Designing Student Worksheets To Improve Critical Thinking Ability Based On Problem Based Learning

Bunga Putri Syafina, Suparman

Abstract: The purpose of this study was to develop the plan of student worksheets based on Problem Based Learning to improve the critical thinking skills of seventh-grade students. This study uses the ADDIE development model which includes five stages, namely analysis, design, development, implementation, and evaluation. This research only reached the design stage. The subjects of this study were seventh-grade students of MTs Muhammadiyah 1 Berbah and SMPN 1 Depok. The objects in this study are student characteristics, evaluation of teaching materials and curriculum. This study produced a design analysis of Student Worksheets consisting of the initial section (cover, catalog in publications, preface, table of contents, instructions on materials of Student Worksheets, instructions for using Student Worksheets, concept maps, core competencies and necessary competencies, mathematical history), content section (learning activities using Problem Based Learning steps, summaries, and evaluations) and the final chapter (glossary and bibliography).

Index Terms: Critical Thinking Skills, Student Worksheets, and Problem Based Learning (PBL).

1. INTRODUCTION

The development of the industrial world is increasingly rapid in line with the demands of the world of education, especially Indonesia in improving the results of professional graduates and preparing excellent human resources in creating innovative products [1]. So that mathematics is a subject that must be mastered early because it is a tool/means of learning other fields of science [2]. Because of the development of 21st-century education students is expected to be able to prepare the ability to master various skills, especially creative thinking skills to become increasingly advanced people in life [3]. Mathematics also has a significant contribution in achieving abilities such as the ability to connect, communication skills, problem-solving, the ability to represent (representation) reasoning and evidentiary abilities [2]. In the technological era in designing a learning material that is good will have the desired learning outcomes and facilitate learners in achieving learning needed to play a unique role in the teaching and learning process with a variety of methods, techniques, and learning materials that are increasingly developing [4]. Student worksheets are one of the tools in the learning process to be able to facilitate students in learning to more easily understand mathematical concepts [5]. Schooling student worksheets are often used but have not been based on a particular learning model so that it does not improve good learning outcomes [6]. Based on the results of previous studies through the design of student worksheets with developing learning models is one alternative to be able to improve the ability to learn mathematics which is included in the 21st century [3]. Based on several studies [7] - [12] Student worksheets contain summaries of mastery of learning that must be done by students to improve learning outcomes because interactions can occur between instructors and students. This was also revealed by other researchers, namely student worksheets containing lesson identities, curriculum units to be achieved by students, learning activities, systematic preparation of materials, sample questions, easy-to-understand answers, and formative and summative questions [14]. Problem Based Learning (PBL) learning model is an innovative learning. [5]. Problem Based Learning (PBL) is learning designed by the teacher to demand students to obtain critical knowledge, independent learning strategies, team participation skills and problem-solving skills [13]. Problem Based Learning learning can be clearly defined through comparison with Problem Based Learning (PBL) [14]. Problem Based Learning (PBL) is a student-centered learning strategy for solving unstructured problems [15] - [16]. A teacher presents a problem for students so that they can involve a goal, existing problems, gain experience and develop solutions with discussion, and assessment [17]. Problem Based Learning (PBL) makes teachers change their educational roles and rethink in developing factual learning in order for students to acquire and compile knowledge in an efficient and structured way [18]. Students discuss in small groups so as to produce hypotheses about cases and learning objectives then discussion outside the classroom to fill in the lack of information then gather again to teach each other and solve problems [13]. All fields of education are interested in teaching students for critical thinking because critical thinking is an important and vital topic in education in the modern era [19]. Students must be taught critical thinking skills explicitly and are expected to practice them as early and as often as possible [20]. The concept of critical thinking dispositions is at least as important as critical thinking skills and disposition ideas have been applied in the conception of critical thinking [21]. Critical thinking skills consist of sub-skills such as analyzing, evaluating and concluding so that it is a metacognitive process [22]. Essential skills of thinking include several activities such as logical reasoning including analyzing, synthesizing, reducing, reducing, and inferring [23]. In preparing for the 21st-century generation, critical thinking insights showed a significant contribution [24]. The ADDIE model is a teaching system design process developed by B. Seel and Z. Glasgow, by taking the initial letters of each of the five components, namely Analysis, Design, Development,

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Implementation, and Evaluation [25]. Depending on the ADDIE design model, the teaching design model is the most popular, because the stages are adjusted in detail [26]. Another thing expressed by experts is that the ADDIE model provides detailed specifications aimed at making and measuring practical and systematic learning. [27]. The ADDIE model consists of five stages, namely analysis, design, development, implementation, and evaluation. Each stage has learning objectives so that students can achieve good results but there is a key, namely content to students who will spend time studying independently with a flexible approach as an effective tool [25]. Based on several researchers' opinions that have been described above, it can be concluded that the development of the world in various fields is increasingly advanced, especially in developing critical thinking skills. Critical thinking needs encouragement from learning that requires students to achieve these abilities. Problem Based Learning (PBL), learning is one of the lessons designed by the teacher in demanding students get the results of critical knowledge, independent learning strategies, and skills. This study aims to improve the critical thinking skills of seventh graders by developing the design of student worksheets based on the Problem Based Learning (PBL) learning model.

2 RESEARCH METHODS

The type of research conducted is development research. The product to be developed in this study is to improve the critical thinking skills of seventh grade students, namely to design student worksheets based on Problem Based Learning (PBL). This research model uses the ADDIE development model which includes five stages, namely analysis, design, development, implementation, and evaluation. Data analysis using Miles and Huberman consisting of data reduction, appearance, and conclusions. The research subjects included VII grade students of Muhammadiyah 1 Berbah MTs and Depok 1 Public Middle School. The objects in this study are student characteristics, evaluation of teaching materials and curriculum. The instrument for collecting data uses observation guides, interview guides, and questionnaires. Guidelines for observation are conducted to find out the learning process with the curriculum and characteristics of students. The interview guide is used to retrieve data about evaluating teaching material sources. The stages of development in this study can be seen in Figure 1. This research has been carried out until the design stage.

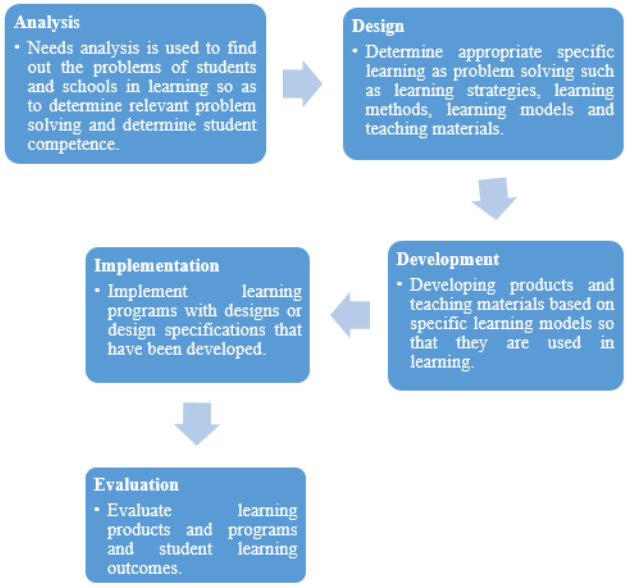

***Figure 1**. ADDIE Development Flow*

3 RESULTS AND DISCUSSION

This study uses the ADDIE model (Analysis, Design, Development, Implementation, and Evaluation) which stands for taking the first letter of each step of the research. The first step in ADDIE is analysis. At this stage there are two stages, namely performance analysis and needs analysis. The analysis was carried out observations and interviews with mathematics teachers and secondary school students. Before conducting interviews and observations, researchers make interview guidelines and observation guidelines as a reference to get what information. Performance analysis is carried out to clarify and find out the performance problems at school that are being faced so that it requires problem solving solutions in the form of improving management or organizing learning programs such as low motivation for achievement, work saturation, it is necessary to renew in school work. Furthermore, a needs analysis is carried out to analyze the needs of students in school so that they can give an idea of the problem solving that will be done. Can determine the abilities that have been learned by students in improving learning outcomes. Based on the results of interviews and observations of problems at school is how to improve student achievement with modern performance because so far the skills and achievements of students are still unexplored. Researchers get information on student characteristics, overall background from students such as age, level of knowledge, and interests. In mathematics lessons students in the comparison material still cannot be mastered well by students based on the results of the previous students' daily tests. Students want a teaching material that can make it easier to understand the comparison material. Furthermore, curriculum analysis is carried out by conducting a literature study which includes material analysis, Competency Standards (SK), Basic Competence (KD), learning indicators, learning activities, assessment, time allocation, and learning resources used. The basic competencies found in the order and material in the series are in Table 1.

Table 1 Basic Competencies Basic

No	Basic Competencies Basic
3.8	Distinguish comparisons of values and turn values using data tables, graphs, and equations
4.8	Resolve problems related to comparison of values and turn around values

The second step in this stage is design. Students cannot achieve learning outcomes in accordance with predetermined competency standards after going through the learning process so students need teaching material that is student worksheets that can improve learning outcomes with certain learning models. So that researchers develop student worksheets then design the contents of the worksheets of students adjusting the learning process in accordance with a specific learning model. The researcher uses the Problem Based Learning (PBL) learning model in the comparison material then designs the learning according to the learning model and student characteristics. Students are trained to analyze a problem so that it becomes more critical in mathematical thinking. Problem Based Learning (PBL) has a step of learning can be seen in Table 2 as follows.

Table 2. Steps to Learning Problem Based Learning

No	Learning Objectives
1	Student orientation to problems
2	Organizing students to learn
3	Guiding investigation
4	Presenting and developing the work
5	Evaluate and analyze problem-solving processes

Next, the researcher outlines the contents of the student worksheet, the student worksheet design, and the student worksheets assessment instrument. An outline is carried out for the initial plan develop student worksheets to fit the curriculum analysis carried out in the previous stage. The design of the contents of the student worksheets developed consists of several components including cover, catalog in issue, preface, table of contents, instructions on the contents of the text, instructions for use, concept maps, core competencies and basic competencies, mathematical history, learning activities using Problem Based Learning steps , summary, evaluation, end of glossary and bibliography. The third step in ADDIE research is development. At this stage the product development of the Student Worksheet matches the results of the previous step.

3.1. Cover Student Worksheets

The cover page consists of student worksheets title, user target, author name, and agency name. The cover image is made with CorelDraw as attractive as possible to prepare students motivated to use the developed worksheet. The cover of development can be seen in Figure 1.

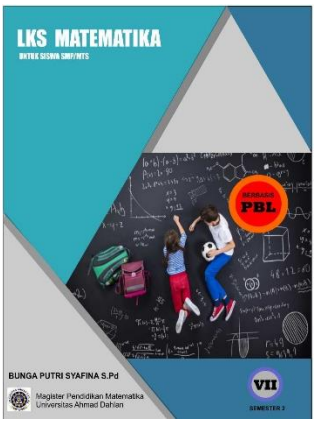

Figure 2 *Cover*

3.2. Preference

The preface contains a statement of gratitude for the completion of the math worksheet developed and thanks to those who have helped in completing the student worksheet. The introduction can be seen in figure 3.


KATA PENGANTAR

Puji syukur atas kehadirat Allah SWT yang telah melimpahkan rahmat, hidayah, dan karunia-Nya sehingga penyusunan Lembar Kerja Siswa (LKS) berbasis model pembelajaran *Problem Based Learning* untuk siswa kelas VII SMP/MTs dapat terselesaikan.

LKS disusun dengan tujuan untuk melatih siswa dalam memahami materi perbandingan senilai dan berbalik nilai secara lebih terperinci. LKS yang dikembangkan dengan model pembelajaran *Problem Based Learning* dilengkapi dengan beberapa soal dalam berpikir kritis. Penyajian LKS ini sangat sederhana dan mudah dipahami.

Ucapan terima kasih kepada semua pihak yang telah membantu dalam penyusunan LKS ini. Semoga LKS ini dapat memberi maanfaat bagi siswa dan khususnya bagi semua pihak yang membutuhkan serta dapat dijadikan panduan untuk mempelajari konsep perbandingan seilai dan berbalik nilai.

Yogyakarta, Januari 2019

Penyusun

LKS Matematika Kelas VII Semester VII iii

Figure 3 *Preference*

3.3. Concept Map

The concept map contains an outline of the material mapping in the student aimed at facilitataing student to see the mapping of the to be studied. The student worksheet concept map can be seen in figure 4.

Figure 4*: Concept Map*

3.4. Basic Competencies (KD) and Core Competencies (KI)

KD and KI contain indicators of what students must achieve when learning to use student worksheets. Basic Competencies (KD) and Core Competencies (KI) student worksheets can be seen in Figure 5.

Figure 5 *Basic Competencies (KD) and Core Competencies (KI)*

3.5. Learning activities based on Problem Based Learning (PBL)

Learning activities contain material, examples of questions and practice questions. The material is outlined so that students can understand the material. Examples of problems are given according to Problem Based Learning steps and are appropriate in the real world. Practice Questions to find out how students 'abilities in responding to the material that has been studied and become a benchmark for students' understanding of the completeness of learning objectives. Learning activities can be seen in Figure 6.

Figure 6 *Learning activities based on PBL*

3.6. Summary

The summary concludes the comparison material briefly. The goal is to make it easier for students to understand and recall the outline of the material that has been studied. A summary can be seen in figure 7.

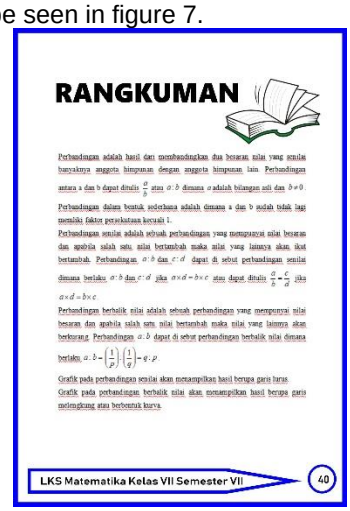

Figure 7 *Summary*

3.7. Evaluation

Evaluations are presented in the form of multiple choices and brief descriptions. The aim is to evaluate student learning outcomes in understanding the material that has been studied. The evaluation in this study can be seen in Figure 8.

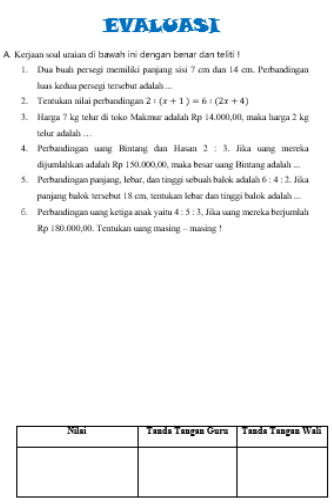

Figure 8 *Evaluation*

Some input and suggestions from material experts that have been summarized can be seen in Table 3.

Table 3 Inputs and suggestions from experts by a validator

Suggestions and comments	Follow up
Add questions from simple to more difficult ones	It's been fixed from a simple problem
Describe proportions	A description of proportion has been added

Inputs and suggestions from the validator were then revised. Assessment is carried out by two validators namely the teacher. The results of the teacher questionnaire calculation about the designs developed can be seen in Table 4.

Table 4 Questionnaire Calculation Results Feasibility of Media

No	Appraisal	Position	Score	Criteria for Quantitative Data
1.	Sarjono, S.Pd	Teacher in Mathematics study at SMP N 1 Depok	32	Very Good
2.	Yulianto, S.Pd	Teacher in Mathematics study at SMP Muhammadiyah 1 Berbah	34	Very Good
Total			66	
Average			33	Very Good

Based on Table 6, the average score of the material for the assessment of media experts is 33. So it can be concluded that the learning media is in a very good category. Student worksheets have been validated by the validator and student worksheets revisions will be conducted. The next stage is the improvement of student worksheets. Next, a small class of 5 students per class will be tested. This small class test is conducted in two schools. After that, large classes will be tested/used in 30 students. The fourth step in the ADDIE stage is implementation. At this stage, products that have been developed and meet the eligibility and effectiveness criteria are given to the school that will be used as a place of research. This stage is done to ensure students achieve their goals in learning outcomes and solve the problems encountered. Students ultimately possess knowledge competencies, skills and attitudes that can improve learning outcomes and motivation. The fifth step in the ADDIE stage is evaluation. At this stage, a process to provide value to the learning program that has been developed. Students will be evaluated to the extent to which students can learn comparative material, students will provide an assessment of the results of the learning program that they follow whether it makes students like lessons that most students find difficult.

4 CONCLUSION

This study resulted in the design of student worksheets with the Problem Based Learning (PBL) learning model to help improve the critical thinking skills of seventh grade students. The results of the research in the design phase are obtained by several components arranged in student worksheets, namely the initial part (cover, catalog in publications, preface, table of contents, instructions on the contents of the text, directions for use, concept maps, core competencies and necessary competencies, mathematical history), the content section (learning activities using Problem Based Learning steps, summaries, and evaluations) and the final chapter (glossary and bibliography). The development of critical thinking skills is found in problem training and evaluation.

ACKNOWLEDGMENT

To improve critical thinking skills of seventh grade students can be done by developing Problem Based Learning Based (PBL) Worksheets. This research can be developed again at the stage of development, implementation and evaluation so that it can determine the feasibility and effectiveness of student worksheets in the learning process.

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