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THE DEVELOPMENT OF STUDENTS WORKSHEET USING PMRI APPROACH ON MATERIALS OF RECTANGLE AND SQUARE FOR THE VII GRADE STUDENTS OF JUNIOR HIGH SCHOOL

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Abstract

Indonesian Realistic Mathematics Education (PMRI) is a learning approach that links the student's daily life with the concepts of mathematics for meaningful and easily understood mathematics learning. To support the implementation of the learning with PMRI approach, PMRI learning tools such as student's worksheet is required. Student's worksheet with PMRI approach has not developed well in many schools yet. One of the topics that can be taught by using PMRI approach is rectangle and square. Therefore, researcher conducted a study with the aim to describe and generate worksheets that using PMRI approach on the materials of rectangle and square. A good student's worksheet must be satisfied criteria of valid, practical and effective. This research is a developmental research using Plomp's model, without the implementation phase. It has been conducted on 36 students of VII-D SMP Negeri 1 Wonoayu. In this study, data obtained from the results of the validation, the result of learning implementation, the results of student's score as learning outcomes and student's respond. From the results and discussion on this research, it can be concluded that the development of student's worksheet satisfies aspect of validity (average total validity is 3.64), practically (LKS easy to use and with an average total learning observations of 3.81), and effectiveness (student's learning outcomes is classically passed out with percentage of 86.11% and the students gave positive responses to the student's worksheet for more than 50% of each statement included in the category of strong). Therefore developed student's worksheet in the category of good.

Key word: Student's worksheet, PMRI approach, rectangle and square.

INTRODUCTION

One of the principles in the study of mathematics is that students are directed to truly understand the concepts being taught. This condition can be reached if the learning process is meaningful for students. To make the learning more meaningful and easily accepted by the students, it needs the learning approach that is related to the everyday life of students with mathematics concepts. One of learning approach that allows the connection between students' experiences with mathematics learning had been developed by Freudenthal since 1971 in the Netherlands with the name Realistic Mathematics Education (RME) (Amin, 2006: 7).

RME based on the Freudenthal's opinion (in Gravemeijer, 1994: 82) that mathematics is a human activity and learning mathematics should be connected to the reality and human activities. RME has three main principles namely guided reinvention/ progressive mathematizing, didactical phenomenology and self-development model.

Furthermore RME also has five characteristics, namely the use of context, the use of models, the student contributions, interactivity, and intertwining (Treffers in Streefland, 1991: 24).

In Indonesia, RME is known as Indonesia Realistic Mathematics Education (PMRI). PMRI itself is a result of the adoption of the RME. The addition of the word "Indonesia" is done to provide different characteristics due to developed according the circumstances and context in Indonesia (Siswono, 2006: 2).

On PMRI, mathematics is done by directing students to the use of the variety of situations and the chance to rediscover the mathematical concepts in their own way. The process begins with the issue in accordance with the provision of student life (contextual) (Hadi, 2005). PMRI also require students to be active, with the teacher as a facilitator in the learning process.

The real world on PMRI was used as early in the development of mathematical ideas and concepts. According to de Lange (Hadi, 2005: 20) the development of the idea or concept of mathematics that is began from the real world called the conceptual Treffers (Hadi, 2005: 20) distinguishes two kinds mathematization. of mathematization, i.e. vertical and horizontal fmathematization. In the horizontal mathematization, students start trying to decipher contextual problems with language and symbols that are made, then they solve it. In this process, it may be that every students use different ways with other students. In other words, a horizontal mathematization is mathematization of the real issues related to knowledge that students already have or things that can be understood or reflected by students (Amin, 2006: 41), while the vertical mathematization is related to the process of reorganizing the knowledge that has been gained into the more abstract mathematical symbols, to the students until the formal mathematical knowledge (Amin, 2006: 41).

To support the learning process by using PMRI approach, learning tools are needed, one of them is the student worksheet. In this research, student worksheet selected as learning tools which would be developed because it can support teacher in performing learning process, assist students in learning and understanding the learning material (Depdiknas, 2008: 13). Researchers also argue that student worksheet can be used directly by the students and students will get the chance to learn independently in accordance with the tasks of the worksheet. For implementing the learning approach well, it needs student worksheet using PMRI approach.

According to Kuswadi (2005: 35) student worksheet is a series of tasks laid out in the form of questions. By answering these questions, students are able to master the materials they studied. The function of student worksheet for students is to make students easier to understand the subject matter studied. Meanwhile, according to Ladyawati (2008: 43), student worksheet is a series of tasks with questions that make students in working on and get it done. Preparation of student worksheet intended to provide ease of students in understanding the material taught in the learning process.

The criterion by which to develop student worksheet by using PMRI approach referenced to criterion qualities of a material based on by Nieveen (1999). A material is valid if it fulfils aspects such as:

1. Validity

- 2. Practicality
- 3. Effectiveness

Development of student worksheet on rectangular and square material in VII Grade followed the stages of development as a result of modifications to the development model expressed by Plomp (Khabibah, 2006) called the development model of public education. This model consists of five phases, namely: a) preliminary investigation, b) design, c) realization, d) test, evaluation, and revision, e) implementation.

Based on the description above, researchers then considered that it is important to develop student worksheet through research with title "The Development of Students Worksheet Using PMRI Approach on Materials of Rectangle and Square for The VII Grade Students of Junior High School. The purpose of this research is to describe the process of development of student worksheet by using PMRI approach on the subjects of rectangular and square in VII Grade of Junior High School and yield student worksheet by using PMRI approach on the subjects of rectangular and square in VII Grade of rectangular and square in VII Grade of Junior High School.

Method

This research is research development because researchers developed student worksheet by using PMRI approach on subject of rectangular and square. The development model was used to development model of general education advanced by Tjeerd Plomp (Khabibah, 2006). This model consists of five phases, namely 1) preliminary investigation, 2) design, 3) realization, 4) test, evaluation, and revision, 5) implementation. However, it was only done until phase of test, evaluation, and revision. This was because the implementation required process and a long time.

The limited trial was conducted on grade VII-D SMP Negeri 1 Wonoayu with the number of students as much as 36 that consists of 14 male students and female students.

Stages of development of student worksheet with the PMRI approach can be presented in the following chart.



From the picture, it is seen that the first phase of Plomp development model which are used in this research is original investigation, the second phase is the design, the third phase is realization and the last phase is a test, evaluation, and revision.

The research procedure started with the preparation phase, followed by the implementation of a limited trial. Limited trial process implemented in VII-D Grade for two meeting or four-hour lessons. The researchers gave test in the last meeting and student response sheet. After limited trials conducted, researchers analyzed the data based on the data analysis technique that was suitable for further use in the preparation of reports on research results.

There were four instruments used in this research, namely a) validation sheet b) observation sheets, c) student response sheet and d) final test. The data obtained was then analyzed and used to develop the student worksheet, so that it would be meet the criteria of valid, practical, and effective.

ANALYSIS AND RESULT

These are the results of this research:

1. Preliminary Investigation

At this stage, the analysis performed curriculum analysis, students analysis, teaching material analysis, and the demands of the curriculum analysis. The curriculum was KTSP 2006. So the LKS developed based on principle and characteristics of PMRI also refers to KTSP in 2006. The results of the analysis of the theories of PMRI for the development of student worksheet was about the development of student worksheet based on the principles and characteristics of PMRI.

Analysis of the students was the student characteristics examination in accordance with the development design of the student worksheet that VII grade students of junior high school. The intended characteristics included knowledge background of students, academic ability of students and potential students ' ability to construct knowledge.

Analysis of the teaching material was done by identifying the main parts of the learning material, rectangle and square, that were be studied and the primary skills that students have to have after following learning process based on KTSP 2006. Rectangle and square materials that will be loaded in the their worksheet covered the properties of a rectangle and a square. Standard of competencies is to understand the concept of a square and a triangle and determine its size. While basic competence is essentially to identify the properties of rectangle, square, trapezoid, parallelogram, rhombus and kite. Here these the indicators:

- 1) Discover the properties of rectangle and square;
- 2) Write the definition of rectangle and square by using their own words;
- 3) Answer the problem that related to the properties of rectangle and rhombus.
- 2. Design

Student worksheet developed by researchers consisted of two worksheets. The first worksheet is about the properties of a rectangle. The second worksheet is about the properties of a square. Worksheets were developed by bringing up the principles and characteristics of PMRI which were shown through the work steps on worksheet as follows.

- 1) Worksheet consists of applications of rectangle and square material in everyday life which is easily to be understood by students.
- 2) Worksheet consists of activities for discovering the concept of properties of rectangle and square.
- 3) Worksheet consists of activity that steer students to develop a model for discovering the concept of rectangle and square properties.
- 4) Worksheet consists of activity that requires students to construct their own knowledge.
- 5) Worksheet consists of activity that requires students to interact between student and student or student and teacher.
- 6) In worksheet, there is connection between the material of rectangle and square and the other topics.

Besides developing student worksheet, researchers also designed the instruments used in this study. The instruments being developed included the validation sheet, observation sheet, test, and student response sheet.

3. Realization

In realization phase, it got prototype 1, that consists of:

a. Worksheet by using PMRI approach that has been developed by researchers. In this phase, the design that has been created by researchers became a part of the basic manufacture of worksheet that we said prototype 1. In this phase, the worksheet has not been validated. Here is a picture of worksheet that has been developed by noticing the characteristics of PMRI.



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Figure 2. Prototype 1

- b. Research instrument, is a device used to collect data that consists of: 1) validation sheet of student worksheet 2) learning observation sheet 3) learning test 4) student response sheet.
- 4. Test, evaluation, and revision

Student worksheet developed was given to experts, a mathematics professors and mathematics teacher, to validate. We calculated the average total (RTV) of the validation score, matched to validation category according to the criteria of Khabibah (2006) then, namely:

 $\begin{array}{l} 4 \leq RTV_{PB} \leq 5: \mbox{ very valid} \\ 3 \leq RTV_{PB} < 4: \mbox{ valid} \\ 2 \leq RTV_{PB} < 3: \mbox{ less valid} \\ 1 \leq RTV_{PB} < 2: \mbox{ invalid} \end{array}$

Based on the results of validation, student worksheet which has been developed included in valid category with a validity total average of 3.64. The experts also provided general assessment at student worksheet stating that it can be used with little revision. So this research can proceed to the next stage which is doing a small revision.

The small revisions made by researchers based on assessment and improvement suggestions from experts are repairing less understandable sentences, contextual image selection on student worksheet, the use of inconsistent mathematical symbols in worksheet, and addition information on worksheet. The following outline describes some examples of results of the revision made by the researchers.

- 1) Selection of contextual pictures in student worksheet

Figure 3. The First Outline of Worksheet2) The use of inconsistent mathematics symbols in student worksheet



Before revision

After revision

Figure 4. The second outline of worksheet

3) Addition information in student worksheet



Before revision

After revision

Figure 5. The Third outline of worksheet

Limited trials of student worksheet with the PMRI approach which used Prototype II was carried out with the aim to test the practicability and effectiveness of student worksheet that has been developed. In the limited trial phase, it obtained data about 1) learning implementation, 2) student learning outcomes, 3) response of students.

Based on implementation criteria used by the researchers, the learning which used the student worksheet included in good category with a total average of observation results approximately 3.81. It means that the study of using PMRI student worksheet can be implemented properly.

Meanwhile, based on the test results (THB) and completeness criteria (\geq 70), it was obtained that 86, 11 % of students got \geq 70. Student response data retrieved from questioner that given to the students after the study was carried out using student worksheet with PMRI approach. Based on the results of the data analysis acquired from student response sheet to the entire grain question, we can conclude that for each item provided, all students responded in strong or very strong so that it can be said the students responded positively towards the implementation of learning using student worksheet with PMRI approach. This is confirmed also by the students' impression that learning by using worksheet with PMRI approach is helpful in construct the concept of the properties of a rectangle and a square. Based on the results test which has completed classically and the existence of a positive response from students, then it can be inferred that the student worksheet with the PMRI approach on material of properties of the rectangle and square criteria is effective.

CONCLUSION

The development of learning tools in this research was conducted in four phases: namely preliminary investigation, the design, the realization, and the phases of the test, evaluation, and revision. After doing this research, it obtained that the result about the development of student worksheet with the PMRI approach in the subject of the rectangle and the square properties is the average value of the validation score provided by experts (3,64). So, the student worksheet with the PMRI approach on the subject of rectangle and square was valid. In addition, student worksheet with PMRI approach on the subject of rectangle and square was valid. In addition, student worksheet with PMRI approach on the subject of rectangle and square can be said to be theoretically practical because based on a common assessment of the experts, it can be said that the student worksheet can be used with little revision. While practicality based on learning process which carried out through observations found the average score of 3.81. It means that student worksheet developed practicality can be applied in the field well. So, the worksheet with the PMRI approach on the subject of rectangle and square included in the practical criteria. It can also be said to be effective because it brought 86.11% classical completeness and got positive response from students.

From the above statement, student worksheet with PMRI approach on the subject of rectangle and square is in the valid, practical and effective criteria. Then, student worksheet developed can be said either.

As a suggestion, in order to achieve a better learning process with PMRI approach, it should be developed not only student worksheet, but also the other learning tools, such as lesson plan, student books and assessment sheet. In addition,, to get the validation result of student worksheet with the PMRI approach surely valid, all the principles and the characteristics of PMRI must be contained in composing validation sheets in order to explain that the validity criteria shows the student worksheet in accordance with the principles and characteristics of PMRI.

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