

Design of Teaching Material for Problem-Based Learning to Improve Creative Thinking Skills

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Received December 5, 2019; Revised January 7, 2020; Accepted January 13, 2020

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Abstract Creative thinking plays an important role in student learning and is part of the higher-order thinking skills that need to be developed in students. Students who have low creative thinking skills will have difficulty solving problems that require higher order thinking skills. Teaching materials that integrate creative thinking skills will help students develop creative thinking skills. One learning resource that can be used as a tool to improve the process of creative thinking is a module. This study aims to design a mathematical module based on the Problem-Based Learning model to improve students' creative thinking abilities. This research uses descriptive qualitative. Data collection instruments include validation guidelines and observation guidelines. Observation guidelines are used to identify the appropriate module criteria. Validation guidelines are used to validate module design by experts. Data were analyzed using the Miles Huberman model consisting of data reduction, data display, and conclusion drawing. This research resulted in a module design. The results showed that the quality of design in the category was very good for improving students' creative thinking skills. Research contributes to designing modules that integrate creative thinking skills. The design of this module can be used by teachers in developing learning resources so that students have creative thinking skills.

Keywords Creative Thinking, Learning Modul, Problem-Based Learning

1. Introduction

Creative thinking skills play an important role in the learning of all children and is part of a high-level thinking skills need to be developed and students need to explore their potential for overcoming the various problems of mathematical contextual, which requires reasoning, argumentation and creative [1]. Mathematics has five

competencies, namely mathematics problem solving, mathematical communication, mathematical punishment, mathematical connections, and mathematical representation of students in Indonesia is still low in these 5 competencies [2]. And mathematics is believed to improve the creative thinking of students [3] Associated with the ability to think creatively about emotional perspectives is the ability to think divergent in different domains may very much depend on the same basic configuration, domain specific functions may also be important, need to compile to increase the truth, more creativity [4]. Students must have the skills of creative thinking in solving mathematical problems by using a variety of alternative solutions. Unfortunately, many students still have poor quality creative thinking skills for their lack of attention to develop their skills while learning mathematics [5]. Based on the results of observations in SMP Muhammadiyah 1 Depok that problem-solving ability, creativity of students is still low and the learning modules are used are not able to improve problem-solving abilities. Problem-based learning allows students to solve real-world problems, learn to think at a higher level, and motivate students in learning activities [6]. Mathematical skills that will be achieved in mathematics are an understanding of the mathematical concepts, patterns of reasoning, problem solving, communicating mathematical ideas, and making mathematical connections in the form of solving everyday problems using the mathematical concept [7]. PBL aims to enable students to acquire knowledge and form them in an integrated manner case [8]. PBL is a series of learning activities centered science problem solving process, the problem is the starting point in learning and learning activities directed to solve the given problem [9]. The learning objectives in PBL are the ability to find and correct problems, complete problems, discuss problems, analyze alternative problems, and make correct decisions. [10]. Problem-based learning can make students to solve problems so they can get independent material concepts. One of the characteristics of problem-based learning is giving problems that are close to real life [11]. The problem

lies in learning innovations that must be optimized through work groups or problematic problems, so that it can be done to empower, improve, and develop students' ability to think continuously. the role of PBL learning is expected to sharpen students' creative thinking abilities [12]. The good teaching materials are materials that are arranged systematically to make the environment and students to learn [13]. Teaching material is a type of material to assist educators in carrying out teaching and learning activities in class so as to increase student interest [14]. Teaching materials such as textbooks tend to be the main guideline for teachers and students of the School. A very important role is not supported by adequate provision of teaching materials in accordance with the characteristics of students [15]. The problem presented in most books are not related to the mathematical context of everyday life so that the learning of mathematics to be away from student life. In other words, mathematics becomes less significant [16]. Based on the nature of mathematics learning in mathematics teaching material needed something interesting preparation before taught to students and in accordance with the conditions of the students [17]. Based on the above, the researchers are interested in doing research related to developing learning modules with learning model Problem-based Learning. This study entitled "Design Module based Learning Math Problem Based Learning for Students junior class VIII".

2. Methods

This type of research used in this study is the research and development. The development model used is the ADDIE model. This ADDIE model is an abbreviation for the five stages of the development process, namely: Analysis, Design, Development, Implementation, and evaluation. This ADDIE model is presented in figure 1:

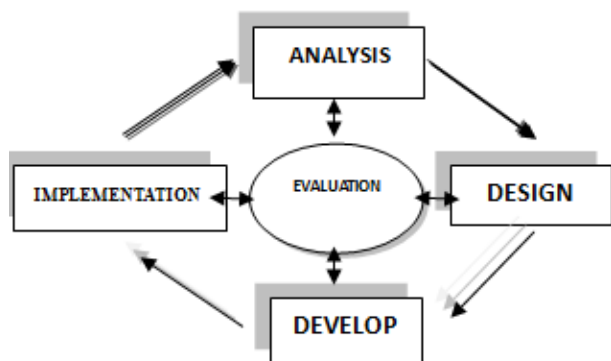


Figure 1. ADDIE Stages [18]

This study is limited in two phases: the analysis and design phase. Phase analysis in this study is divided into 2 curriculum analysis and analysis of student characteristics. The results of the analysis used as the basis for developing products such as math learning modules for students with visual impairment. Stage design were conducted in this

study starts from the preparation of the product template and designing an early form of the product. The third stage is the development the fourth stage is the implementation which is the application of a product that has been made, and the fifth stage is evaluation were performed to assess the overall product that has been created and implemented.

Data collection instrument is the form of a questionnaire. It is used for the feasibility of the product, observation and interview guides. This type of data is generated that is qualitative data in the form of the use of the school curriculum, character of students. Subjects in this study were students of SMP Muhammadiyah 1 Yogyakarta. The data analysis technique used is descriptive data analysis techniques.

3. Result and Discussion

The research was done by designing a PBL-based on mathematics learning modules for students of class VIII SMP Muhammadiyah 1 Yogyakarta Depok. The following results develop module design through the analysis phase and design phase of the ADDIE.

3.1. Phase Analysis

3.1.1. Analysis Curriculum

This analysis is the planning phase of learning undertaken to determine the material studied by students. Based on interviews conducted by researchers with the mathematics teacher SMP Muhammadiyah 1 Yogyakarta Depok, then the material presented in mathematics module is Linear Equation System Two Variables. Once the material has determined the curriculum based on analysis with the material.

Based on the results of the analysis of material that has been conducted by researchers, in particular the results of analysis of curriculum refers to the curriculum in 2013, Analysis of Student Characteristics

In the analysis phase characteristics of learners is, the result of the interaction of learners in mathematics learning, involvement of learners in an effort to gain an understanding, the attention of learners, learners' interest in the subject matter, as well as the responses of students to instructional materials that are already available.

The involvement of learners and active learners in mathematics learning is still lacking. Learners tend to rely on the teacher as the center of learning so that the learning activities of students tend to be passive. Competencies required learners have the ability to acquire, manage, and use information to survive in a changing constantly, the situation is uncertain and competitive. However, mathematics is a frightening lesson for students is one of the most challenging subjects to be understood by students. Teaching and learning process in schools do not produce maximum results. Most of the students are unable to connect [19]. Quality education produces good academic records. Intelligence and personality are important factors to

learn in success with academic achievement. People who have different characteristics and affect their lives, so these personal characteristics affect the way they learn [20]. So, the need for innovative learning modules to encourage learners to participate actively and is expected to assist learners in constructing their understanding and increase the interest of students in learning mathematics that can improve the ability to think creatively. PBL is one alternative that can be used to achieve these goals.

2.1. Stage of Design

After observation, interviews and information gathering,

hereinafter stage is the stage of design. Steps in the design phase are as follows.

2.1.1. Making the Template Module

The process of drafting the module will be easier, if the first created as an outline of the module frame modules. The module framework are as follows: Cover page, Identity Module and Foreword. Foreword in the form of thanks to those who have helped in making this module as well as apologies and suggestions for the mathematics learning module based on this PBL. Following the design of the foreword has been created, preface is presented in figure 2 below:



Figure 2. Preface

2.1.2. Table of Contents

The table of contents in a PBL-based math learning module contains material that will be discussed. The material appeared based on the sequences present in the module. Students are also able to see the whole of the material covered in the modules and printed page number to the reader in finding topics. Following the design of content that has been created, table of contents is presented in figure 3 below:



Daftar isi.

<i>Halaman</i>	
DEKSRIPI MODULI	I
KATA PENGANTAR	II
PETUNJUK PENGGUNAAN MODUL	III
PETA KONSEP	IV
DAFTAR ISI	V
DAFTAR TUJUAN KOMPETENSI	VI
SISTEM PERSAMAAN LINIER DUA VARIABEL	
SOAL-SOAL LATIHAN	
TES AKHIR	
RANGKUMAN	
GLOSARIUM	
KUNCI JAWABAN	

Figure 3. Table of Contents

3.2. Introduction

Introduction include: Core Competence, Competency, Competency Achievement Indicators Basic overall, Completeness Module, Instructions for Use Module and Concept maps. Map concept in the learning module

mathematics the PBL-based lists of topics to be studied in module and shows the interrelatedness of topics in the module. Map concept also helps teachers to improve the effectiveness of the learning process in the classroom. The following map design concept that has created, map concept is presented in figure 4 below:

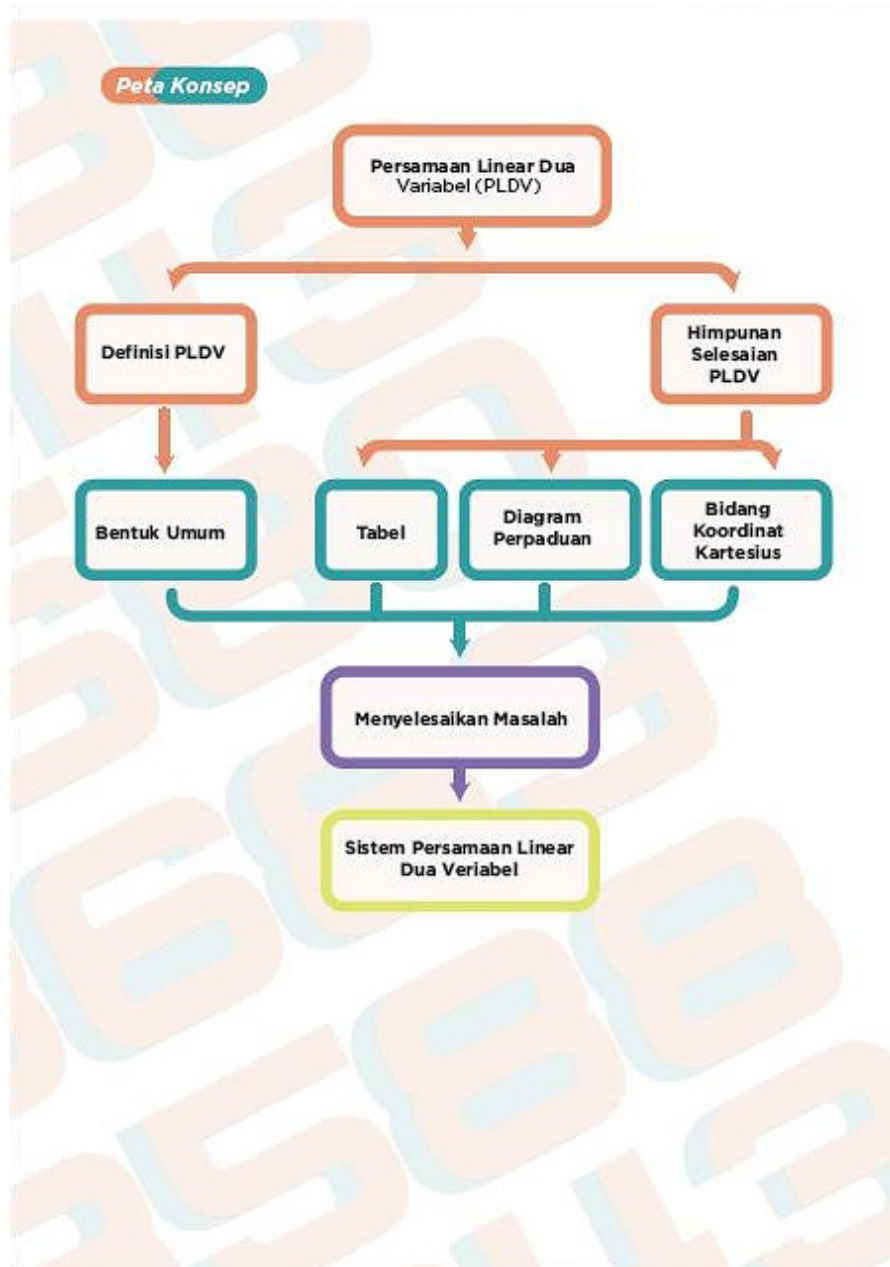


Figure 4. Map Concept

3.3. Learning Activities

Learning Activities include: Basic competencies, Indicator Achievement Basic competencies, Introduction to Materials, Illustration, description of materials and learning activities according to the learning model Problem-Based Learning (PBL). The material in the learning module math-based PBL contains explanations in detail, the module made in accordance with the applicable curriculum and load step PBL learning that focus students on the issue, to organize students to learn, guiding the investigations of individuals or groups, develop and present students' work and develop and evaluate problem-solving [21].

3.4. Module Display Design Making

The design process of the module display consists of making a module cover design, font type, font size, space, image icon, and module coloring.

3.4.1 Module Cover

The module cover is a display on the outside. The module cover is divided into two parts, namely the front cover and the back cover. The parts contained in the cover of the module both front and back, include; module title, education level and group, curriculum base used, publisher identity, author's name, appropriate illustration with the module title. The module cover design is presented in Figure 5 below:

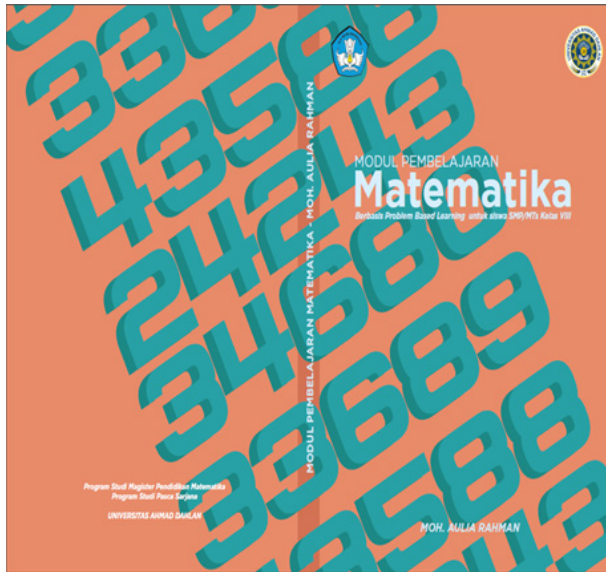


Figure 5. Cover Design

The following are the results of the questionnaire calculation of the feasibility of instructional media by the material experts shown in Table 1.

Table 1. Result of the questionnaire calculation

No	Aspect	Score		Average
		Expert 1	Expert 2	
1	Content Feasibility	80	70	75
2	Familiarity	70	85	77,5
3	presentation of guiding students in making based learning PBL	80	75	77,5
4	presentation material encourages students to think creatively	90	90	90
Average		80	80	80

Based on Table 1 it can be seen that the average score of the material expert assessment is 80. So it can be concluded that the learning media developed in terms of media are included in the very good category.

3.5. Advantages and Differences of Modul

The advantage of this module is that it can be used as a reference as teaching material in the process of learning mathematics in Special High Schools / MTsLB, Helps create interesting learning in the classroom by supporting problem-based learning approaches, developed based on the stage of problem-based learning approaches to improve creative thinking skills student.

The difference in this module is the material that uses SPLDV, so it is different from other studies such as

Suhendri research on the development of mathematical modules based on guided discovery learning to improve the creativity skills of students with visual impairments on triangular material [22].

4. Conclusions

The results obtained show that the design of the PBL based mathematics learning module has been carried out at the analysis and design stages. The point of analysis the grouping is divided into two, namely curriculum analysis, analysis of student characteristics. In curriculum analysis it was found that the curriculum used was the 2013 curriculum in accordance with the government. There is an analysis of student characteristics that students are more likely to memorize and need media that can help students in quadrilateral learning. At the design stage the researcher designs three parts in outline namely the opening part which consists of cover, introduction, module description, list of competency goals, concept maps, table of contents, initial test. As for the advice of researchers that further research is needed to develop a module based on problem-based learning can be used in learning in schools

Acknowledgements

The authors wish to thank the reviewers for their comments and suggestions.

REFERENCES

- [1] J. Sari., D. M., M. Ikhsan., Abidin, Z., The Development of Learning Instruments Using The Creative Problem Solving Learning Model To Improve Students Creative Thinking Skills In Mathematics, Journal of Physics: Conference Series, V, 2018.
- [2] F. A. Sari., I. A. V. Yandari. The Application of Problem-Based Learning Model To Improve Mathematical Literacy Skill and The Independent Learning of Student, Journal of Physics: Conference Series, 2017.
- [3] R. Maharani., T. Y. E. Siswono., E. B. Rahaju. Students Creative Thinking in Posing Mathematical Problem with DifferentContext.in mathematics. Informatics, Science and Education International Conference, 2018.
- [4] C. Rominger, I. Papousek, E. M. Weiss, G. Schultze, C. M. Perchtold., H. K. Lackner, A. Fink. Creative thinking in an emotional context specific relevance of executive control of emotion laden representations in the negativity in generating alternative appraisals of negative events, Creativity Research Journal, Vol. 30, 256-265.
- [5] D. M. Sari., M. Ikhsan., Z. Abidin. The Development Of Learning Instruments Using The Creative Problem Solving Learning Model To Improve Students Creative Thinking

- Skills In Mathematics, Journal of Physics: Conference Series, 2018.
- [6] M. Ruhimat., E. Ningrum., B. Wijayanto. The Implementation of Problem Based Learning Toward Students Reasoning Ability And Geography Learning Motivation, IOP Conference Series, 2018.
- [7] Satrianawati, S. Development of flat side building materials as part of preparation for prospective primary school teachers, in research journal of mathematics education. Procedia Social and Behavioral Sciences, 2018.
- [8] M. Hafiz, J. A. Dahlan. Comparison of mathematical resilience among students with problem based learning and guided discovery learning models, Journal of Physics, Vol. 895.
- [9] Z. Amir, M. S. Lubis, M. Syafitri. The effect of problem-based learning models (PBL) towards high school students creative thinking and self-efficacy of junior high school in Pekanbaru, Journal of Physics, Vol. 1116, No. 2.
- [10] Yerizon., Jazwinarti., Yarman. Developing learning material based on problem-based learning courses based on problem-based learning 1 department of mathematics, IOP Publishing, 2018.
- [11] W. B. Rahmantiwi., R. Rosnawati. The Effect of Problem Based Learning (PBL) Toward Mathematics Communication Ability and Curiosity, Journal of Physics: Conference Series, 2018.
- [12] F. Nurdyani, I. Slamet, I. Sujadi. Creative thinking of students with high capability in relations and functions by problem-based learning, Journal of Physics, Vol. 983, No. 1.
- [13] R. Momo., S. Revelation. Skill Analysis of Students Creative Thinking in the Implementation of Problem Based Learning with Plastic Waste Handling Contexts 1 Student of Chemistry Science Education School of Postgraduate Studies, Journal of Physics: IOP Conf. Series, 2018.
- [14] V. N. Yulian. Developing Teaching Materials Using Comic Media To Enhance Students Mathematical Communication, IOP Conference, 2018.
- [15] M. K. Abadi, H. Pujiastuti, L. D. Asaat. Development of teaching materials based interactive scientific approach towards the concept of social arithmetic for Junior high school students, Journal of Physics, Vol. 812, No. 1.
- [16] I. Farida., I. Helsey., I. Fitriani., M. A. Ramdhani. Learning Material of Chemistry in High School Using Multiple Representations, IOP Conference, 2018.
- [17] H. Helma., M. Mirna., E. Edizon. Development Of Contextual Mathematics Teaching Materials For Integrated Senior Sciences And Realistic For Senior High School XI Grade Students, IOP Conference, 2018.
- [18] G. Welty. The design phase of the ADDIE model, Journal of GXP Compliance, Vol 11, 40-53.
- [19] R. Johar, M. Ikhsan, B. Zaura. The development of learning materials uses contextual teaching learning (CTL) approach oriented on the character education, Journal of Physics Vol. 1088, No. 1.
- [20] A. C. Septiana, T. A. Kusmayati, L. Fitriana. Mathematical communication skill of senior high school students based on their personality types, Journal of Physics, Vol. 1108, No. 1.
- [21] K. D. P. Mekle, D. U. Wutsqa, D. D. Alfi. The Effectiveness of Problem Based Learning Using Manipulative Materials Approach on Cognitive Ability, Mathematics Learning Conf. Series 1097, 2018.
- [22] Suhendri, Suparman. Development mathematics modules based on guided discovery learning to improve creativity skills of blind students, International Journal of Scientific and Technology Research, Vol. 8.