Realistic mathematic education of students worksheet (LKS) for reasoning ability of mathematical reflection of class XI High School number 1 Lubuklinggau

Y Yanto and M Luthfiana*

Program Studi Pendidikan Matematika, STKIP PGRI Lubuklinggau, Jl. Mayor Toha, Kota Lubuklinggau 32626, Indonesia

*Maria_Luthfiana@yahoo.co.id

Abstract. This research aims to develop high quality PMR based on Student Worksheet (LKS) to facilitate mathematical reasoning ability of grade XI students of SMA Negeri 1 Lubuklinggau. This research used research and development method (Research and development) and the stage of Analysis Design, Development, Implementation, and Evaluation. In the development stage, there are two kinds of processes, namely the development of LKS and LKS validation, then evaluated LKS by the experts of linguists, and media experts. Validity of LKS was developed categorized "Valid" with an average score of 3.09 was determined based on the LKS assessment result by 3 experts (material experts, linguists, and media experts) maximum score was 4.00. Data analysis used LKS Practicality analysis developed "Praktis" with an average score of 3.38 is determined based on the result of student response to LKS. Descriptive and statistical analysis. The effectiveness can be seen from the results of students achievement tests. Based on the results of the Test Achievement shows that the percentage mastery learning class XI SMA Negeri 1 Lubuklinggau was 87%. Thus, learning mastery reaches good criteria, In shortly, LKS that used in teaching and learning was effective.

1. Introduction

"Mathematical material and mathematical reasoning are two inseparable things, mathematics material understood through reasoning in the understanding and training through learning mathematics material" [1]. Mathematical thinking patterns developed do need and involve critical, systematic, logical and creative thinking. The reasoned ability is not only needed by students when they learn mathematics and other subjects, but it is necessary for every human being to solve a problem or when make a decision.

Indonesia has participated in the Programme for International Student Assessment (PISA) since 2000. However, the ranking obtained by Indonesia from the first period to the fifth period, namely from 2000, 2003, 2006, 2009 and 2012 increase was no significant improvement, precisely the last data showed that education of Indonesia Decreased the quality of [2].

Many reasons are the factors that cause poor PISA results in Indonesia, including: 1) students are not accustomed to solving routine problems. Students tend to be more proficient in solving the problems that have been discussed in the classroom than in the face of a new problem. 2) Students are weak in modeling real situations into mathematical problems and interpreting mathematical solutions.
to real situations. 3) Reasoning and analyzing levels are very poor. This means that the reasoning ability demanded by the global world is higher than that which runs in the practice of learning mathematics in Indonesia which tends to be still less applicable [3].

Based on the explanation above, it can be said that the reasoning ability of students in Indonesia still needs to be improved. There is only a few percent of Indonesian students who are able to develop and work on mathematical modeling that demands thinking and reasoning skills. Therefore, it needs to be done an approach that improves student reasoning ability and view that mathematics is not a finished product, but is a process that needs to be built-in every student's mind. A student will easily be able to think of a mathematical problem when the problem is in everyday life or the experience of the student, or it can be said that the problem is real [4].

Approach to learning mathematics in Indonesia. Realistic Mathematics Education (PMR) is an approach in learning mathematics that starts from "real" things for students, emphasizes the "process of mathematic" skills of discussing and collaborating, arguing with classmates so they can find out for themselves and finally use mathematics to solve problems, both individually and in groups[4]. PMRI is a learning model that starts from the real things of students, emphasizing the skills of “Process of doing mathematic” [5].

In education, teachers are an important figure in mathematics learning. Learning mathematics has implications for the teacher's function as a facilitator as well as possible so that students can learn mathematics optimally [6]. Teachers as facilitators play a role in facilitating this activity, one of the facilities that play a role in supporting the students' activities is by using the Student Activity Sheets. “LKS is one of the media that can be used to present learning materials where the learning activities are centered on students. LKS is a form of teacher effort to guide students in a structured’ [7].

The student worksheet (LKS) contains visual material that includes a summary of the material and exercises with questions to answer, a checklist to complete, and an experiment sheet in the form of work steps for completing an assignment. LKS is still practical and does not emphasize the process. This is not in accordance with the objectives of the 2013 curriculum. In addition, the students' reasoning ability is also poor because the existing learning media cannot facilitate the development of student reasoning.

Based on observations that researchers have made in Senior High School (SMAN) 1 Lubuklinggau. It can be said that SMAN 1 Lubuklinggau has been classified as a good quality school and has used LKS as a teaching medium, the development of LKS is still needed to improve the quality of teaching materials. Worksheets that have been used in learning in the classroom are still less varied and less attractive to students. In addition, the material in the worksheet is only a short formula without explaining the basis for writing the formula. At present, there is no mathematical worksheet that has been developed using the PMR Approach.

Based on this problem, researchers are moved to make PMR-based worksheets in accordance with the standards of the learning process in schools that are expected to help the achievement of students' reasoning abilities.

2. Methods
This research uses research and development methods. "Research and development" aim to produce new products through the development process [8]. The product developed in this research is teaching the material in the form of student activity sheets (LKS) based on realistic mathematics learning to help the achievement of reasoning ability of class XI students of SMAN 1 Lubuklinggau.

The research design starts from the Analysis phase which includes curriculum analysis, analysis of student characteristics and analysis of learning needs. The Design Phase includes the preparation of research instruments, the formulation of an LKS framework/outline and the systematic arrangement. The Development Phase includes the activity of making LKS, after determining the LKS preparation framework, the next step is to decide the LKS product. The Implementation Phase is the worksheet and instrument that has been revised and then trialed then the response or response is contained in the filling of the student and teacher questionnaire sheets. Learning ends with a test of reasoning ability to
find the achievement of mathematical reasoning abilities. The development model used in this study is the ADDIE development model, with the stages of Analysis, Design, Development, Implementation, and Evaluation [9].

3. Results and discussion

This type of research is development research with products developed in the form of Student Worksheets (LKS) with a Realistic Mathematics Learning approach. The development model used in this study is the ADDIE development model, with the stages of Analysis, Design, Development, Implementation, and Evaluation. Based on the research development carried out, obtained research results as follows:

3.1. Curriculum analysis

The results of the curriculum analysis carried out showed that SMAN 1 Lubuklinggau used Curriculum 2013 (K13). The indicators that will be achieved after studying this PMR-based worksheet are (1). After learning to use this worksheet 80% of Class XI high school students can find the concept of modeling linear program problems into mathematical form and students can decide the aim functions and constraints of these linear program problems with a value of ≥ 75. (2). After finding the concept of modeling a linear program problem 80% of Class XI high school students can describe the set of settlement areas and find the corner points of a linear program problem with a value of ≥ 75. (3). After learning to use this worksheet 80% of Class XI high school students can solve contextual problems related to linear programs with a value of ≥ 75. (4). By learning to use this worksheet 80% of class XI high school students can solve linear program problems that maximize the corner point method with a value ≥ 75. (5). By learning to use this worksheet 80% of class XI high school students can solve linear program problems that lower using the corner point method with a value ≥ 75.

3.2. Analysis of student characteristics

In the analysis phase of student characteristics, it was obtained that the results of Class XI high school students were generally agreed between 15-16 years. Based on the theory of cognitive development that was coined by Piaget, class XI high school students who chose 15-16 years were at the formal working level. According to Piaget (Ratna Wilis Dahar, 2011: 139), the main progress in children in children during this period is that children do not need to think with the help of concrete objects or conversations, they have the need to be able to help improve abstractly.

3.3. Requirements analysis

After observing at SMAN 1 Lubuklinggau, it is known that teachers still find it difficult to find teaching materials that help students' reasoning abilities. The limitations of teaching materials can have an impact on the quality of learning carried out. Based on observations, it is known that teaching materials used by teachers in mathematics learning are oriented towards student academic achievement.

3.4. Preparation of research instruments

In this activity, the design of research instruments was carried out which included assessment instruments by material experts, media experts, and teachers in the form of LKS Validation Assessment Sheet, and student questionnaire responses.

3.5. Compilation of LKS / outline approval

The LKS section is divided into three, namely the beginning, contents, and end. The first part consists of the cover, LKS identity page, preface, instructions for LKS presentation, concept map, linear iceberg program and table of contents to be developed. In the contents section, there are all activities carried out by students to gain knowledge in accordance with the KD and KI Linear Material Program.
Meanwhile, the last part consists of a bibliography. By paying attention to what was chosen based on the results of the analysis, the Mathematics Learning was discussed.

3.6. Systematic preparation
Systematic presentation of material in this worksheet always starts by presenting the Basic Competencies and Indicators to be achieved during the use worksheets, then followed by presenting Problems in daily life that are included by supporting images of the problem, then providing columns to find solutions that always start with instructions to fill in the solution columns, at the end of the problem the conclusion column is provided. After successfully drawing conclusions, exercises are given in the form of realistic problems along with supporting images and only an answer column is provided without any instructions or steps to work on. And at the end is given Competency Test as a tool for the success in using this worksheet, the competency test is given using question benchmarks that can help the reasoning ability of Class XI high school students.

3.7. Instrument development
The instruments designed were then arranged and developed based on a theoretical foundation. The instruments that have been prepared are presented in the appendix, namely the Worksheet Validation Assessment Sheet, Student Response Questionnaire, Observation Sheet, and Competency Test of reasoning ability.

3.8. Product development
LKS was developed using Indonesia language. Applications used in the development of LKS include Microsoft Office Word 2013 and Corel Draw.

3.9. Implementation phase
Learning tools in the form of lesson plans and worksheets with the Indonesian Realistic Mathematics Education (PMRI) approach on a linear two-variable program material is arranged for six meetings with a time of 2x45 minutes each meeting. The implementation of field trials can be seen in the following figure.

![Figure 1. Implementation of field trial.](image)

After students have completed the learning process, students are asked to fill in the student response questionnaire, the student response questionnaire consists of 20 statements. A student response questionnaire was given to find out students' responses to the worksheets developed. Students can give answers to statements honestly because students' answers will not affect any results.

3.10. Evaluation phase
In the evaluation phase, Validity of LKS was developed categorized "Valid" with an average score of 3.09 was determined based on the LKS assessment result by 3 experts (material experts, linguists, and media experts) maximum score was 4.00.
Based on the analysis of student response questionnaire data, an average of 3.38 was obtained. Thus the results of the assessment questionnaire response to the LKS that are developed categorized as practical. In this study, the effectiveness of the use of student worksheets with the PMRI approach was determined from the achievement of students' mathematical learning completeness.

Before and after the field trial the teaching material is conducted pre-test and post-test to figure student achievement. The effectiveness of mathematics teaching materials in terms of achievement tests. The results of the analysis of 30 student achievement tests showed students who completed the pre-test were 2 people with completeness by 7% and students who completed the post-test were 26 people with completeness by 87%. Based on the quality of teaching materials from the pre-determined and post-test results, it can be concluded that the mathematics teaching material developed has effective quality. Teaching materials are said to be effective if the teaching materials used can help students make the competencies they must have [10]. The percentage of students in completeness is more than 75%. This means that mathematics teaching materials produced are effective and can be done to use.

Achievement of the quality of learning tools using the PMRI approach to improve student achievement results is in accordance that the PMRI Effective Approach in terms of students' interest in learning mathematics which resulted in increased student achievement test results. Based on this description, it can be concluded that the PMRI-based worksheet developed has valid, practical, and effective qualities.

4. Conclusion
Based on the results of research on the development of worksheets with the Realistic Mathematics Education Approach in Class XI Linear Program Materials, the conclusion that can be drawn is that development research results in worksheets with the Indonesian Realistic Mathematics Education approach to Linear program material. This research refers to the ADDIE development model, namely Analysis, Design, Development, Implementation, and Evaluation. In the analysis phase, requirement analysis, curriculum analysis, and analysis of student characteristics are carried out. The design stage, LKS is designed with an Indonesian realistic education approach, and the instrument is designed to measure the quality of LKS, in the form of expert questionnaires and student response questionnaires. The expert questionnaire is used to measure the validity of LKS while student questionnaire responses are used to measure the practicality of LKS. A kind of process, the development of worksheets and validation of worksheets after the worksheets were developed, an LKS validity assessment was carried out by material expert lecturers, linguists, and media experts, after which a revision was made to get an LKS that was ready to be trialed. During the implementation phase, a trial phase is carried out.

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