Design Of Module To Increasing Critical Thinking Ability For Seventh Grade Students

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Abstract: Critical thinking is needed in overcoming various complex problems in aspects of life. Critical thinking is one of the skills associated with thinking activities, evaluating our own ideas and others without prejudice. The purpose of this study is to design of mathematics learning modules that are useful for students in increasing critical thinking with the PMRI approach. The type of this research is research and development and used the development model is the ADDIE (analysis, design, development, implementation, and evaluation). The subjects of this study were seventh grade students. Research instruments include interview guidelines, observation guidelines, and tests. Interview guidelines are used to obtain data on student characteristics. Observation guidelines are used to obtain data about the curriculum, materials, and modules used by the teacher. Tests are used to obtain data regarding students' critical thinking abilities. Data analysis consists of reduction, presentation and conclusion drawing. The results of this study showed that this research uses the ADDIE type of development model. In the analysis phase carried out analysis for curriculum, material, and student's character. At the design stage, the initial framework of the module is prepared and the framework developed at the development stage. In the implementation phase validation is carried out from the module framework that has been developed and continued with improving the design according to the results of validation.

Index Terms: ADDIE, Critical thinking, Module, PMRI

1. INTRODUCTION

Education is an effort made intentionally to shape the learning situation, so students can develop their own potential for themselves and the surrounding environment [1]. One of the skills that must be possessed in the 21st century era is critical thinking. Critical thinking is needed in overcoming various complex problems in aspects of life. Critical thinking is one of the skills associated with thinking activities, evaluating our own ideas and others without prejudice [2]. That skill can be developed through learning and assessment in class [3]. In solving a problem or making a reasonable decision, someone will be able to consider and choose the right information through critical thinking [4]. Learning activities at school can also develop critical thinking skills, so that problems related to learning and the problems of everyday life can be resolved properly [4]. Mathematics is one of the subjects that can develop critical thinking skills. Mathematics is also the basic capital for problem solving in everyday life, so mathematics must be taught at all levels. [5]. Mathematics plays a role in preparing students to face environmental change. Preparation is done by training students to use critical thinking in learning mathematics and science in daily life rationally and carefully [1, 6]. Students are expected to be able to use mathematics and mathematical mindset in everyday life, and learn a lot of science that emphasizes the arrangement of logic, character formation, and ability to apply mathematics [7]. Unfortunately, at this time many students experience difficulties in learning mathematics so students do not have the desire to try and think high-level to find solutions to the difficulties found in learning mathematics [8]. In mathematics, critical thinking can be defined as the ability to integrate prior knowledge, mathematical reasoning, and problem solving strategies to reflect mathematical problems in a reflective manner [4]. It is important for students to create effective and efficient ideas to minimize mathematical problems [9]. The purpose of education is to provide meaningful understanding and learning for students, for that critical thinking skills are very important in developing students' mathematical skills in understanding what they are learning [10]. To achieve the objectives of mathematical learning, most teachers teach mathematics through explaining the concepts of mathematical operations, giving examples of answering questions, and giving few directions [11].

Success in learning can be influenced by various factors, one of which is teaching materials used in mathematics learning. The use of teaching materials allows students to understand material in a shorter and more enjoyable time [12]. One of the teaching materials commonly used in schools is a module. Modules are one of the teaching materials used to support students in learning. Therefore it is necessary to develop modules that can facilitate students' skills [13].Students will easily remember when involved directly in the process of finding mathematical concepts using concrete objects [14]. RME (Realistic Mathematics Education) was first introduced by Freudenthal. RME was then adapted and adapted to the needs of Indonesian students better known as PMRI (Pendidikan Matematika Realistik Indonesia). PMRI was developed specifically for learning mathematics [15]. Freudenthal argues that mathematics can familiarize students with the application of mathematics in their daily activities, so learning mathematics must be real [16]. This means that students will be given the issues much easier for them to imagine [17]. PMRI's main goal is to make mathematics learning easier and more enjoyable for students through the introduction of real problems that are often touched by students. [7,18]. Based on the description above, this study aims to design of mathematics learning modules that are useful for students in increasing critical thinking with the PMRI approach.

2 RESEARCH METHOD

The type of this research is research and development. This research used the development model is the ADDIE (analysis, design, development, implementation, and evaluation). The scheme for the stages of the ADDIE model research as shown in Figure 1.

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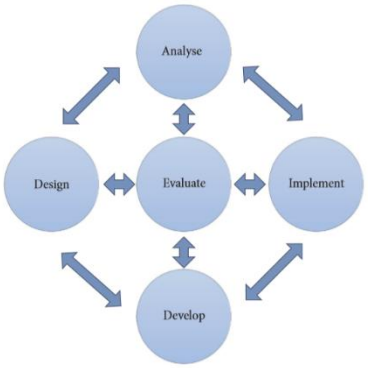


Figure 1. *Scheme of the ADDIE Model [1]*

Activities at the analysis stage are analyzing and clarifying learning situations so that instructional objectives, student characteristics, and needs are set. At the design stage, researchers design learning methods to overcome problems in strategic learning situations. Furthermore, at the development stage, researchers develop instructional resources that are in line with the strategic learning process. At the implementation stage, researchers apply a teaching system in learning situations. In the last stage of evaluation, the researcher evaluates whether the teaching system does overcome the learning situation [1]. In the analysis phase there are three components, namely, analysis of the curriculum, material, and characteristics of students. After analysis, the results obtained will be used as a basis in developing the module. At the design stage, it begins with the preparation of the module framework and designing the initial form of the module. After the initial design is formed, the next process is entering at the development stage. In the development stage a module framework is developed in the previous stage. Then the next stage is the implementation stage. In the implementation phase a validation process is carried out from the framework that has been developed. Then the evaluation phase is to improve the module design in accordance with the results of the validation in the previous stage. The subjects of this study were class VII students consisting of 64 students. The object of this study is the curriculum used in schools, student characteristics, and teaching materials used by the teacher. The instrument of this study consisted of interview guidelines, observation guidelines, and tests. Interview guidelines are used to obtain data about the characteristics of seventh grade students. The observation guide is used to obtain data on the curriculum used by the school and evaluate the materials and modules used by the teacher in mathematics learning. This test is used to determine the level of critical thinking of students in mathematics learning, especially in social arithmetic subjects. In analyzing the data, three stages were carried out, namely reduction, presentation, and conclusion. Data that has been obtained from interviews, observations, and tests are then analyzed to obtain a result and conclusion. The results of the analysis are in the form of things needed in the development of teaching materials in the form of mathematics learning modules.

3 Result and Discussions

This research was conducted by designing PMRI-based mathematics learning modules for seventh grade students of SMPN 2 Dlingo. The following are the results of the module development design through the analysis and design stages in ADDIE.

3.1 Analyze Stages

Based on observations, SMPN 2 Dlingo uses the 2013 curriculum. The learning process is centered on students so that the teacher's role as a facilitator. Teaching materials can also help students in the learning process so that student-centered learning activities can be achieved. However, the teaching materials used have not been able to make students easily understand. This is because students still have difficulty in bringing problems given to the appropriate mathematical models. Students are accustomed to accepting concepts rather than finding themselves so that students become difficult when given various questions. In addition, the difficulty of learning social arithmetic occurs because of the wrong teaching method, where mathematics is not subject to reason but to memorize. Such learning is a problem because students who memorize procedures without understanding can limit the transfer or connection of concepts learned in new situations [18]. Another reason for the difficulty of learning mathematics in students is because mathematics learning is less meaningful [19]. Based on the results of interviews, students are more happy when they can be directly involved in finding concepts. Students are also easier to understand when the material delivered is related to concrete objects or problems that students know every day. Students are less happy to read so often feel quickly bored while studying. The interest in student learning is also characterized by the fact that most students focus more on each other's activities than paying attention to the teacher in front of the class. This indicator is a reference for module construction. Basic competencies found in Social Arithmetic material in Table 1:

Table 1. *Basic Competience*

No.	Competence
3.9	Get to know and analyze various situations related to social arithmetic (sales, purchases, deductions, profits, losses, single interest, percentage, gross, net, tara)
4.9	Solve problems related to social arithmetic (sales, purchases, deductions, profits, losses, single interest, percentage, gross, net, tara)

Based on Table 1 there are 2 basic competencies that will be used in making the module. Based on the results of the interview with Ms. Basirah, A.Md.Pd as a grade VII math teacher, it was found that students could not absorb mathematics well. Students need modules that can facilitate students in understanding the concepts of Social Arithmetic material. The teacher also explained that the obstacle in the process of learning mathematics is mastery of concepts and understanding of children who are low. Learning objectives of developed previously. The indicators of achievement of competencies that have been learning objectives are in Table 2 below:

***Table 2** of Learning Objectives*

No	Learning objectives
1.	Get to know various situations related to social arithmetic (sales, purchases, discounts, profits, losses, single interest, percentage, gross, net, and tara)
2.	Describe various situations related to social arithmetic (sales, purchases, discounts, profits, losses, single interest, percentage, gross, net, and tara)
3.	Analyze problems related to social arithmetic (sales, purchases, discounts, profits, losses, single interest, percentage, gross, net, and tara)
4.	Resolve problems related to social arithmetic (sales, purchases, discounts, profits, losses, single interest, percentage, gross, net, and tara)
5.	Summarizes issues related to social arithmetic (sales, purchases, discounts, profits, losses, single interest, percentage, gross, net, and tara)

3.2 Design Stages

In the design stages, starting with the preparation of the module framework in each part such as the opening, content, and cover. Preparation of the module framework based on the results of the analysis in the previous stage. The stages in design include media selection, format selection, initial design. The appearance of the cover design of the module developed can be seen in Figure 2

***Figure 2.** Design of Cover*

In the contents section, the design of the first learning activity is displayed. As for the design of the contents section can be seen in Figure 3

***Figure 3.** Design of First Activity Learning*

3.3 Implementation Stages

At this stage, a validation process is carried out to determine the validity of the developed module design. Module design is validated by lecturers and teachers. The module design validation uses assessment instruments in the form of questions and questionnaires that have been reviewed by the instrument validator lecturer. Valid instruments can be used by media experts to assess module design. In the assessment there are 5 categories namely very good, good, sufficient, lacking, and very lacking. While the formula in calculating the score is shown in table 3.

***Table 3.** Category Rating Criteria Ideal*

Score range	Calculation	Classification
$\bar{X}_i + 1{,}8\ SB_i < X$	$16{,}9 < X$	Very good
$\bar{X}_i + 0{,}6\ SB_i < X \leq \bar{X}_i + 1{,}8\ SB_i$	$13{,}6 < X \leq 16{,}9$	Well
$\bar{X}_i - 0{,}6\ SB_i < X < \bar{X}_i + 0{,}6\ SB_i$	$10{,}4 < X \leq 13{,}6$	Pretty good
$\bar{X}_i - 1{,}8\ SB_i < X \leq \bar{X}_i - 0{,}6\ SB_i$	$7{,}1 < X \leq 10{,}4$	Less
$X \leq \bar{X}_i - 1{,}8\ SB_i$	$X \leq 7{,}1$	Very less

The results of the validation conducted by the teacher can be seen in the table 4.

***Table 4**. Results Calculation Questionnaire Design validation module*

Evaluator	Position	Score	Criteria for Quantitative Data
Basirah, A.Md. Pd	Mathematics Teacher in SMPN 2 Dlingo	20	Very Good

Based on the above results indicate that the design in the category is very good but some input was obtained in the form of suggestions for improving module design. Some of these inputs can be seen in table 5.

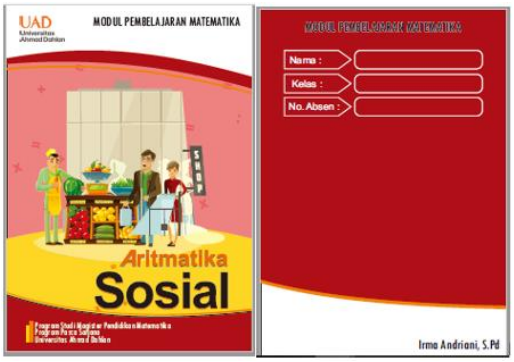
***Table 5**. Suggestions from Validator*

Suggestions	Follow-Ups
Give the name of module writer	Added the name of module writer
give an identity column for students	Added the identity column

Based on the results of the validation, it was found that the design of the module was declared eligible to be developed at a later stage.

3.4 Evaluation Stages

At this stage, the researcher improves the module design according to the advice given by the validator. As for the appearance of the design that has been improved according to



the suggestions can be seen in Figure 4.

***Figure 4**. Design of Cover after Revision*

The addition of the author's name from the module being developed is intended so that readers know the identity of the module. Addition of an identity column for the module owner so that the reader modules are not confused with others.

4 CONCLUSIONS

Based on the results obtained, the module design has been carried out from the analysis to evaluation stages. The first stage is the analysis stage, where there are 3 parts, namely curriculum analysis, material, and student characteristics. In the curriculum analysis section it was found that the curriculum used was the 2013 curriculum. In the analysis of the material, it was found that students had difficulty in solving the subject matter of social arithmetic. Whereas in the analysis of student characteristics it was found that students were more likely to be less happy to read so that interest in learning was reduced. Students also more easily understand if the material presented is related to concrete objects. At the design stage, researchers have designed the framework of the module to be developed. For the development stage, the development of the framework that has been determined previously was carried out. At the implementation stage, it was found that the module design was feasible to be developed at a later stage. Finally, at the evaluation stage the researcher improves the module design in accordance with the suggestions.

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