IMPROVING INTUITION SKILLS WITH REALISTIC MATHEMATICS EDUCATION

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Abstract

The intention of the present study was to see the improvement of students' intuitive skills. This improvement was seen by comparing the Realistic Mathematics Education (RME)-based instruction with the conventional mathematics instruction. The subject of this study was 164 fifth graders of elementary school in Palembang. The design of this study was a Pretest-Posttest Control Group Experiment. Data was analyzed with the help of SPSS. The result of this study showed that there was different improvement of students' skills. The improvement was higher in the class using the RME-based instruction that in conventional mathematics class.

Keywords: Realistic Mathematics Education (RME), Intuition

Abstrak

Penelitian ini bertujuan untuk mengetahui peningkatan kemampuan intuisi siswa. Peningkatan ditinjau dari pembelajaran matematika realistik (PMR) dibandingkan dengan pembelajaran matematika konvensional (PMK) terhadap siswa kelas V SD di kota Palembang. Penelitian ini merupakan penelitian eksperimen berbentuk Pretest-Posttest Control Group Design. Sampel penelitian sebanyak 164 siswa. Data dianalisis menggunakan program SPSS. Hasil penelitian menunjukan, terdapat perbedaan peningkatan kemampuan intuisi siswa yang signifikan. Peningkatan kemampuan intuisi siswa dengan PMR lebih tinggi dibandingkan dengan PMK.

Kata kunci : Pembelajaran Matematika Realistik (PMR), intuisi

In mathematics education, it is not enough for the teacher to only teach how to problem solve. The more important is to make sure that the students are able to create effective and efficient ideas to solve mathematics problems. For the students to be able to create such kind of ideas or notions, the intuitive skills in solving mathematics problems need to be improved. The intuitive skills are very helpful in helping the students in problem solving situation, Tall stated that when the students face some difficult situations in logical thinking, it is really important to also consider their mathematics intuition (Yohanes, 2007).

Epp (1994) also stated that when the teacher teaches the students about the deductive reasoning, he has to make an emphasis on students' intuitive understanding through the image the students have in their mind. In psychology, Jung stated that intuition is one of the three cognitive functions; they are: thinking, feeling, and sensation (Henden, 2004). Some psychology experts view the intuition as a parallel function with analytic thinking and the results of intuitive thinking can be wrong sometimes. Similarly, there is some different opinions between the experts' views about intuition; some of them views intuition as a product of experience and reasoning, while the others view the intuition as a non-

product of experience and/or can be viewed as an implicit reasoning (it happens unconsciously). In Zeev and Star (2002), a mathematician, Hadamard, stated that intuition is a way in understanding the evidence and conceptualization.

Intuition is a word that almost everyone has said. In daily life, people use this word often. Some people defines intuition as imagination, some other defines it as a sense, and there are also some who defines it as something similar to feeling, and many more definition about intuition can be found. It is shown that in daily life, intuition is understood in various ways and there is no common agreement about the definition of it.

In Merriam Webster's Collegiate Dictionary, Tenth Edition, intuition is defined as an immediate apprehension or cognition). In the Encyclopedia of Philosophy, intuition is defined as an immediate apprehension. The meaning of the word "immediate" is there is no need of reference, thinking about the cause, ability in defining the terms that is used, justification, symbols, and rethinking process. In Dictionary of Psychology, intuition is defined as a mode of understanding or knowing characterized as direct and immediate and occurring without conscious though or judgment. In Indonesian Online Dictionary, intuition is defined as a power or ability in understanding or knwing something without thinking or learning about.

On the other side, there is a tendency that intuition is an immediate effort, no use of reference and the result is considered as a truth so that the person who uses his intuition feels that there is no need of proving or justifying their thought. From the definitions of intuition above, we can conclude that the intuition is a mental cognition or process in understanding something, or in receiving knowledge. This mental process has the nature of immediateness, direct, and no need of justification.

According to Fischbein (1993), intuition is a mental (cognition) process that has some unique characteristics. Fischbein uses the intuition term equivalent with the process of receiving intuitive knowledge. Intuition is viewed as a cognitive type. The knowledge that is built from this mental process is stated as the intuitive knowledge.

There is a need of creating a whole mathematics instruction that develops formal and cognitive intuition. A way to do this is always giving opportunity to the students so that they can create their own ideas in understanding mathematics knowledge and solving mathematics problems.

The term mathematics intuition means the intuition used in understanding the mathematics concept, fact, operation, and principle, or intuition used in solving mathematics problems (Yohanes, 2007). Bruner and Hart (in Usodo. 2007) stated that in solving mathematics problems, there are two approaches, such as analytically and intuitively. Intuition is defined as a cognitive consists of subjective truth in it, can be directly received, holistic, pursuing, extrapolative, non-analytic, without logic reasoning process. Mathematics intuition definition depends on two views, mathematics intuition definition in classic intuitionist view and inferential intuitionist view.

According to classic intuitionist view, mathematics intuition is the ability in understanding and solving mathematics problems directly without formal mathematics reasoning. The knowledge from

this kind of intuition cannot be tested, supported, or understood intellectually. Intuitive knowledge is not practical and cannot be applied, and independent from prior knowledge (Zeev & Star, 2002). It also stated that classic intuitionist views intuition as "a special contact with prime reality, producing a sense of ultimate unity, true beauty, perfect certainty, and blessedness."

The inferential intuitionist view is different from the classic one. The inferential intuitionist views intuition as a form of reasoning guided by the interaction between rational person and his environment. The intuition is a result of prior experience from e series of decision making process happen directly and unconsciously. It is possible that a mistake happen in the decision making process using because it depends on experience this view is in line with some philosophers' such as Ewing and Bunge (Zeev & Star, 2002) that stated intuition as a product of reasoning and prior learning experience. Bunge also stated that intuition is a hypothesis tested by people by doing probabilistic judgment.

To improve students' mathematics intuition skills, the RME approach has to be done. According to Hudoyo (1988), the goal of mathematics instruction is to make the students able to problem solve faced with their reasoning and scientific consideration. The definition of problem solving Polya stated (in Hudoyo, 1988) is a way in finding the way out of any difficulties to reach a goal. By that definition, the problem solving can be seen as a high intellectual activity. This learning is a psychological process engaging the application of some theorems.

Students' ability in problem solving is need to be improved, especially the ability in improving problem solving technique and strategies, and the ability in problems synthesis. One thing the teacher can do when guiding the students is choosing the best instructional approach. The use of inappropriate model can create a boring class, make it hard for the students to understand the concept, and finally decrease students' motivation in learning.

One of instructional models that can be used in solving the problem aforementioned is Realistic Mathematics Education (RME). RME is an instructional approach in mathematics that has been developed in the Netherlands. The theory of this approach is based on Freudenthal's view that mathematics is a human activity and has to be connected with the reality. The mathematics instruction cannot be separated from someone's nature of mathematics, looking for problems, and organizing or mathematizing the concept (Gravemeijer, in Hadi 2003).

Freudenthal stated that students cannot be passive receiver of ready-made mathematics. Mathematics instruction has to be directed to the use of situation and possibility that allow students to reinvent mathematics by their own strategies. According to Zulkardi (2002), students need to get accustomed to the concrete tasks. It means that in solving mathematics problem, they have to be given realistic problems that related to their reality.

In the process of doing mathematics, Freudenthal (in Zulkardi, 2002) emphasizes that the students have to be allowed and supported to create their own ideas and use their own strategies. In other word, they have to learn mathematics in their own way. In every activity, the students are free to

discuss what strategy they can use to solve the problems given by the teacher. In doing that, the social interaction that occurs in the classroom is an important part of the whole class performance. Working in group can create a natural situation for social interaction (Zulkardi, 2002).

According to Zulkardi, there are two important things that have to be connected with the reality and mathematics as a human activity. **First**, mathematics has to be closed to the students and relevant with the daily life situation. However, the word "realistic" not only refers to the real world, but also to the imaginable problems that experientially real for the students. For this kind of problems, it is of course important that they have to be connected with the real world of students, but it is not always a must. De Lange (1996) stated that the problems situation can also be viewed as an application of modeling. **Second**, mathematics as a human activity is important to be considered. RME is a school mathematics instruction that is being done by placing students' reality and environment as a starting point of the instruction (Freudenthal, 1973). The learning process is not started with the definition, theorems or characteristics and followed by the example of problems, but those three is something the students have to reinvent.

According to Gravemeijer (1994), there are three key principles in RME that can be used as a basic in designing the instruction. Those are: (1) guided reinvention and progressive mathematization; (2) didactical phenomenology; and (3) self-developed models. De Lange stated that the RME theory has five characteristics (Zulkardi, 2002) as follows:

1. The use of real context as a starting point of the instruction to be explored.
2. The use of models.
3. The use of students own production and construction.
4. Interactivity in the learning process.
5. Intertwinement in other learning strands.

The results of the study about RME in the Netherlands have shown the satisfying result (Becher & Shelter, 1996). Even Beaton (1996) refers to the Third Mathematics and Science Study (TIMSS) report that by their evaluation, Dutch students get the satisfying result both in computational and problem solving skills. Because of the problems mentioned above, the researcher wants to do a study about elementary school students' intuition skills with the help of RME.

Elementary school has an important role in education. Students' success in elementary school is really connected to their success in high school. However, there are many opinions that in mathematics instruction, especially in elementary school, students' reasoning, logic, and their thinking process are not considered much yet (Siswono, 2007).

The research question is: Are the students that learn mathematics with RME approach have better intuition skills than those who learn mathematics with a conventional approach?

The intention of this study is to know the improvement of intuition skills. This improvement is observed by comparing the RME approach mathematics instruction to the conventional one. The result

of this study can be used as a way for the teacher to apply the RME approach in their instructional process to improve their students' intuition skills.

METHOD

Research Design.

This study is pretest-posttest control group design experimental study (Sugiyono, 2006). The design of the present study can be drawn with this:

O X O

O O

X = Realistic Mathematics Education

O = Test of mathematics intuition skills

The present study was conducted in 2 (two) elementary schools consist of high level and middle level school. The school level was determined by the school accreditation. In each level, one elementary school was picked randomly.

There are two groups of classroom in each level: the experiment class in which RME approach was applied, and control class that was treated with conventional mathematics instruction.

To know the improvement of students' mathematics intuition, the data of student's n-gain was analyzed between those who received the RME instruction and those who got the conventional approach.

The Subject of the Study

The fifth graders of elementary schools in Palembang are the subject of the present study. The reason why they were chosen as the subject was because the range of their age is between 11-12 years old, which is potentially are in the best phase of intuition development (Piaget, in Cherry).

Data Analysis

Quantitative data analysis was conducted to see the difference of improvement between the RME students' intuition skills and the conventional students, by the level of the schools.

RESULT AND ANALYSIS

The subjects of the present study were 164 fifth graders of elementary schools. Eighty-two of them were given the RME-based mathematics instruction and the other 82 were given the conventional mathematics instruction.

One of the aims of the study was to describe the difference of students' improvement in intuition ability between those who got the RME-based instruction and those in the conventional instruction, based on the school levels, and students' prior mathematics ability. The study was also conducted to see the difference of the interaction between those approaches. The data analyzed were the n-gain score of intuition ability between students' pretest and posttest score.

From the data of all the students, it could be concluded that there was an improvement of students' mathematics intuition ability both in RME-based classroom and conventional-based

classroom. The students in the RME-based classroom had an average improvement score of 0.5415 for their intuition ability, while those in the conventional-based classroom had an average score of 0.3951. According to Hake's category (Hake. 2002), this improvement could be classified in the middle group. Descriptive result of the n-gain score of students' intuition ability on both groups is shown in the Table 1 below:

Table 1. The Description of Students' Intuition Ability Result in both Groups

Approach	N	Mean	Std. Deviation
RME	82	0.5415	0.1640
Conventional	82	0.3951	0.1784

Data Normality Test

The result of the data normality test n-gain of the students' intuition ability had shown that both probability score (sig.) is more than 0.05. From this result, it can be concluded that we can accept H_0. The sample in both groups is normally distributed. The result of data normality test of both group (RME and conventional) can be seen in Table 2 below:

Table 2. Data Normality Test N-gain of Students' Intuition Ability from Both Group

Approach	N	Mean	Z	Sig.	H_0
RME	82	0.5415	1.124	0.159	Accepted
Conventional	82	0.3951	1.176	0.126	Accepted

Variance Homogeneity Test

From the variance homogeneity test n-gain data of students' intuition ability, we get that both probability scores (sig.) were better than 0.05. It can be concluded that the H_0 was accepted or both group data were homogeneous. The result of variance homogeneity test of both groups is shown in the Table 3 below:

Table 3. Variance Homogeneity Test for Students' Intuition Ability N-gain Data

Approach	N	Std. Deviation	F	Sig.	H_0
RME	82	0.1640	0.311	0.578	Accepted
Conventional	82	0.17840			

Signification Test

Statistical hypothesis was used to see the significant difference between the RME-based instructional students' intuition ability and those who got the conventional one. The formula of statistical hypothesis tested was:

$$H_0: \mu_1 \leq \mu_2$$

$$H_1: \mu_1 \geq \mu_2$$

With:

μ_1 = the average of students' intuition ability improvement using RME-based approach

μ_2 = the average of students' intuition ability improvement using conventional approach

The criteria used in this test were:

a. If probability score (sig.) is more than α = 0.05, then the H_0 is accepted
b. If probability score (sig.) is less than α = 0.05, then the H_0 is rejected

The result of signification test of students' intuition ability using the t-test is shown in table 4 below:

Table 4. Significant Difference Test of Students' Intuition Ability Improvement

Approach	*N*	Mean	Mean Difference	t	df	*Sig.*	H_0
RME	82	0.5415	0.1463	5.468	162	0.000	rejected
Conventional	82	0.3951					

It can be seen from Table 4 that the probability score (sig.) is less than 0.05 which means we have to reject the H_0. Students' who got the RME-based approach mathematics instruction significantly had better improvement of intuition ability than those who got the conventional mathematics instruction.

CONCLUSION AND SUGGESTION

From the data analysis and the discussion aforementioned, it can be concluded that:

1. The students who got the RME-based approach had better improvement of intuition ability than those who got the conventional mathematics instruction.
2. According to Hake's category, the improvement of students' ability was in the middle level.
3. There was a significant improvement of intuition ability between the students who got the RME-based mathematics instruction and those who got the conventional one.

From the summary, it can be suggested that:

1. There is a need of application of RME-based mathematics instruction in the classroom, so that mathematics instruction can be meaningful for the students, and they can apply the concepts of mathematics in the real world.
2. There is a need of teacher training program to make it accustomed for the teachers to apply the RME-based mathematics instruction in the classroom.

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