
2	SMP Muhammadiyah 10 Yogyakarta	134,35	Very Good
Mean		131,80	Very Good

From the two tests conducted, it can be concluded that the developed mathematical modules reach an average of 131.80, with the category of very good and very feasible to be used in the learning process.

CONCLUSION

Based on the research results of the development of mathematics modules based on guided discoveries on rectangular material for seventh-grade junior high school students, the following conclusions are obtained:

1. Relating to the development of mathematics modules based on guided discoveries on rectangular material for seventh-grade junior high school students by using the Research and Development (R&D) development model.
   a. This research was conducted based on the determination of the potential and problems that have been obtained. From the results of the interviews of the two schools, the problem found by researchers in learning that teaching material in the form of a publisher's book is difficult to understand, not yet developing a mathematics module based on guided discovery.
   b. Data collection is done by analyzing CS and BC and collecting references about rectangular material and determining the material scope presented in the module.
   c. Product design is writing and doing mathematical modules on rectangular material in the form of initial products.
2. Relating to the feasibility of a mathematics module based on the guided discovery of rectangular material for seventh-grade junior high school students is a product that has been prepared in the

form of initial products and then validated by material experts (mathematics education lecturers and mathematics teachers) and media experts (mathematics education lecturers and teachers mathematics), namely by filling in the formative instrument evaluation sheets of material experts and media experts. Revisions were made to improve the product. If there are improvements and input from material experts and media experts, then revisions will be made. The results of the module's eligibility by material experts reached an average of 102 in the very good category, and media experts reached an average of 120.67 with the very good category.

3. Relating to the results of students' responses from teaching materials in the form of a guided discovery-based mathematics module on rectangular material for seventh-grade junior high school students is a mathematical module that has been developed very well for use in the learning process based on the assessment of grade VII junior school students from SMP Negeri 2 Moyudan and Muhammadiyah 10 Yogyakarta Junior School obtained an average score of 131.80 in the very good category. So this module can be used in the process of learning mathematics.

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