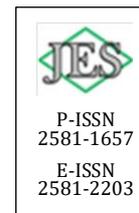




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Mathematical Learning Development using Discovery Learning Model to Improve Mathematical Understanding Skills of Students

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ABSTRACT

This study aims to produce a mathematics learning tool with a discovery learning model on rectangular and triangular material, with valid, practical and effective criteria to improve the mathematical understanding ability of grade VII students in junior high school. The type of research was development research with the design development using Borg and Gall. This study produced learning tools consisting of syllabus, lesson plans and student worksheets (LKPD). The results of the study showed that the learning tools met valid, practical and effective criteria. The validity of the product development was determined by expert validation with an average value of 4.46 with a very valid category. The practicality of the product development is determined by the teacher with an average of 99%, students 90.57% and observers 4.16 which is categorized as very practical while the effectiveness of the development product in terms of the achievement of learning objectives using KKM scores of 75 is obtained from the test results of mathematical understanding ability with the results there is an increase in learning outcomes using developed learning tools.

1. Introduction

The curriculum used in education in Indonesia uses the 2013 curriculum which requires educators to make learning plans before starting the learning process. Learning planning can be done one of them by developing learning tools. Developing learning tools must be in accordance with the circumstances and needs of students and meet the components of the regulation (Yulius, et al, 2017). This makes the device developed must be in accordance with the circumstances of

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students. Development of learning tools must pay attention to rules, targets and students so that they will produce good learning tools (Suarman, et al, 2018).

Based on the results of observations and analyzes conducted by researchers on the learning tools used by teachers in several junior high schools in Kampar: information was obtained that the learning tools used by teachers, such as the lesson plans prepared did not refer to the lesson plans components put forth by Permendikbud Number 22 of 2016, namely (1) competency achievement indicators have not used appropriate operational verbs; (2) the details of learning activities that are not in accordance with the learning model used, (3) the scientific approach has not been seen, (4) the learning model used has not been seen in the learning activities either in the syllabus, lesson plans or in the learning process. Learning resources used such as books and student worksheets (LKPD) provided in schools make more use by the publishers. The use of LKPD is only limited to the need for practice to do the practice questions after the material is delivered by the teacher. The LKPD does not contain learning activities that involve students directly in discovering mathematical concepts and does not encourage the development of thinking skills for students.

The results of several studies related to mathematics learning tools used in schools are not in accordance with the 2013 curriculum (Rahmiati, et al, 2017; Fatmawati, 2014). From the results of observations and analyzes conducted, it is necessary to develop learning tools for mathematics to help the implementation of the learning process by referring to the 2013 curriculum. Lismawati (Yennita, et al, 2018) in developing learning devices that refer to the 2013 curriculum requires a learning model that can help participants students in discovering the concept of learning and learning independently, then the learning model that is suitable for use is the discovery learning model. Illahi (Dina, et al, 2015) states that discovery learning is one of the models that allows students to be directly involved in teaching and learning activities, so that students are able to use their mental processes to find a concept and theory being studied, and demand to find a concept with the help of stimulus provided, this will make learning oriented towards students. Rahmiati, et al (2017) states discovery learning is a learning process in which the learning concept is not immediately presented, but students are asked to get their own concepts so students can find new concepts / information.

Learning tools that are not in accordance with the 2013 curriculum can result in learning outcomes not yet maximally in accordance with the learning objectives to be achieved, this is obtained from the results of interviews and observations conducted with several junior high school teachers in Kampar obtained results that students lack mastering the concept of learning, participants students cannot provide other examples of learning material, and students are not able to use concepts in solving problems, difficulties in using simple formulas or calculations, and students quickly forget about the material just learned. Because mathematics must be introduced to students through the process of thinking (Heleni & Zulkarnain, 2018). So the results of the interviews and observations show that the students' mathematical understanding ability is classified as low, especially in terms of rectangles and triangles.

Hendriana, et al (2017) state that mathematical understanding is a basic mathematical competency that includes the ability to absorb a material, remember formulas, mathematical concepts and apply in simple cases also formulas and theorems in problem solving. Natawidjaja (Muna & Afriansyah, 2016) states that mathematical understanding includes recognizing, understanding and applying mathematical concepts, procedures, principles and ideas. This shows that the material presented is not just for memorization, but students are expected to be able to understand and comprehend concepts.

Kurniawan (2016) states that rectangles and triangles are one of the main topics of discussion in mathematics which have several concepts and involve formulas in doing so. Khomsiatun & Retnawati (2015) states that rectangular and triangular material is one of the material that is difficult for students to understand because in quadrilateral and triangular structures there are concepts arranged hierarchically, and principles must be considered in order to develop students' ability to think logically, systematically, creatively, and objectively so that students can truly solve and solve mathematical problems.

The application of discovery learning model is an alternative to improve students' mathematical understanding ability in mathematics. Illahi (Dina, et al, 2015) states that discovery learning is one of the models that allows students to be directly involved in teaching and learning activities, so that students are able to use their mental processes to find a concept and theory being studied, as well as in discovery learning students are required to find a concept with the help of stimulus provided, this will make learning oriented towards students.

Based on the problem of the learning device, a mathematical learning device was developed with a discovery learning model to improve the ability of mathematical understanding in the quadrilateral and triangle material of class VII SMP. Researchers develop learning tools in the form of syllabus, lesson plans that are used as guidelines in implementing the learning process. Researchers also developed the LKPD that students use to investigate and construct knowledge about rectangular and triangular material with their instruments.

2. Methodology

The form of this research was development research. The development research model used was the Borg & Gall development model (Setyosari, 2013). Development procedures consist of: (1) research and data collection, (2) planning, (3) development of initial product drafts, (4) initial field trials, (5) revision of trial results, (6) main product field trials, (7) product revisions, (8) field trials, (9) revision of the final product. The subjects of this study were students of class VII SMPN 1 Kampar as many as 62 students in large-scale trials and 8 students in small-scale trials and 31 students in control classes. Data analysis techniques used in the study are as follows:

Learning Tools Validation Data Analysis

The validity assessment of the product in the form of a learning device with a discovery learning model was carried out by 3 validators consisting of two mathematics education lecturers from UIN SUSKA RIAU and one mathematics lecturer from Riau Islamic University. The evaluation by the validator uses a scale of 1 to 5 which can be seen in Table 1.

Table 1. Validator Rating Scale

Assesment Scale	Criteria
5	Very appropriate
4	Appropriate
3	Less appropriate
2	Not appropriate
1	Very not appropriate

The validation sheet analysis process was started from the tabulation process from the collected validation data. Then the tabulation data was converted to a percentage form with the formula:

$$P = \frac{\sum \text{skor per item}}{\text{skor maksimal}} \times 100\%$$

Describe the average score of each aspect obtained into qualitative data according to the assessment criteria of Widoyoko (2013) which can be seen in Table 2.

Table 2. Validity Criteria

Interval	Criteria
$4,2 < \bar{x}$	Very Valid
$3,4 < \bar{x} \leq 4,2$	Valid
$2,6 < \bar{x} \leq 3,4$	Less Valid
$1,8 < \bar{x} \leq 2,6$	Not Valid
$\bar{x} \leq 1,8$	Very not Valid

In Table 2, the validity criteria of the product developed are presented. The product developed is said to be feasible to try if a minimum level of validity is achieved based on the results of the validator assessment included in the valid category ($3.4 < \bar{x} \leq 4.2$) or worth testing with a small revision.

Practicality Data Analysis

Practical assessment was used by teachers and students and was also seen by observers of the learning device with the discovery learning model to improve the ability of mathematical understanding of the quadrilateral and triangle material developed. For teachers, the assessment sheets used were closed and open questionnaires. For a closed questionnaire using criteria such as very appropriate, appropriate, less appropriate, not suitable and very not in accordance with the scores

in a row 5, 4, 3, 2, 1. Open questionnaire was used to find out suggestions from teachers that will be used as a basis for revision. For students using a Likert scale with an assessment sheet made in the form of a closed questionnaire response to LKPD that has been used. Criteria for choice of yes or no answer with a score of zero (0) and one (1). And for observation sheets using criteria such as highly implemented, implemented, less implemented, not implemented and not very implemented with successive values of 5, 4, 3, 2, 1. The product developed was said to be suitable for use if a minimum level of practicality is achieved based on the observer's assessment results included in the practical category ($3.4 < \bar{x} \leq 4.2$) or feasible to use with minor revisions.

Data Analysis of Mathematical Understanding Ability

This mathematical understanding ability data was obtained from the results of the mathematical understanding ability test after the students learn using the developed learning device. Achievement of learning objectives that were developed and seen from the results of students mathematical understanding ability tests using the value of minimal completeness criteria (75). analyzed using One Sample Test t-test by looking for normality in advance using SPSS 24 software. After obtaining normally distributed data, it was followed by a one-sample t-test, by setting the KKM that was 75 on the test value (due to the achievement of the desired learning objectives based on the KKM 75).

The decision making:

If $\text{sig} < 0.05$, then H_0 is rejected there is an increase in learning outcomes using mathematical learning tools using discovery learning models on rectangular and triangular material. If $\text{sig} > 0.05$, then H_0 is accepted there is no increase in learning outcomes using mathematics learning tools using discovery learning models on rectangular and triangular material.

3. Results and Discussion

The results and discussion obtained, namely research and collection, is an analysis of needs obtained by initial information for product development. At this stage the researcher conducted a needs analysis including the analysis of learning devices which obtained information that the limitations of learning tools that refer to the 2013 curriculum used at school. In the analysis of the material, the material taught is quadrilateral and triangular material with details of the learning materials of the four meetings. In the analysis of learners obtained information that students need help to develop cognitive by facilitating a learning model that contains students to learn independently and find the concept of learning, the discovery learning model. Then Planning by designing a learning device format consisting of three components, namely Syllabus, RPP, and LKPD. The syllabus was developed based on graduate competency standards and content standards of Permendikbud No 22 of 2016 for primary and secondary education units. Syllabus development conducted by researchers only covers a few aspects, including: aspects of the distribution of subject matter, time allocation, and learning activities. The

Learning Implementation Plan (RPP) was developed from the syllabus to direct learners' learning activities in an effort to achieve Basic Competence (KD). The lesson plans are arranged in a complete and systematic manner so that learning takes place interactively, pleasantly, efficiently, giving rise to students' motivation to participate actively, as well as providing space to develop students' talents, interests, and physical and psychological development. Whereas the selection of LKPD format was adjusted to the format that was adapted from several experts.

After developing the initial product draft by developing the initial product format design. The cover of the development of the developed mathematics learning tool can be seen in Figure 1.



Figure 1. Cover of Mathematics Learning Tools

Furthermore, validating to assess the learning tools that have been prepared with discovery learning models on rectangular and triangular material for grade VII students of SMP / MTs. In the syllabus and RPP are assessed namely content and construction. And LKPD assessed content aspects, didactic aspects, construction aspects and technical aspects. Validation results obtained an average of 4.43. RPP and LKPD results can be seen in Figure 2.

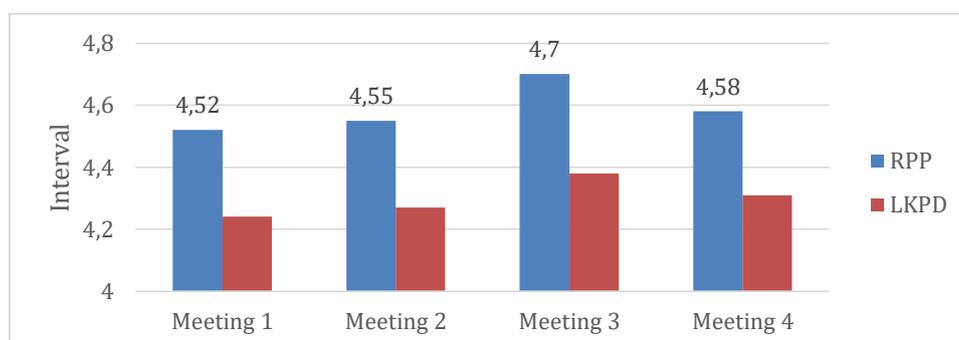


Figure 2. Results of RPP and LKPD validation

After the learning tools in the form of syllabus, lesson plans, LKPD and question instruments were finished, they were validated by the validator and continued

testing the use of the learning tools that have been developed. The results of small group trials The level of implementation of this learning device is obtained from the results of the questionnaire responses of students as much as 8 students with an average yield of 91.94% which is categorized as very practical. Based on the questionnaire responses of small group students, it can be concluded that the mathematics learning device the discovery learning model on quadrilateral and triangle material for grade VII students of SMP / MTs has a very practical level of implementation with an average of 91.94. After getting suggestions or deficiencies from the results of small group trials the product is revised according to the deficiencies found in small group trials. Furthermore, it was tested on a beasar group with a subject of 31 students. Based on the questionnaire responses of students and the response of teachers and observers found that mathematics learning tools with discovery learning models on quadrilateral and triangle material for grade VII students of SMP / MTs have a very practical level of implementation. Respondents stated that students could easily understand the learning material with the help of LKPD. With LKPD train students to find their own concepts and discuss with their respective groups to find solutions to rectangular and triangular problems. And the results of observations in large group trials can be seen in Figure 3.

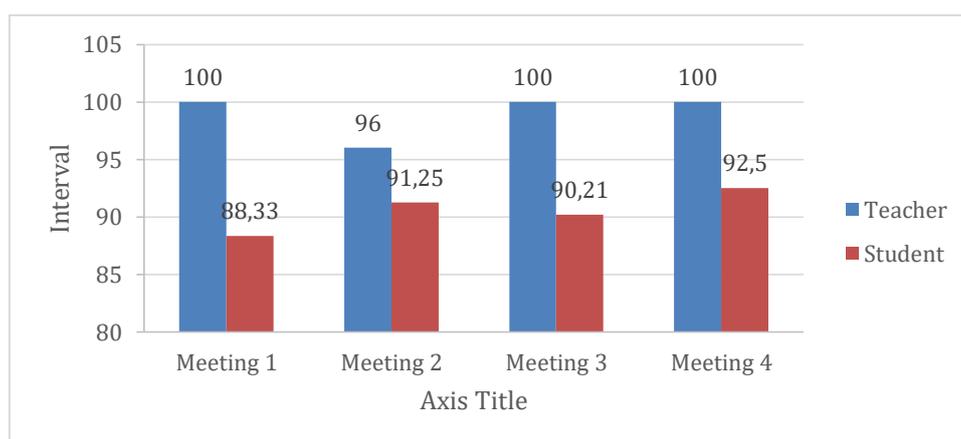


Figure 3. Results of Large Group Trials

Based on the results of the observation sheet on a large group trial, the learning tool uses discovery learning models on quadrilateral and triangle VII class material in SMP with a value of 4.16 can be implemented with the category of very practical.

Data Analysis of Mathematical Understanding Ability

In this effectiveness analysis, which is first analyzed the results of tests of mathematical understanding ability using the One Sample Test t-test by looking for normality in advance using SPSS 24 software. Based on the normality test, it is found to be significant $0.202 > 0.05$ so it can be concluded that the student learning outcomes data have a normal distribution. Thus the assumption of normality in the one sample t-test has been fulfilled. After obtaining the normal distribution of data, then in the one-sample t-test, by setting the KKM that is 75

on the test value (due to the achievement of the desired learning objectives based on the KKM 75) . Based on the result of sig 0.001 <0.05, H₀ is rejected, meaning that there is an increase in learning outcomes using mathematics learning tools using discovery learning models on rectangular and triangular material.

4. Conclusion

This development research has produced a product in the form of a book containing mathematical learning tools consisting of syllabus, lesson plans and LKPD with discovery learning models on rectangular and triangular material for junior high school / MTs students. This learning device is considered valid and practical after going through the validation process by experts and twice the trial phase to see the level of implementation of the mathematics learning device and effective way to improve students' mathematical understanding abilities. After conducting this research the researcher suggests to other researchers who conduct similar studies to pay more attention to the compatibility between students in groups because in the formation of discussion groups in this study, researchers only pay attention to the distribution of high, medium and low only, so that it can inhibit the interaction between students .

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