Development Of Students Worksheet Mathematics Based On Problem Based Learning (PBL)

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Abstract: *Critical thinking skills must be part of student learning, and the school must be responsible for developing and evaluating critical thinking skills in the learning process. Efforts that can be made to improve critical thinking skills include promoting learning aids in the form of student-based problem-based learning worksheets. This study aims to design learning tools in the way student worksheets are based on problem-based learning. The method used in this study is the 4-D method which includes the stages of Define, Design, Development, and Disseminates. Data collection instruments in the form of expert validation instruments to measure validity as well as student questionnaires to measure practicality and obtain development product assessment from experts and students. The results of the validation data analysis by two validators stated that the validity level was 3.58 for the aspect of the worksheet content, the validity was 3.50 for the constructed aspect and 3.67 for the language aspect. This shows that the suitability of worksheets developed in all three elements of validation is good. After validation, the worksheets were tested on 23 VIII grade 2 students at Gunungkidul MTs, and the results of the trial said that the LKS received a good response from students and was practically used in the learning process of mathematics in the classroom.*

Keywords: *Student Worksheet, Critical Thinking, Problem Based Learning*

INTRODUCTION

Critical thinking is a complex concept that involves cognitive skills and affective dispositions that affect the way the teacher presents ideas to students (Chukwuyenum,2013). Critical thinking skills in mathematics are critical thinking processes related to mathematical knowledge, mathematical reasoning, and mathematical evidence in Indonesian mathematical problem solving (Rohaeti,2010). Critical thinking is one of the skills of the 21st century that is needed by students (Mason,2010). 21st-century skills require a person to achieve success professionally and have the ability to think critically (Rajendran,2010).

In research (Merdekawati,2011) the development of critical thinking skills can improve mathematics achievement. Critical thinking skills will encourage students to think independently and solve problems in school or the context of everyday life (Jacob,2012). In the study (Putra,2017) evaluation of the thinking of Student Critical Thinking in Mathematics Learning uses three components, namely (1) identification and interpretation of information, (2) information analysis, and (3) evaluation of evidence and arguments. Mathematics is one of the subjects that can develop critical thinking skills (Inan,2017). According to (Facione,2011) the most basic concepts of critical thinking are evaluation, self-regulation, inference, explanation, interpretation and analysis ability. Critical thinking skills in mathematics are closely related to problem-solving (NCTM,2000).

However, the education system in Indonesia is still focused on graduating students during national exams. Therefore the practice of teaching focuses on subject content and ignores the development of students' thinking skills (Zulyadaini,2017). According to TIMSS study data in 2011, students' thinking ability in Indonesia is at a low level, which is ranked 38th out of 42 countries (Mullis,2012). Meanwhile, the results of the 2012 PISA survey found Indonesian students in positions 64 of 65 states in mathematical thinking skills (OECD,2014).

Problem-Based Learning (PBL) is learning that results from the process of working towards understanding and resolution of problems in a real context (Barrows,1980). PBL deliberately

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combines cognitive and teaching metacognitive learning (Mattews,2007). This method gives students the opportunity to explore, investigate and solve problems (Arends,2007). Therefore, PBL is trusted to help students produce new knowledge and also encourage students to think critically through various processes of solving problems (Herman,2007).

Based on the results of observations of mathematics learning in VIII grade of Gunung Kidul MTsN 2, in the learning process that takes place, the teacher still dominates learning activities. The teacher gives the definition and decrease of the formula, the problem-solving steps are followed by students, students only listen and develop all the ways the teacher works, students are also less motivated to argue about the material delivered by the teacher, so that the students' learning experiences in constructing their knowledge by thinking still needs to be improved. In solving or doing practice exercises, some students write the final answer, without writing down the steps to complete it. So if given more different questions, students are still confused to finish and use the logic to think in solving mathematical problems according to the steps described by the teacher.

Based on research (Isrokijah,2015) Worksheets are considered reasonable and can support the learning process through the development of PBL-based worksheets in improving students' critical thinking skills. According to (Arends,2007) stated that the relationship between PBL and critical thinking is where students are faced with real problems so that they are expected to develop their knowledge, high-level skills of students develop, students become independent and increase trust. One method that can help students to develop critical thinking is the Problem Based Learning (PBL) method (Herman,2007). Mathematics learning can develop critical thinking skills in mathematics requiring complex mathematical tasks that can encourage higher-order thinking skills (Henningsen,1997). High-level mathematical problems involving thinking, analysis, synthesis can stimulate students' critical thinking skills (Aizikovitsh,2015). Thus complex problem-solving activities will improve students' understanding and can apply knowledge built in new situations (HEnningsen,1997).

Efforts to develop critical thinking skills in mathematics have become the main agenda in the mathematics education curriculum around the world (Mason,2010). Efforts that must be carried out on an ongoing basis use various methods and appropriate learning in developing critical thinking skills (Rajendran,2010). Attempts were made to overcome essential thinking one of them with student worksheets (Ananda,2016).

From the above problems, it is indicated that students' abilities are in building knowledge in solving mathematical problems still needs to be improved (Izza,2018). To improve students' critical thinking, one of them is by developing student worksheets with PBL models. This study aims to design learning tools in the form of PBL-based student worksheets for VIII grade students of Gunung Kidul MTsN 2 Indonesia.

Artikel ini ditulis untuk mengusulkan desain pengembangan Lembar Kerja Siswa (LKS) berbasis Problem Based Learning untuk kelas VIII MTS. Lks ini diharapkan dapat meningkatkan berpikir kritis siswa dan hasil belajar siswa.

METHOD

This research is a development research in the field of mathematics education which aims to produce learning tools in the form of student worksheets (LKS) based on proper (valid, practical, and useful) Problem Based Learning (PBL) (Perwitasari,2017) by using stages of development research 4 -D (Thiagarajan,1974). However, this research is limited to measuring the level of validity and practicality of LKS. These stages are as shown in Figure 1.

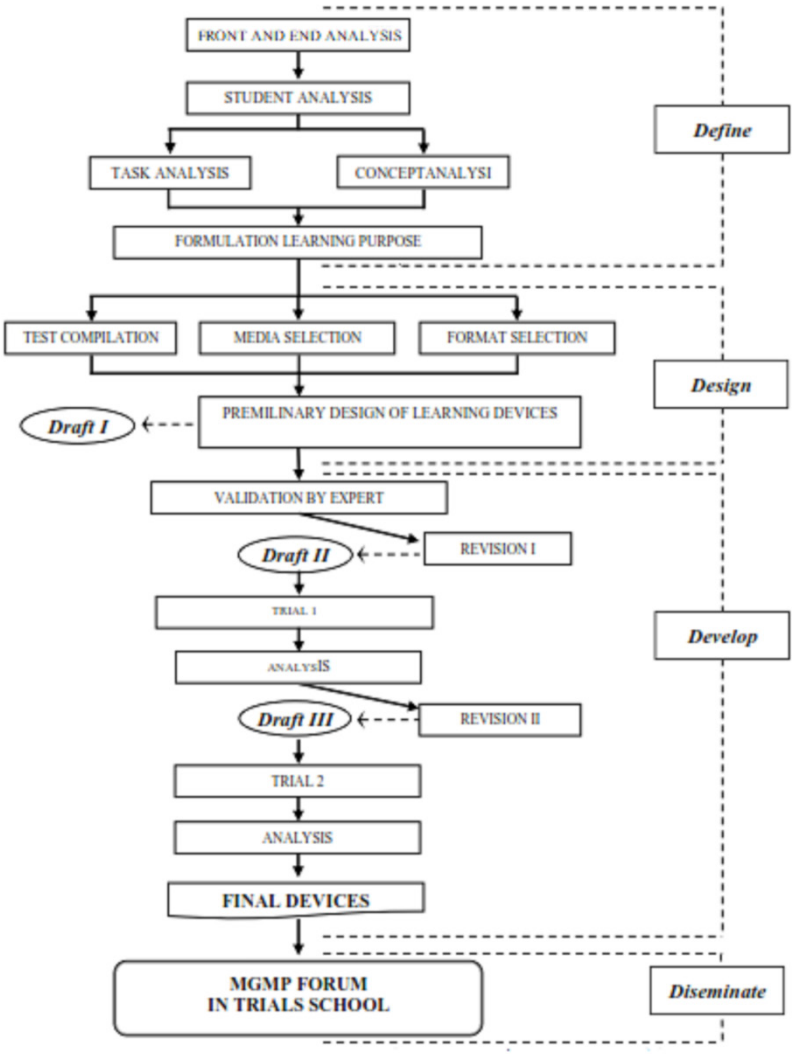

Figure 1. Chart Development of Learning Devices with 4-D Model

This research was carried out in MTs N 2 Gunungkidul. The subjects of the research were the eighth-grade students of Gunungkidul 2 MTs N 2, which consisted of 23 students. The research instrument was also developed in the study in the form of validation sheets and student response questionnaires. The LKS validation sheet is addressed to an expert (one lecturer) and practitioner (one math teacher) then to see the level of practicality of the product a student response questionnaire is used. a). Instruments to validate worksheets are compiled and adapted to the curriculum. The measurement is done by filling out a questionnaire in the form of a rating as well as qualitative advice from experts for product revision considerations. The level of validity of learning products is seen through scores obtained from the results of completing the validity sheet of the device by experts.b) To measure the level of practicality of the product a student response questionnaire was used. The questionnaire sheet is given in the form of a rating that will be processed quantitatively, while student comments are used for consideration of device revisions.

In the development of this worksheet, revisions will be made if the results of the validation score and the results of student response questionnaires are categorized as lacking if there are suggestions for improvement from the validator and students when carrying out the trial.

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RESULTS AND DISCUSSION

This research was conducted by designing PBL-based mathematics LKS for students of class VIII MTsN 2 Gunung Kidul. The following are the results of the development design with 2-D stages. This result was obtained from observations and interviews by students and teachers at MTsN 2 Gunung Kidul.

1. Results of the Defining Stage

   a. Defining

   Based on observations of class VIII MTs N 2 Gunungkidul requires worksheets based on problem-based learning because students need to understand the problem presented so that it is easier to find a mathematical concept by constructing itself through knowledge. PBL-based worksheets are considered necessary because they can train students in solving problems, thinking critically and being able to improve students 'understanding of mathematical concepts so that students' mathematics learning outcomes will also increase.

   b. Design

   LKS products are developed by looking at the aspects of validity and practicality. Also, the selection of appropriate media is carried out so that it can be used in presenting the contents of the teaching. The initial design was carried out to design LKS products based on the results of the analysis that had been carried out in the define stage. Figure 2 shows the design of PBL-linked LKS that has been developed.

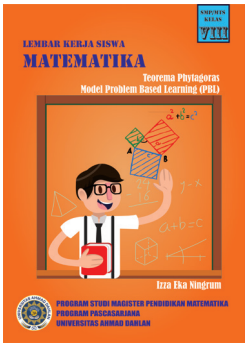


Figure 2. PBL Approved LKS

   a. Development

1. Expert Assessment (Validity)

   Haris Rizqi Arifin (2014) The existence of LKS as a student workbook must be effective as a learning tool both in terms of content, practicality, and appearance. Based on the results of the evaluation of the learning tools by experts, Table 1 presents the results of the expert evaluation of the LKS products.

Table 1. LKS validity test results by expert validators and practitioner validators

Table 1: The test results of student worksheet validity by expert validators and practitioner validators

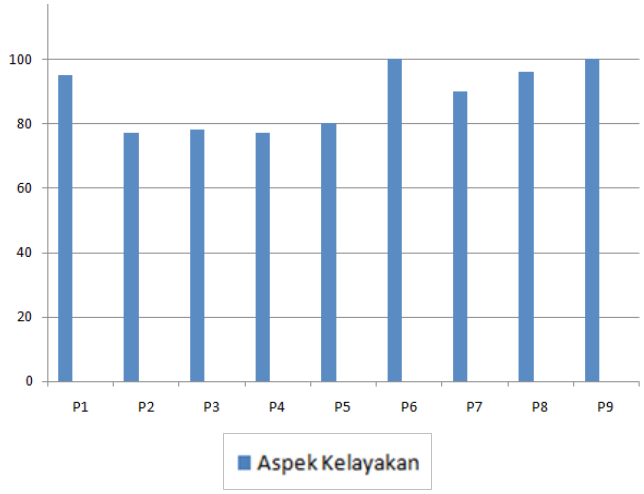
	Level of validity	*Validity criteria*	*Description*
Student Worksheet contents	3,58	Valid	No revisions needed
Construct	3.50	Valid	No revisions needed
Language	3,67	Valid	No revisions needed

The results of the analysis can be concluded that the LKS products that have been developed meet the stringent minimum criteria so that they can be tested in schools to

see other eligibility criteria in learning activities. Nieveen (2007) states that the validity of learning devices must be reviewed based on content validity and construct validity. However, the revision was still carried out by the researcher based on the comments and suggestions of validator experts and practitioners.

2. The practicality of Learning Devices

Analysis of the practicality of the learning device is done to see the results of the practicality test of LKS namely the results of filling out questionnaires by students. The questionnaire is filled after a series of LKS work is completed. Graph 1 presents the results of the students' assessment of LKS products.



Graph 1. Results of testing the practicality of student worksheets

Based on the results of filling out the questionnaire, 95% of students stated (P1) Student Worksheet with PBL approach is easy to understand because it is easy to observe and clear usage instructions, then 77% stated (P2) Design of Student Worksheets (LKS) is more interesting than the design of Student Worksheets usually because it looks simpler, then 78% states (P3) Context and pictures on student worksheets (LKS) with PBL approach attract students' learning interest because the problems provided are related to the life of the surroundings, then 77% of students state (P4) problems and the exercises on the Student Worksheet (LKS) are easier to learn, then 80% state that P (5) Student Worksheets (LKS) is made based on the concepts of real-world problems making learning mathematics feel more meaningful. Then 100% of students stated (P6) Student Worksheets (LKS) with the PBL approach had a lot of learning activities that made students more active and critical in the learning process, then 90% of students stated (P7) LKS with the PBL approach directed you in finding a concept and make students more easily understand math lessons, then 96% of students stated (P8) Student Worksheets (LKS) with PBL approach easy to carry, and 100% stated that P (9) LKS with PBL approach was easy to do.

Overall the practicality criteria for each aspect/indicator of LKS is practical and does not need revision. This shows that the developed worksheets have been suitable for use in the learning process. Achmad Dhany F (2013) Student worksheets can be used directly by students and students will get the opportunity to study independently according to worksheet assignments. For implementation With a good learning approach, student worksheets are needed using the PBL approach.

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CONCLUSION

This study develops Student Worksheets (LKS) based on a valid and practical Problem Based Learning (PBL). The content of LKS material based on Problem Based Learning also emphasizes students to build a concept in learning by giving a problem to build the level of critical thinking of students. The results of the validation data analysis by two validators stated that the validity level was 3.58 for the aspect of the worksheet content, the validity was 3.50 for the constructed aspect and 3.67 for the language aspect. This shows that the suitability of worksheets developed in all three aspects of validation is good. After validation, the worksheets were tested on 23 VIII grade 2 students at Gunungkidul MTs, and the results of the trial said that the LKS received a good response from students and was practically used in the learning process of mathematics in the classroom.

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