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# Improving The Understanding Of The Arithmetic Concept Through Realistic Mathematic Education (RME)

**Anggit Prabowo**
**Dr. Marsigit**
**Atmini Dhoruri, M.S**
**E-mail: anggit_191085@yahoo.com**

*Yogyakarta State University*

## Abstract

This study aims to improve the arithmetic concept understanding of the second grade students of Percobaan 2 Yogyakarta elementary school through Realistic Mathematic Education (RME). This study was a classroom action research. This study was conducted in two cycles. The participants were the students and teacher of second grade (IIA) of Percobaan 2 Yogyakarta Elementary School. The data were collected by observation form, manual interview, and test. Observations were used to collect the data of the students's activities in mathematics teaching and learning. The test was used to collect the data of the students's arithmetic concept understanding.

The results of the study show that RME improve the students's arithmetic concept understanding of Percobaan 2 Yogyakarta Elementary School. There are the improvements of arithmetic concept understanding after doing mathematic teaching and learning through RME. The improvements are: (a) repeating a concept ability increases from 79.9798% to 84.3434%, (b) classifying objects according their characteristics increases from 70,9090% to 86.3636% , (c) giving the example and non-example ability increase from 94.8864% to 95.4545%, (d) presenting the concept in all of represented mathematics increases from 73.8634% to 89.3939%, (e) developing the sufficient and necessary condition ability of a concept increases from 46.9697% to 79.5454%, (f) Using and deciding a particular procedure increases from 71.9697% to 78.0303%, (g) aplying concept increases from 71.2121% to 78,7879%. Generally, the arithmetic concept understanding increases from 72.7273% to 85.0000%.

**Key words**: arithmetic concept understanding, realistic mathematic education

## I. INTRODUCTION

Students in Indonesia learn mathematics at all levels of education. Students learned mathematics since they were in elementary school. Even, they had been introduced about mathematics in kindergarten. Mathematics need to be learned early for preparing student's logical, analytic, systematic, critic, and creative thinking. This competences are needed in order to give students's getting, organizing, and maximazing the informations, and surviving in the dinamic and competitive situation.

The quality of mathematics education in Indonesia had not been satisfied yet. According to the report of Trends in International Mathematic and Science Study (TIMSS) in 2007, Indonesia got a score 405 (scale 0-800). According to the report of

Program for International Assesment of Studenta (PISA), in 2006 Indonesia got a score 391 (scale 0-800). It is anxious. Singapore and Malaysia were better than Indonesia. Singapore got a score 593 and Malaysia got 474 in TIMMS.

Zulkardi (2007) said that there are some factors that cause Indonesian mathematics achievement low. That factors are (1) crowed curriculum, (2) too difficult materials to be followed, (3) uninteractive teaching method, (4) uneffective media, and (5) uneffective evaluation.

Seeing the problems of education in Indonesia as described above, the Indonesian experts in education changed the curriculum. Curriculum of mathematics in 1994 and 1999 was changed to Based Competence Curriculum. Then, in 2006 it was changed to Unit Level Education Curriculum.

In unit level education curriculum, teaching and learning which previously centered on the teacher was converted into the student (student oriented). It emphasize the students on mastery of competencies. Learning-based education unit level curriculum suggestes a meaningful learning. This curriculum combines two aspects, competence and student learning process. In other words, this curiculum change the teaching paradigm to learning paradigm.

To implement the unit level curriculum, the learning approach should be developed. Especially in mathematic, needed a new approach make it meaningful. One of the approach that suitable with the principle of this curriculum is realistic approach.

Realistic approach in mathematics is based on the Realistic Mathematic Education (RME) which had been developed by Hans Freudenthal since 1973 in Netherlands. Mathematics learning by this approach is a mathematics learning that started by contextual and realistic mathematics problems. Realistic approach is a learning approach that started by a real problem for students. It is focused to the students's mathematical skills by discussing, collaborating, and arguing with their classmates to find the concepts in mathematics and ultimately use it to solve

mathematical problem either individually or in groups (Zulkardi, 2007). Thus, the realistic approach is the approach expected to support the implementation of KTSP.

To support and develop the realistic mathematics learning in Indonesia, Indonesia mathematics education experts formed Pendidikan Matematika Realistik Indonesia (PMRI) in 2000. Although it had been developed since 1970 in the Netherlands and since 2000 in Indonesia, the realistic approach is still relatively unfamiliar to teachers of mathematics in Indonesia. Currently realistic mathematics learning has been piloted in several schools in Indonesia. In Yogyakarta, realistic approach has been piloted in several elementary schools, one of which is Percobaan 2 Elementary School. It is located in Sekip, Catur Tunggal, Depok, Sleman, Yogyakarta. It has implemented the learning of mathematics with a realistic approach since 2001. At 2011, mathematics learning with a realistic approach has been implemented in all of the classes.

Arithmetic is one branch of mathematics. Formally, students learn mathematic start in elementary schools to enrich their numeracy (using numbers) skills as a tool in life. Skills on numeracy are absolutely necessary in calculating, because counting skills will be widely used in solving the more complex problems of mathematics.

How the students's concept understanding is important to be understood by the teacher. There are indicators to measure how students' concept understanding, (1) repeating a concept, (2) classifying objects according their characteristics, (3) giving the example and non-example, (4) presenting the concept in all of represented mathematic, (5) developing the sufficient and necessary condition ability of a concept, (6) Using and deciding a particular procedure, (7) aplying concept (Depdiknas, 2006).

Students will be easier to do the calculations when they master the concepts of initial calculations beforehand. They will be succes in arithmetic when they understand the concept correctly. By the good and right concept of numeracy, students will be succes when they faced more complex issues about calculation (Sweller, 1999). The introduction of concepts in mathematics can be begun by recogniting the contextual

problem. According to Chapman (1976:173), students's concept formation is strongly influenced by their daily experience.

Based on the observations and interviews that researcher done, in the class of IIA Percobaan 2 Elementary School show that even the students have studied the calculation of numbers from 1 to 100 before, their numeracy skills are still less. Students tend to make mistakes in calculations. Only some students are able to do the calculations correct. Concepts in calculation have not been understood well. It brings consequence that a solution should be sought immediately to enhance the students's arithmetic concepts understanding level.

One solution that is expected to improve the students's arithmetic concept is realistic mathematics learning. Why realistic approach is expected to enhance students' arithmetic concept in mathematics, because realistic mathematics learning is started from a contextual problem for students. This is accordance with Dienes's opinion quoted by Bell (1981:124), that each concept in mathematics can be more easily understood when the students initiate learning activities through the concrete things. Based on the explanation above, researcher plan to conduct a Classroom Action Research, collaborate with the teacher of IIA Percobaan 2 Elementary School entitle "Improving the Arithmetic Concept Understanding through Realistic Mathematic Education (RME)".

## II. RESEARCH METHOD

### A. Research Type

This research is a Classroom Action Research (CAR). It was implemented in a collaborative and participatory. Collaborative means reseracher collaborate or cooperate with the teacher of class IIA of Percobaan 2 Elementary School. Participatory means the researcher and teacher concerned as a team, on the cycles of the research.

Research model used in this study is a modified model of action research as shown in below.

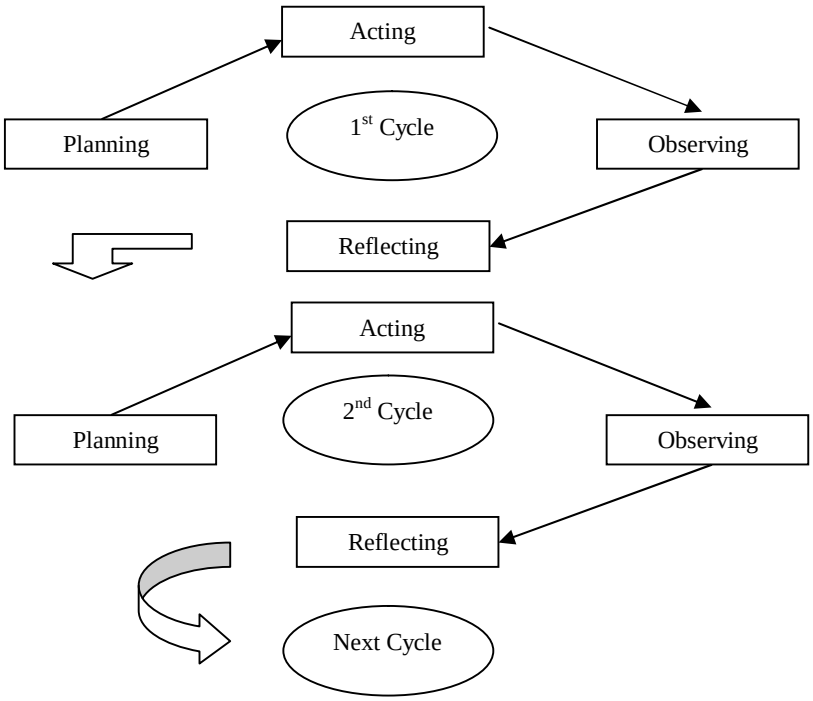


Figure 1. Action Research Model
(Sutama, 2011:27)

B. Object and Subject

Subjects of this study were the class of IIA of Percobaan 2 Elementary School 2008/2009. The object research was the whole process of learning mathematics conducted by realistic approach and students's arithmetic concept understanding in the class of IIA of Percobaan 2 Elementary School, Depok, Sleman, Yogyakarta.

C. Research design

This study was conducted at 2 cycles. Each cycle includes planning, acting, observing, and reflecting.

D. Instrument

The instruments that used in this research are researcher, manual observation, manual interview, and test.

## III. RESULT AND DISCUSSION

### A. Realistic Mathematics Learning

Van Reuwijk (1995) provides the following characteristics of Realistics mathematics Education: “real” word, free productions and constructions, matematization, interaction and integrated learning standards. The explanation of that characteristics are below.

1. “real” world

Contextual problems have a very important role in learning mathematics with realistic approach. Contextual issues that are raised by teachers and students can be used as a "starting point" of learning mathematics. It is suitable with Sutarto Hadi (2003:6) that the real context is necessary to develop a contextual situation in exploring the materials to make the learning more meaningful.

Based on the results of classroom observation, there are some contextual problems used as the starting point learning of mathematics. First, students were guided by teachers use the context of number of students in IIA to learn place value of a numbers. This context is developed to study the place value of numbers from 1 up to 500.

The second contextual problem, students used a context store building and brick making to learn addition and subtraction of numbers from 1 to 500. Here are the issues raised in learning:

> "Toko Makmur" has 230 pieces of bricks. They buys bricks from Mbah Marto. The total of the bricks have been bought are 210 pieces." How many are brick-owned" Toko Makmur"now?

By the context of buying and selling the bricks above, students learn about the summation of numbers. In this case, " Toko Makmur "conducting buy bricks. With that context students can understand that, buy means getting goods, in other words, goods will increase. In the end, students can conclude that summing means add a number by the others.

2. Free productions and constructions

Realistic mathematic learning gives an opportunity to the students to construct knowledge through various activities during learning. Knowledge and experience different learning encourages students to do a good pairly or grouply discussion to construct their knowledge. The interaction will produce a new knowledge results from different experiences.

Based on classroom observations, students and teacher bring up the contextual issues together to initiate learning. These are discussed pairs or groups. Students construct had prior knowledge through discussion. Here are some of the students attempted to construct their knowledge through group discussions.

Ts : “How to solve it?”
Sh : “Let’s solve it by a long way”
Ag : “No, a short way is more simple”
Sh : “Let’s solve by both of them.…”
Hk : “Yes, that is a good idea…”

Students interaction above shows that they try to construct their knowledge. Some students solve the computation by a long way, but there are students who understand the short way. A discussion between students will produce new knowledge for students. After each group finishing the discussion and able to deliver discussions, students evaluate the results of these discussions and conclude the appropriate opinion.

3. Mathematization

There are two types of matematization, horizontal matematization and vertical matematization. Horizontal matematization refers to modelling the problem situation into mathematics. Vertical mathematization refers to the process of reacching a high level of mathematical abstraction (Drijvers, 1999).

Based on the classroom observation, there are several modeling used in learning mathematics (figure 2). First model is "card number". "Card number" consisted units of the cards, cards of tens and hundreds cards. Students use modeling to study the numbers includes determining the symbol number, determine the value of a number, the long form of a number, and study material about addition and subtraction number up to 500. Modeling supports the interaction in the classroom because students use the card numbers to perform games and group discussions.

The second model is Multibase Arithmetic Block (MAB). MAB is an arrangement of the blocks consisting of block units, block tens and block hundreds. Students use MAB invented the concept of units, tens, hundreds, and the long form of a number based on the rules of the place. Students also use the MAB invented the concept of addition and subtraction.

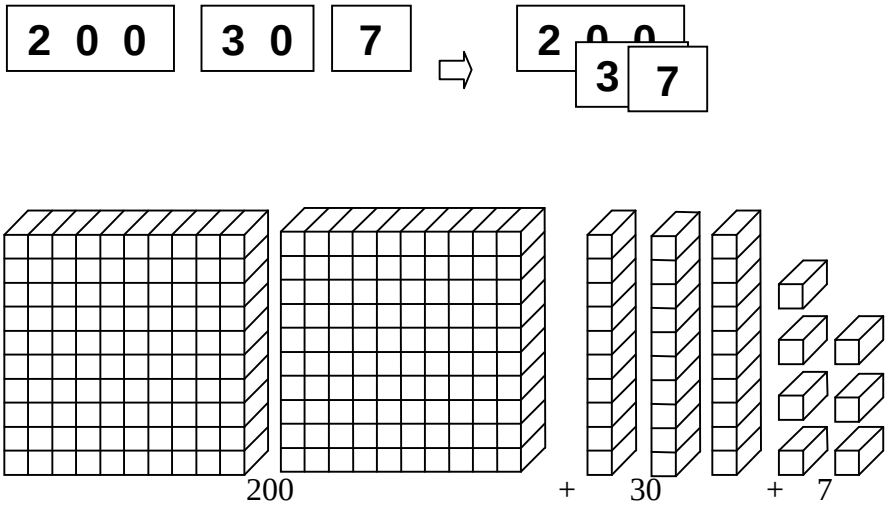


Figure 2. Card number and MAB

4. Interaction

Interaction in learning is a major thing. In the realistic mathematic learning, interactions are expected. The interaction is not only between students and teacher, but also the interaction among the students.

Based on the results of classroom observation, discussion can stimulate students to interact. Students discuss in pair or group. In group of discussions, each group consisted of 4 students. Mostly, students discussed about the way to solve a problem. If a group was not able to settle the problem, one or several members of the group asked the teacher or researcher. During group discussions, sometimes there are differ opinions among students. Each student expressed thoughts in accordance with the understanding they had.

Interactions formed between students and teacher more visible on coaching in the classical style or individual. When students discussed, the teacher walk around and give guidance to the students who have difficulties. If the level of difficulty was low, teacher coached individual (figure 3). However, when the problems faced by students is a problem that important and need to know the other students, teacher coached in classical style.

The students have a various way to deliver their problem to the teacher or researcher. There are some students who come near to the teacher immediately when they faced a problem, with a soft voice. There are also students who directly communicate problems faced with a loud voice without show of their hand first. Another group told the problem by showing of their hand first. There was also a group of students who present their problems when the researcher was passing beside them.

Figure 3. Individual coaching

5. Integrated learning standards

In the RME, different topics should be integrated in one curriculum (Drijvers, 1999). Based on the results of classroom observation, the integrated topics occur when students calculated the additional of numbers. Student wrote:

$$\begin{array}{rl} 235 & = 200 + 30 + 5 \\ \underline{144} & \underline{= 100 + 40 + 4} \; + \\ & = 300 + 70 + 9 \\ & = 379 \end{array}$$

The way students calculated indicates an association between place value and summation of numbers. Before doing summation, the students formed a number into a long form and then add them up.

B. Students's arithmetic concept understanding

The students's arithmetic concept understanding were measured by the test. The test consists of 7 items representated the each indicators of the concept understanding. Based on the result of the test at first cycle and second cycle, there are the improvements about the students's arithmetic concepts understanding. The improvements are below.

1. Repeating a concept ability increase from 79.9798% to 84.3434%,
2. Classifying objects according their characteristics increase from 70.9090% to 86.3636%,
3. Giving the example and non-example ability increase from 94.8864% to 95.4545%,
4. Presenting the concept in all of represented mathematics increase from 73.8634% to 89.3939%
5. Developing the sufficient and necessary condition ability of a concept increase from 46.9697% to 79.5454%,
6. Using and deciding a particular procedure increase from 71.9697% to 78.0303%,
7. Applying concept increase from 71.2121% to 78.7879%.

Generally, the arithmetic concept understanding is increase from 72.7273% to 85.0000%. It means realistic mathematic learning has an ability to improve the arithmetic concept understanding of students of IIA Percobaan 2 Elementary School. It is suitable to Chapman (1976:173) that students experience affect the concept forming.

## IV. CONCLUSION AND SUGGESTION

### A. Conclusion

According to the result and discussion, can be concluded that RME improved the arithmetic concept understanding of student's of II A Percobaan 2 Elementary School. The improvement of arithmetic concept understanding is showed in each aspecs on concept understanding.

### B. Suggestion

Based on the coclusion of this study, some of suggestions need to be considered in the learning of mathematics by using realistic approach.

1. To improve the understanding of math concepts through RME is needed context of "real world" interesting for students to start the learning.

2. To improve the understanding of math concepts through RME, students should be given freedom to express his knowledge by using models during the learning.

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