Design Problem Based Student Worksheet To Improve Student Problem Solving Abilities in Indonesia

Eddy Supriyadi, Suparman

Abstract—This study is aimed at developing design of a Problem Based Learning students' worksheet to improve the problem solving ability of eighth grade students of junior high school in Indonesia. This study uses the Four-D development model. The development procedure uses four stages, namely defining, designing, developing, and disseminating. The research subjects were eighth-grade students of Muhammadiyah 2 Kalasan Junior High School, Indonesia. The object of this research were curriculum, student characteristics and evaluation of teaching materials. The research instruments were Student Worksheets, validation questionnaires, observation study sheets and student questionnaire responses. The research results are a) students’ need analysis on Problem Based Learning worksheets to improve students’ problem-solving ability in accordance with the curriculum, student characteristics, material and learning objectives. b) the design of the Student's Worksheet which consists of cover, introduction, table of contents, instruction manual, basic competency, supporting information, action steps, and exercises. Further, this research still can be developed and disseminated.

Keywords— Problem Based Learning, Problem Solving, Student Worksheet.

1 INTRODUCTION

Solving mathematical problems is to find solutions to mathematical problems faced by using all the mathematical knowledge possessed by students [1] and someone with problem solving skills is a thinker who is confident, creative, and independent [2] so that problem-solving skills are a must owned by students in the 21st century [3]. One important learning goal to be achieved is problem-solving ability. The importance of problem-solving is reinforced by the National Council of Teacher of Mathematics which states that problem-solving is a means of learning mathematical ideas and mathematical skills [4]. Polya reveals four steps in solving a problem, namely understanding the problem, planning a problem solving (devising a plan), implementing a problem solving (carrying out the plan), and re-checking all steps that have been done (looking back) [5]. The level of problem-solving ability of Indonesian students is still weak in solving non-routine or high-level problems [6]. Thus, problem-solving is part of learning mathematics that is very important because students are allowed to use the knowledge and skills they already have to apply to solve problems that are not routine. Appropriate and innovative learning models can be efforts to improve students’ problem solving ability. One of the models is Problem Based Learning. Problem-based learning (PBL) has been applied for more than twenty years in various fields of education in many countries. Problem-based learning is often understood only as a method [7]. Problem-based learning is a learning model designed to help students develop thinking skills and problem-solving skills, learn adults’ roles, and become autonomous learners (Arends, 2008). Problem Based Learning is a centralized instructional approach that empowers students to conduct research, integrate theory and practice, apply knowledge and skills to get appropriate solutions to the problems specified [8], instructional strategies that claim to support higher order thinking skill as students try to solve unstructured problems [9]. Student worksheets are one teaching material consisting of a summary of material and an independent work guide directed to the basic competencies to be achieved [10] [11]. From the independent work instructions in the student worksheet, students are more active in solving a problem presented. In the student worksheet, there is also another discipline that learning design can do effectively [12], [13]. Student worksheets can also be a means to instill mathematical concepts, and besides student worksheets can also improve student achievement [14]. The teacher's limitations in learning such as limitations in the material, equipment, and learning technology that they need also need to be considered [15]. Besides mathematics learning must also be designed to be fun and students learn without coercion [16]. This can be supported by the existence of learning media in the form of student worksheets [17]. Therefore student's worksheets is lead students to think and solve problems. Student’s Worksheets based on the Problem Based Learning model is an student’s worksheets that can help students to think and solve problems. As was done by several other researchers [18]. The purpose of this study was to develop the design of the Problem Based Learning Student Worksheet to improve problem-solving skills of eighth-grade students especially in the subject matter of two-variable linear equations.

2 METHOD

The type of the research is development research. Product of the study is a worksheet using Problem-Based Learning approach for students of grade VIII to improve students' problem-solving skills. The research model is Four-D development model applying four stages; define, design,
develop, and disseminate [19]. The research subjects were eighth grade students of Muhammadiyah 2 Junior High School 2 Kalasan, Indonesia. The object of this research is curriculum, student characteristics and evaluation of teaching materials. Instruments for collecting data include questionnaires, observation guides, interview guides, and questions. Observation is carried out to obtain curriculum data and students’ characteristics. Interview is done to obtain information related to teaching and learning process carried out by the teacher. Data analysis uses Miles and Huberman which consists of data reduction, appearance, and conclusions. The stages of development can be seen in Figure 1.

### Figure 1. Development Flow

<table>
<thead>
<tr>
<th>DEFINE</th>
<th>DESIGN</th>
<th>DEVELOP</th>
<th>DESSEMINATE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Curriculum Analysis</td>
<td>Characteristic Analysis</td>
<td>Material Analysis</td>
<td>Formulate Objectives</td>
</tr>
<tr>
<td>Test Cancellation</td>
<td>Module Selection</td>
<td>Format Selection</td>
<td>Preparation of ITL KD, SKL and Concept</td>
</tr>
<tr>
<td>Expert Appraisal</td>
<td>Developmental Testing</td>
<td>Validation Testing</td>
<td>Packaging</td>
</tr>
</tbody>
</table>

3.2 Designing Phase

This stage is done by designing products from student worksheets according to the analysis results in determining stage. Student worksheets consist of (a) cover, (b) preface, (c) table of contents, (d) Basic competencies, (e) summary of material and (f) exercises. Activity steps are based on Problem Based Learning. In student worksheets, there are activities carried out by students in groups and provided opportunities for students to discover their concepts in learning.

(a) Cover

The worksheet’s cover is given “Student Worksheet Mathematics Linear Equations Two Problem Based Learning Variables” title. Student’s Worksheets is designed based on the Problem Based Learning method, and the material presented is Two Variable Linear Equations and aimed for eighth grade of odd semester. It is showed in figure 2.

(b) Preface

The Preface page functions to deliver the reader to the content or text contained in the student’s worksheets. Not only thanking to God Almighty, those who helped the writer and apologizing, but also descriptions encouraging others to read student’s worksheets because of the superiority of this student’s worksheets. The introduction can be seen in Figure 3.
**KATA PENGANTAR**

Pujian dan syukur marilah kita panjatkan kehadirat Allah SWT yang telah melimpahkan Rahmat Nabi Nya kepada penulis sehingga penulis dapat menyusunkan LES Matematika kelas VIII dengan pembahasan Persamaan Linear Dua Variabel (PLDV).

Selesaikan LES Matematika kelas VIII ini tidak lepas dari bantuan, bimbingan dan dorongan dari berbagai pihak, untuk itu penulis mengucapkan ucapan terima kasih kepada pembimbing, keluarga dan teman-teman semuanya yang telah bantuan membantu baik ducukang materi maupun spiritual.

Penulis mengatakan bahwa dalam pembuatan LES Matematika ini masih ada terdapat kesalahan, diharapkan kesalahan yang terjadi, untuk itu penulis mengucapkan maaf dan semoga dari pihak pihak yang telah membantu pembuatan LES Matematika kelas VIII ini.

Kami mohe nafas apalagi usaha kami berusaha untuk sesuai dengan yang diharapkan. Bahan 2013 ini sudah diubah pada kurikulum 2013 dan sudah sesuai dengan apa yang diharapkan di abad 21 yaitu inovasi dan peningkatan kualitas dengan berbagai pengajaran mulai yang sudah menggunakan Higher Order Thinking Skills (HOTS). Adik baik penulis berharap semua LES ini dapat memudahkan pengajar dalam memahami sesuai dengan pihak-pihak yang diselesaikan oleh penulis.

Yogyakarta, 01 Januari 2019

Penulis

(c) Table of Contents

The table of contents serves the order of contents. The contents are arranged based on the accompanied by a sequence of pages to make readers easier to find the material contained in this student’s worksheets. The table of contents can be seen in Figure 4.

(d) Core Competencies and Basic Competencies

This student’s worksheets includes Core Competencies and Basic Competencies as well as learning indicators that are in accordance with the 2013 curriculum. The pages of Core Competence and Basic Competence can be seen in Figure 5 below.
In the summary of material presents materials of Two Variable Linear Equations. Concise and clear material is presented, students are hoped can immediately understand the material presented once. It can be seen in figure 6.

3.3 Developed

In the next step after making the student’s worksheet design, the initial design of the student worksheet was developed and validated by media and content experts. Student worksheets are revised according to suggestions from the validator [21]. At the expert judgement stage, an assessment is carried out to determine the validity of the developed student’s worksheet design. The student’s worksheet design that was created was then validated by the validator, namely some mathematics teachers who were experts in their fields. Validation of the student’s worksheet design using assessment instruments in the form of questions and questionnaires. After a valid instrument can be used by material experts and media experts to assess the design of the developed student’s worksheet. As material and media experts, there are two experts, namely Lailatul Fuah, S.Pd.Si as a Mathematics Teacher in Kalasan Yogyakarta Muhammadiyah 2 Kalasan Junior High School and Martina Kurniawati, S.Pd. as a Mathematics Teacher at MBS Yogyakarta High School. Following are some of the inputs and suggestions from material and media experts summarized in Table I.

TABEL I.
FEEDBACK, SUGGESTIONS AND FOLLOW-UP

<table>
<thead>
<tr>
<th>No.</th>
<th>Feedback and Suggestions</th>
<th>Follow-up</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>the phrase &quot;Lembar Kerja Siswa&quot; on the cover is not appropriate</td>
<td>The replacement phrase &quot;Lembar Kerja Peserta Didik&quot;</td>
</tr>
<tr>
<td>2</td>
<td>Add instructions how to use student’s worksheet</td>
<td>The instructions for using the student’s worksheet are added</td>
</tr>
<tr>
<td>3</td>
<td>The material need to be sharpen based on Core Competencies and Basic Competencies</td>
<td>The material has been adjusted to Core Competencies and Basic Competencies</td>
</tr>
<tr>
<td>4</td>
<td>The image should be adjusted to the material to make it more attractive</td>
<td>The image has been adjusted to make the material more attractive</td>
</tr>
<tr>
<td>5</td>
<td>Add instruction on the completion column on the worksheet such as: known, asked and answered</td>
<td>The completion column on the worksheet has been included: known, asked and answered</td>
</tr>
</tbody>
</table>

The results of the media experts’ judgment of the design validation are obtained from the student’s worksheet design validation instrument. After validation results obtained, then the results are compared with the Ideal assessment criteria’s table as shown in Table II.
The results of the student’s worksheet design validation can be seen in Table III below.

<table>
<thead>
<tr>
<th>No.</th>
<th>Name</th>
<th>Position</th>
<th>Score</th>
<th>Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Fu’ah, S.Pd.Si</td>
<td>Muhammadiyah 2 Kalasan Junior High School</td>
<td>3.70</td>
<td>Good</td>
</tr>
<tr>
<td>2</td>
<td>Martina Kurniawati, S.Pd</td>
<td>Mathematics Teacher of MBS Yogyakarta Senior High School</td>
<td>3.75</td>
<td>Good</td>
</tr>
<tr>
<td></td>
<td><strong>Jumlah</strong></td>
<td></td>
<td><strong>3.725</strong></td>
<td><strong>Good</strong></td>
</tr>
</tbody>
</table>

Based on Table III, it can be concluded that the design of learning media meets the criteria of Good. So that, the design of learning media can be declared valid.

4 Conclusion

This study results in the design of student worksheets with the Problem Based Learning method to help improve students' problem solving abilities. The design of student worksheets has the potential to improve students' skills in solving problems. The result designs which meet student worksheets consist of (a) cover, (b) preface, (c) table of contents, (d) basic competencies, (e) summary of material and (f) exercise. Based on the results from media expert validation, it was concluded that the worksheet of the students had a good score so that it was feasible to use with revisions according to the advice of the validator. This study is only limited to the design stage. Furthermore, further research will be carried out on the development of student’s worksheets and testing the effectiveness of the student’s worksheets that have been made.

Acknowledgment

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References


