

Designing Mathematical Didactic Model to be Used in Mathematics Realistic

Eva Monika Safitri Lubis¹, Herman Mawengkang²

Master Student of Graduate School of Mathematics, Universitas Sumatera Utara, Medan, Indonesia¹

Professor, Department of Mathematics, University of Sumatera Utara, Medan, Indonesia²

ABSTRACT: Research on mathematics education is a broader area in which one of them aimed to improving mathematics teaching and learning practices. This paper describes one of tool to promote students ability in mathematics called didactic model. Such model can be used for learning a new mathematical concept, e.g, Realistic Mathematics. It consists of objects familiar to the learner with well-defined operations on them. The operations performed on the objects are rigorously defined and are fully and uniquely mapped onto the formal mathematical operations and syntax of this yet unknown mathematical concept. These operations support the construction of an understanding of more formal reasoning about mathematical concepts and about their essential properties. This paper proposes designing the model which would be appropriate for Realistic Mathematics.

KEYWORDS: Mathematics education, Realistic Mathematics, Design, Didactic model

I. INTRODUCTION

Research on mathematics education is a very broad study in which one aims to improve teaching and learning activities. There are 3 main causes of mathematical literacy in Indonesia which are very low, namely the weak curriculum in Indonesia, lack of trained teachers in Indonesia and lack of support from schools and the environment. Mathematics is one of the lessons given starting from elementary school to college. Objects in mathematics are abstract. Because of its abstract nature it is not uncommon for teachers and students to experience some obstacles in teaching and learning activities.

The learning of mathematics which is carried out by the teacher so far is explaining mathematical objects, giving examples of mathematical objects that are explained, asking students to solve problems similar to the examples and giving practice questions. Learning mathematics like this tends to make students bored and not interested in learning mathematics, even the most pathetic learning achievement is very low. Though these students are not weak students, but so far they are busy memorizing the concepts, principles and mathematical operations addressed by their teacher [4]. Renewal efforts to improve mathematics learning have long been carried out in various ways and purposes. The study effort is in the form of a curriculum with clear objectives, there is also a renewal of learning in the classroom. The didactic model always plays an important role in the field of mathematics education, but it is not always the main theme of theoretical interest in society. Didactic models are a means of learning new mathematical concepts, such as realistic mathematics. It consists of objects that are familiar to students with operations that are well defined by them [5].

In many articles and journals, didactic theory has been used to analyse ordinary teaching and practice learning, and bring significant changes to students' understanding of mathematics [6]. Therefore the author tries to discuss the use of didactic models in realistic mathematics education. The problem that will be discussed in this paper is the design of the didactic model design in realistic mathematics education.

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II. RELATED WORK

Didactic Model

The concept of a didactic model was introduced into mathematics education by Brousseau, et al. [1] to analyze the interaction between students and teachers in the classroom. The didactic model is a way to negotiate and share the responsibilities and expectations of a teacher and student with respect to the mathematical knowledge learned [7]. There are two roles of teachers in the didactic model of devolution and institutionalization. Devolution is the process by which a teacher assigns responsibility to students to acquire new mathematical knowledge, solve problems or provide appropriate situations from a particular environment. While institutionalization is the institutionalization process that students relate to their previous knowledge and new knowledge to solve other problems in new situations. Attempts to use didactic models of mathematical concepts to overcome complexity establish meaningful formal language described by [8]. The heart of the Nesher mathematical model learning system is the main means towards understanding the characteristics of formal mathematical language. As in the traditional approach, the physical world only enters the sequence only after formal language has been meaningfully understood. Thus, while didactic modeling offers a significant way to understand the nature of number concepts (eg comparison of numbers as objects, groups of binary operations) and linking them to formal language, the relationship between physical fields and mathematical concepts is not well established [9].

Realistic Mathematics Education

Mathematics education is the theory of mathematics domain-specific instruction, which was first developed in the Netherlands in [2], and then adopted in Indonesia since 2001. Realistic terms are not always real-world situations, but it can be a situation where students can imagine even formal mathematical words, as far as they are real in their minds. Learning-oriented realistic mathematics education prioritizes the introduction of concepts through contextual problems, concrete things or from students' environments with mathematical processes by students by constructing their own ideas. In [3] argues that realistic mathematics education is basically the use of reality and the environment that students have understood to facilitate the process of learning mathematics, with the hope that the goals of mathematics learning can be achieved better than in the past. Realistic mathematics education learning does not begin with definition, theorem or traits then proceed with examples, such as those that have been carried out in various schools. But the characteristics, definitions and theorems are expected to be rediscovered by students through the completion of contextual problems given by the teacher at the beginning of learning. Thus in realistic mathematics education students are encouraged or challenged to actively work, and are even expected to be able to construct or build their own acquired knowledge. Realistic mathematics education has six principles: understanding contextual problems, describing and solving contextual problems, comparing and discussing answers and drawing conclusions. These principles can be used in designing teaching and learning.

III. RESULT AND DISCUSSION

Learning Design

1. Introduction

- a. The teacher opens the lesson and reminds the material previously learned, namely by appointing several students to give examples of open sentences, closed sentences and similarities and variables.
- b. The teacher checks and discusses homework given at the previous meeting.
- c. The teacher communicates the learning objectives to be achieved.

2. The core activities

- a. The teacher share the worksheets in each group and provide opportunities for students to read and understand realistic problems in LKS (the teacher asks one student to read realistic problems)
- b. The students the right to ask questions for those who have no understanding of the realistic problem. The

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- c. teacher gives the teacher gives the opportunity for students individually to solve realistic problems by answering the questions in part A in their own way (the work of one student does not have to be the same). If students experience difficulties the teacher guides them as needed.
 - d. The teacher gives students the opportunity to discuss / compare (check, improve, select) the answers with their group friends. The teacher walked around the classroom to see the results of the group's work and selected several groups to display the results in front of the class.
 - e. The teacher gives an opportunity to a student from the group selected to display the results of the group's work.
 - f. Through class discussions students' answers are discussed / compared
 - g. From the results of class discussions, the teacher gives students the opportunity to draw a conclusion about the definition and steps to solve the one-variable linear equation.
 - h. The teacher gives the opportunity for students to ask for those who do not understand.
3. Closing
- a. The teacher reaffirms the lesson material about the definition of one variable linear equations resolution.
 - b. The teacher gives home assignments to other realistic problems in the student book.

In learning, the teacher is only as a facilitator, which only explains what is necessary for things that are not understood by students in solving problems. Besides that the learning design is in accordance with the design of the didactic model. The following is a realistic problem design given by the teacher to students:

Realistic Problems 1:

Every 15th, Posyandu Kotapinang weighs a toddler. Because annisa buk Fatimah's daughter is sick, then she cannot be weighed alone. To be able to determine the physical weight of her daughter, the Posyandu officers asked Bu Fatimah to be weighed while carrying her child and obtained their weight of 72 kg. Then Mrs. Fatimah was weighed alone and it turned out that the weight was Fatimah 65 kg. how much is her weight?

Here are some possible alternative answers for each student group:

1. Suppose Annisaa weight = x

$$\text{Weight bu Fatimah} = y = 62$$

$$\text{Obtained equation: } x + 65 = 72$$

$$x = 72 - 65$$

$$x = 7$$

2. Without modeling

$$\text{Weight annisa} = \text{weight annisa and bu Fatimah} - \text{body weight bu Fatimah}$$

$$= 72 - 65$$

$$= 7$$

3. By modeling, but without explanation

$$b - s = 72 - 65$$

$$= 7$$

Realistic Problems 2:

One day sima shopping at supermarket. Sima pay Rp. 40.000 and receive 5 kg of oranges. What is the price of one kg of oranges?

Here are some possible alternative answers for each student group::

1. Suppose amount of money = Rp.40.000

$$\text{The price of 1 kg of oranges} = a$$

$$\text{Obtained equation: } 5 \times a = 40.000$$

$$a = 40.000 : 5$$

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$$a=8000$$

2. Without modeling

$$\text{The price 1 kg oranges} = 40.000 : 5 = 8000$$

3. Wrong pemodelan but the results are correct.

$$\text{Oranges} = x$$

$$\text{Oranges} = 5 \text{ kg}$$

$$\text{Obtained : } x + 5 = 40.000$$

$$x = 40.000 : 5$$

$$x = 8000$$

use of real life contextual situations based on the principle of reality as an environment in the didactic model provides opportunities for some students to institutionalize their knowledge. However, other students are not affected by this situation, but they prefer without using modeling to find results from these realistic problems. In the classroom students learn to use a didactic model to analyze and compare realistic problems, from this problem challenges students to use didactic models in different ways in each of their answers. We must realize that the teacher cannot be sure that students will learn exactly what the teacher teaches. Students may have their own strategies or models to know certain mathematical knowledge based on their previous experience or knowledge.

IV. CONCLUSION

Realistic mathematics learning with the use of didactic models is very important, as well as real world developments in aspects of human life. With the aim that students can handle more complex mathematical problems and can develop mathematical thinking patterns that are critical and analytical.

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