Validation of learning devices guided inquiry-based to increase problem solving ability mathematic participants in class VII SMP

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Abstract. This article discusses the validation of guided inquiry-based mathematics learning tools to improve students' mathematical problem solving abilities. Validated mathematics learning devices are Learning Implementation Plans (RPP) and Guided Inquiry Student Worksheets (LKPD). This validation is carried out by competent experts in their respective fields. RPP and LKPD are validated by 5 experts consisting of three mathematical education experts, one linguist, and one educational technology expert. Mathematicians validate aspects of content and presentation, linguists validate aspects of language while educational technology experts validate graphic aspects. Improvements from mathematicians to RPP are suggestions about improving the steps of learning activities that better illustrate guided inquiry while towards LKPD, the commands or guidance provided must be clear and not make students hesitant in working on LKPD and improve the illustration of the images used. Improvements from linguists to LKPD are changing the language in the referrer and the command mark must be added. Improvements from educational technology experts to LKPD are adding images to the cover. Overall, the average validation value of RPP and LKPD from the fifth has been valid, namely 3.10 which is in the valid category.

1. Introduction

The learning process in the 2013 curriculum emphasizes the principle of active student learning. This is in accordance with the principle of learning constructivism where in the view of constructivism, learning is the search for meaning (Muijs & Reynolds, 2008, p. 88). Learning is defined as an active process in which learners construct meaningful relationships between new knowledge given in learning with existing knowledge on learners (Kemp, Morrison & Ross, 1994, p.120).

In fact, the mathematical problem solving ability of students is still not optimal. This problem was encountered when a preliminary study was carried out in January 2018 in three junior high schools in the city of Padang, namely Padang 15 Junior High School, Padang 16 Junior High School and Padang 34 Junior High School. Preliminary study was carried out on students of class VII of the academic year 2017/2018 in mathematics. Most students have low abilities in mathematics. This is indicated by the following conditions: 1) students cannot answer the teacher's questions about the material preconditions
related to the material to be studied, 2) students rarely ask about material that has not been understood, 3) students cannot express problems with mathematical symbols or mathematical expression, 4) most students cannot solve problem solving problems in everyday life.

Mathematical problem solving ability at SMP 34 Padang is also still low, the low ability of students to solve mathematical problem solving is that students are less able to explore information / concepts contained in the problem, students have difficulty understanding the problem, it is difficult to translate questions related to daily life into language Mathematics, this can be seen from the results of the students' mathematical problem solving abilities given by the researcher, from the indicator questions that require children to be skilled at solving problems only a few children from each class can solve mathematical problems properly and correctly. The results of the problem solving ability test were given, the average problem solving ability of students was only 5.34 out of the 20 maximum scores that students had to achieve.

Problems with students' problem solving abilities were also encountered by previous researchers. Based on previous research conducted by Sugandi (2016) shows that the problem-solving ability of students of class VII IT SMP Hafifudin Arrohimah is still low, resulting in lower learning outcomes of students. This is because students think mathematics is one of the learning that is very difficult to understand and students are not accustomed to finding concepts themselves so that students have difficulties in solving mathematical problems. Based on the conclusions of several studies, it is seen that there is still a low level of mathematical problem solving ability of students.

The existence of textbooks is not the only means of learning for students at this time, although textbooks contain material as stipulated in the 2013 curriculum. Students also need to hold other learning resources so that learning is more lively and purposeful. One of the learning media that can be used, namely student activity sheets (LKPD). LKPD will provide benefits for teachers and students. The teacher will have teaching materials that are ready for use, while students will get an independent learning experience and learn to understand written assignments contained in the LKPD (Depdiknas, 2007).

Based on these problems the researchers tried to make a mathematics learning device based on the Guided Inquiry model. The learning device used is the Student Worksheet (LKPD) and the Learning Implementation Plan (RPP) using the 2013 curriculum. A good lesson plan can help implement effective learning. Successful learning programs require compatibility between what is learned and what students learn (Stringer, 2010, p.4). The lesson plan developed in this study is in accordance with the 2013 curriculum. In this study LKPD is designed so that students can find facts, concepts, principles, and mathematical procedures from the material being studied. The results of Syawahid & Retnawati's (2014, p. 19) study state that the use of integrated learning devices with emotional and spiritual intelligence developers is more effective than the use of learning tools available in schools in terms of student learning outcomes, besides that the use of learning tools is integrated with the development of emotional intelligence and spiritual is more effective than the use of learning devices that are distant in schools in terms of emotional and spiritual intelligence of students.

Given the role of learning devices in determining the achievement of learning objectives, of course a good or valid learning device is needed. Ideally, learning device developers need to re-examine the experts, especially regarding the accuracy of the content, subject matter, suitability with learning objectives, physical design and others (Suparman, 1997). Learning devices before being used in learning activities should be valid learning devices (Haryanto, 1997). According to van den Akker (1999) in McKenney, Nieveen & van den Akker (2002), the developed learning tools are said to be quality if they meet three criteria, namely validity, practicality, and effectiveness. Learning device is said to be valid if there is a consistent linkage of each component of the learning device that is developed with the characteristics of the learning model applied (Asikin & Cahyono, without years), said to be practical if the device is easy and can be implemented, and said to be effective if learning objectives can be achieved through use of developed learning tools (Nieveen, 1999). Thus, the validity, practicality and effectiveness of learning tools are very supportive in creating conducive learning and achieving the expected results.
Muhsetyo (2007: 35) “Guided Inquiry is an activity in which the teacher guides his students by using systematic steps so they feel they find something”. In this model students engage in answering questions from the teacher while the teacher guides students in the right direction. This model also has students' characteristics of active learning and is reflected in experience, students learn on what they know, students develop a series of thinking through guidance, student development can occur gradually, students have different ways of learning, and students learn to interact with social other people so that students' problem solving abilities can increase.

2. Research Methods
This type of research is development research. Meurut Sugiyono (2012) Research and development methods are research methods used to produce certain products, and test the effectiveness of these products. In this study the products produced by guided inquiry RPP and LKS.

The development of learning tools in this study adapted the development model initiated by Tjeerd Plomp. Plomp (2013) provides a development model consisting of three phases, namely, the initial investigation phase (preliminary research), the development or prototype phase (development or prototyping phase), and the assessment phase (assessment phase). This research only reaches the development or prototype (development or prototyping phase) or validation of experts who are competent in their fields.

In the initial investigation phase (preliminary research) is done as a determination of the basic problems needed to develop a guided inquiry-based learning device by conducting needs analysis, curriculum analysis, student analysis, and concept analysis. Furthermore, the results of this analysis are used as a reference to prepare matters relating to the development of guided inquiry-based learning tools. In the phase of development or prototype development (development or prototyping phase) a design for the development of guided inquiry-based learning is developed by taking into account aspects of content, language and presentation. At the same time, instruments of validity, instruments of practicality and instruments of effectiveness were compiled. Furthermore, the guided inquiry-based learning tools and supporting instruments were realized into products, so that the prototype was obtained 1. In the prototype-making phase (development or prototyping phase), formative evaluation was carried out. According to Tesmer (1993) there are four stages of the formative evaluation process, namely 1) expert review, 2) one-to-one, 3) small group, and 4) field test. In self-evaluation (self evaluation) is done evaluating prototypes that have been designed by the researchers themselves with the help of colleagues. The aim is to recheck the completeness of the components, content, language, and presentation contained in the learning tool. From the results of the evaluation itself and colleagues, revisions were made to the device of guided inquiry-based learning. After the prototype is believed to be good and as expected, then the assessment stage is done by experts or experts. An expert or expert assessment, that is, ask relevant experts or experts to provide an assessment and input to the prototype that has been designed by validating the guided inquiry-based learning device. An expert or expert assessment aims to see aspects of content validity and construct validity. The experts or experts involved in the prototype validation process are mathematical education experts, Indonesian language experts, and educational technology experts. By using a validation sheet, if the validation results show valid and feasible to use so as to produce prototype 2.

3. Results And Discussion
In accordance with the development model used in this study consisting of 3 phases, namely the initial investigation phase (preliminary research), the development or prototype phase (development or prototyping phase), and the assessment phase (assessment phase). Where this research only reaches the phase of development or prototype development (development or prototyping phase) or validation by experts. The details of the results of the research that have been carried out are as follows:

3.1. Preliminary Investigation
Preliminary investigations were carried out on grade VII students of Padang State 15 Junior High School, Padang 16 Public Middle School and Padang 34 State Junior High School. The results of the preliminary analysis are divided into results of needs analysis, results of analysis of students, curriculum analysis, concept analysis.

3.1.1. Needs Analysis. The needs analysis stage is done by gathering information to find out the problems found in the process of learning mathematics in school. Information gathering is done by observing teachers who are teaching and paying attention to the activities of students. Based on observations it appears that the learning process has not been carried out optimally. Seen the teacher still dominates class activities. Students still find it difficult to express when the teacher asks questions.

Based on interviews with several teachers, there were teachers who did not use LKPD on the grounds that they still had not had time to make LKPD themselves and only relied on printed books to convey the material to students. Whereas teachers who use LKPD state that LKPD that is used by students has not been optimal to help students to understand the material being taught. This is caused in LKPD, there are no steps for activities that help students to obtain their own knowledge.

One alternative solution to these problems is to provide learning tools especially in the form of LKPD that can support the achievement of the desired learning goals and LKPD can develop students' mathematical problem solving abilities. One learning model that can facilitate students to develop mathematical problem solving is a guided inquiry learning model. In addition, the LKPD developed must be able to attract the attention of students to use it.

3.1.2. Student Analysis. The next stage to find out the character of students other than through interviews with students is also done by distributing questionnaires. Characteristics of the first students that the ability to solve mathematical problems of students is still low is evident from the initial test of problem solving abilities given to grade VII students of SMP Negeri 34 Padang. Students still cannot understand the command questions because students have difficulty in understanding problem solving problems, students find it difficult to find a solution and sketch, and it is difficult to interpret the problem into mathematical forms.

3.1.3. Curriculum Analysis. At the stage of curriculum analysis, a review of the 2013 Curriculum for Mathematics in Grade VII of Junior High School was conducted. Curriculum analysis aims to guide the development of guided inquiry-based mathematics learning tools for students of class VII junior high school. The results of the KI and KD analysis contained in the content standards are translated into indicators of learning achievement. The material that will be used in the framework of developing the learning device is the mathematics material of grade VII junior high school odd semester. Among these material are integers, sets, algebraic forms and linear equations sat variables.

3.1.4. Concept Analysis. Concept analysis aims to determine the content and material needed to develop guided inquiry-based mathematics learning tools. The main concept is all the material contained in the subject matter presented in the guided inquiry-based learning tool.

3.2. Designing learning devices
After the learning indicator has been formulated, as well as the main concept is determined through needs analysis, curriculum analysis, concept analysis and analysis of students conducted during the initial investigation phase, it can be designed as needed. The following are the characteristics of guided inquiry-based RPP and LKPD that are designed.

3.2.1. Designing RPP. Learning activities, consisting of three stages, namely introduction, core and closing. In the preliminary activities there are activities to open learning, apperception and motivation. In the core activities there are activities that are in accordance with the phases of guided inquiry-based
learning and steps of the scientific approach. The phases of the guided inquiry-based learning model activities are formulating problems, hypothesizing, collecting data, analyzing data and concluding. Step by step the scientific approach involves observing, asking, gathering information, reasoning or associating and communicating. In the closing activity there are activities to conclude learning and direct for the next meeting.

3.2.2. LKPD Design. LKPD mathematics based on this problem solving has a size of 21 cm x 29.7 cm (size of A4 HVS paper). This size is chosen because it adjusts to the size of the LKPD commonly used by students. In addition, it will be accompanied by fields that must be filled by students, a large size will make it easier for students to work. The type of writing used in this LKPD is Christian ITC. ITC Christian fonts were chosen because the writing of this type is not too formal and will remain clear even though it is made small. While the font size used is 11-34. Font size depends on the position of the writing in the LKPD. LKPD presentation includes preface, table of contents, LKPD usage instructions, basic competencies, student activities, information, practice questions and bibliography. LKPD learning activities begin with presenting problems that must be resolved by students. Problem solving steps in LKPD are carried out by students by following orders or guidance in LKPD. By carrying out these activities students are expected to be challenged and trained to solve problems. The parts of LKPD that are developed are the same as the existing LKPD, but the difference is in the appearance and activities of the learning model.

Learning devices that have been developed are then named Prototype 1 which consists of Prototype 1 RPP and Prototype 1 LKPD. Then formative evaluation was carried out on Prototype 1 learning device.

3.3. Self Evaluation of Learning Devices
Self evaluation is assisted by colleagues to recheck the completeness of components, content, language, and presentation of learning tools. From the results of the evaluation itself and colleagues on the device of guided inquiry-based learning there are typing errors, sentences that are not clear meaning and punctuation errors that must be revised. After the prototype is believed to be good and in line with expectations, then the assessment phase is done by experts or experts.

3.4. Validation of Learning Devices
Prototype 1 learning devices that have been designed and evaluated themselves are validated. This validation is carried out by competent experts in their respective fields. Prototype 1 RPP and Prototype 1 LKPD are validated by 5 experts consisting of 3 mathematics education experts, 1 linguist, and 1 educational technology expert.

Prototype 1 RPP and LKPD Prototype 1 are validated by the five experts. Prototype 1 RPP validation by the five experts covers all aspects, but for the LKPD Prototype 1 mathematicians validate the content and presentation aspects, linguists validate language aspects while educational technology experts validate graphic aspects.

3.4.1. RPP Validation Results. Learning tools were validated by 5 validators, namely 3 mathematics expert lecturers, 1 education technology lecturer and 1 Indonesian lecturer. In RPP the aspects observed are aspects of RPP identity, indicators of competency achievement, learning objectives, teaching materials, models, approaches, strategies and methods of learning, steps of learning activities, learning resources, assessment, writing language, and RPP benefits.

Arikunto (2009: 80) states that "Valid conditions are considered fulfilled because the instrument in question has been well designed, follows the existing theories and provisions". This means that the mathematics learning device uses a guided inquiry model with a scientific approach that is in accordance with Permendikbud No. 81A of 2013 concerning curriculum implementation.

In the validation process there are several revisions of the device produced in the prototype 2. In the RPP it is recommended and revised that the syntax of guided inquiry models with scientific approaches are more clearly detailed, the problem solving steps write in the form of commands, the determination
of indicators from KD knowledge that will be achieved is found in KI-3 and KI-4 and Indicators from KI-1 and KI-2 are associated with assessment of attitudes (affective) and skills assessment.

Besides that, the writing of learning objectives that have not been compiled in ABCD (audience, behavior, condition, degree) and the closing part of learning should be written down the next material that students will learn.

After improvements are made based on the advice of the validator, the RPP is validated again by the validator. Overall RPP developed is said to be valid with an average of 3.32. So, it can be concluded that the inquiry-based mathematics lesson plan for students of class VII SMP has been valid. Prototype 1 RPP that has been valid is then named Prototype 2 RPP.

3.4.2. LKPD Validation Results. Prototype 1 LKPD is validated by 5 experts who validate according to their respective expertise. In the LKPD aspects observed are aspects of mathematics or presentation, material and content aspects, linguistic aspects, and graphic or display aspects. During the validation process, there are several suggestions for revising the LKPD. Furthermore, LKPD was revised based on suggestions from the validator.

Based on input from the validator, a revision of the Prototype 1 LKPD was carried out. Before being validated there are still problems with LKPD that are not yet appropriate. Improvements made to LKPD based on the advice of the validator are problems that have not been replaced. Improvements to the problem are also followed by improvements to the illustration images used.

Another suggestion from the validator is that at every step of the activity must be given clear instructions to students so that students understand the command and can run activities as expected. After repairing the problem and the command, then the activity command becomes clearer and easier to understand. The part that is also improved on LKPD is the placement of KD positions. Before the improvement of the KD position in LKPD is shown before the title of the material. The validator's suggestion in terms of language, one of which is to change the language in the LKPD usage instructions. Validator's suggestion in terms of graphics one of them is to reduce the image on the cover.

After improvements were made to the Prototype 1 LKPD, then the LKPD was returned to the experts to be validated. Based on the validation obtained that in the aspect of presentation and feasibility of content, LKPD obtained a validity value of 3.15 or in the valid category. So it can be said that the LKPD developed has been valid in terms of presentation and feasibility of the contents. Furthermore, the results of LKPD validation by educational technology experts obtained the validity value of 3.12 which is in the valid category. This states that LKPD has been valid in terms of graphics. While the LKPD validation value by language experts is 3.18 which is in the valid category. So it is known that in the graphic aspect, the developed LKPD has been valid. Overall, the average value of LKPD validity from the five validators is 3.10 which is in the valid category. So it can be concluded that LKPD mathematics based on problem solving for students of class VII SMP developed valid. Prototype 1 LKPD that has been repaired and validated is then named Prototype 2 LKPD.

4. Conclusion
This research is a development research that produces guided inquiry-based learning tools. The tool is in the form of RPP and LKPD class VII on odd semester material. From the results of the development with the Plomp development model which consists of three stages: the preliminary research stage, the development stage and the assessment phase. The research only reached the stage of the battle or prototype 2 assessment from experts. Learning devices based on guided inquiry learning model developed by researchers from this study have met the criteria for product quality that is said to be valid based on the assessment of experts.

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