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Enhancing Students' Mathematical Intuitive-Reflective Thinking Ability through Problem-Based Learning with Hypnoteaching Method

Lia Kurniawati[1*] Yaya S. Kusumah[2] Utari Sumarmo[2] Jozua Sabandar[2]
1. Department of Mathematics Education, State Islamic University, Jln. Ir. H. Juanda No. 95 Ciputat, Indonesia
2. School of Postgraduate Studies, Indonesia University of Education, Jln. Setiabudi 229 Bandung, Indonesia
* E-mail: natasyaidil@gmail.com

Abstract
This research aims to analyze the enhancement and the achievement of mathematical intuitive-reflective thinking ability of students who worked under Problem-Based Learning with Hypnoteaching Method (PBLH) and students who worked under Conventional Learning with Hypnoteaching (CLH). This research is a quasi-experimental research with the pretest-posttest control group design. The research instruments used were mathematical intuitive-reflective thinking ability (MIRTA) test, journals, and students' responses to PBLH. Data were analyzed using two-way ANOVA. The results showed that the enhancement and achievement of MIRTA of the students who worked under PBLH is higher than the students who worked under CLH viewed from the whole students and Mathematical Prior Knowledge (MPK). There is no interaction between learning approach and MPK on the enhancement of the students' MIRTA.
Key Words: Problem-based learning, hypnoteaching method, mathematical intuitive-reflective thinking ability.

1. Introduction

Intuitive-reflective thinking ability is really needed for students for solving problems, because in this activity, students must be able to predict the correct answer immediately so that they can explore the problems by identifying concept or mathematical formula involved in mathematics problems, using various strategies, or giving various samples of statement on certain mathematical concepts. When a strategy has been selected by students, they need to construct an idea, draw a conclusion, and determine the validity of the argument. Once a solution is obtained, the students also need to re-examine the solutions and to develop alternative strategies.

In fact, the students' ability in solving mathematical problems is still not satisfactory. This, among others, can be seen in the observation of the students; when they are given questions that are ill-structured and questions that need to be proven with reason, most of the students cannot even solve the problems associated to the concept. Even more they, confused of what concept they are facing. As the result, they confused to choose appropriate strategy for solving the problems and drawing conclusion.

Generally, the students' weakness in mathematical intuitive-reflective thinking ability, particularly in the department of mathematics education, in one of islamic universities in Jakarta, which was researched, indicates that students' ability in this aspect is still low. It can be observes that from 46 students, 34 students still have difficulty in solving problems that are not simple (involving various concepts) and proving with reason; only 12 students were able to solve these problems. Thus, only 26.09% of the students were able to solve the problems; these results show that the students' mathematical intuitive-reflective thinking ability is still low.

One way to develop an intuitive-reflective thinking ability is using problem-based learning approach. Problem-based learning is a learning approach that gives students the opportunity to work on authentic problems with the purpose to prepare their own knowledge, develop inquiry and higher-order thinking skills, solve problems, and develop confidence. Therefore, problem-based learning is expected to develop students' mathematical intuitive-reflective thinking ability.

In order for these skills to develop well, a comfortable learning situation for the students is required; it is also necessary to make the students present in the class (both physically and mentally), to create comfortable mathematics learning environment, to encourage students' curiosity, self-confidence, concentration and willingness to learn mathematics. Therefore, proper methods to prepare the students to learn mathematics is necessary. One of them is hypnoteaching learning method. With hypnoteaching learning, students are trained to actively engaged, motivate themselves, support each other and teach what they get from the learning process with joy so that they realize their goal can be achieved when they believe they can do it.

In this research, giving a clearer picture of the problem studied, and based on the background of the problem that was presented, the problem formulation in this study includes:

1. Is the enhancement and achievement of mathematical intuitive-reflective thinking ability of the students who worked under the problem based learning with hypnoteaching method higher than the students who worked under conventional learning, in overall review and mathematical prior knowledge?

2. Is there an interaction between learning approach and mathematical prior knowledge of students toward students' mathematical intuitive-reflective thinking ability?
3. How is the students' opinion about problem-based learning approach with hypnoteaching method?

2. Theory

2.1 Mathematical Intuitive-Reflective Thinking Ability

In Indonesian Dictionary (Daryanto, 1997), intuition is defined as the ability to understand something without going through the thought process. According to Fischbein (1987), intuition is a mental process (cognition) which has certain characteristics. Fischbein use the term equivalent to the acquisition of intuition intuitive knowledge. Intuition is seen as a type of cognition. Knowledge is constructed through the mental process called intuitive knowledge. Reflective thinking ability necessary to proof correctness of the predicted to solve a problem.

Lochhead (2001) says that the peak of logical thinking is reflective thinking. According to Lochhead, the ability to think reflectively is one's ability to understand the thought process by looking back at what has been done to find a solution/answer to a problem. So, to achieve this level of thinking, a student requires the internalization of two roles: as a problem provider and as a problem solver.

According to Lipman (2003), reflective thinking ability is the ability to think that observes the assumptions (known hypotheses or elements) and its implications based on reasons or evidences to support a conclusion. In other words, people who have the ability to think reflectively do work or learn mathematics independently in accordance with their claim to achieve something that is expected.

Skemp (Gagatsis and Patronis, 1990) makes it clear that the differences between intuitive and reflective are the differences in tasks (goals) of the subjects. Example: Multiply 16 by 25. (i) What is the answer? (ii) Explain how do you do it? To answer the second question, the diversion of attention from the task for mental processes is involved.

To think intuitively is to think concrete, direct, inductive and rich in non-symbolic ways in representing and processing of information, as well as recognition. Reflective thinking aims to explicitly formulate from a general relationship with the procedures and general foundation, which is the general statement of the object and operations with the object.

Mathematical intuitive-reflective thinking ability means the students' ability to solve problems directly (predict/anticipate answers and justify them by:

1. Identifying concepts or mathematical formulas involved in mathematical problems that are not simple.
2. Arranging problem solving using a variety of solving strategy and choose the most appropriate strategy to solve it.
3. Evaluating the correctness of an argument/reason based on the concept/mathematical properties used.
4. Determining the general rules or conclude from the data presented and the correctness of the conclusion and why.
5. Constructing or declaring a problem or argument in other form with the same meaning.

2.2 Problem-Based Learning with Hypnoteaching Method

Nurhadi (2004) stated that the Problem-Based Learning (PBL) is a teaching approach that uses real-world problems as a context for students to learn about critical thinking and problem solving skills, and acquire essential knowledge and concepts of the subject. According to Arends (2008), PBL is a learning approach that suggests students to work on authentic problems with the intent to construct their own knowledge, develop inquiry and higher order thinking skills, and develop independence and self-confidence.

Jonassen (2010) said that in the PBL, learning focus is on selected problem so that students not only learn the concepts related to the problem but also the scientific method to solve the problem. According to Departemen Pendidikan Nasional (2003), the main characteristics of PBL include orienting students to authentic problem or question, multidisciplinary, requiring a cooperation in the investigation, and produce work. In problem-based learning, situations or problems become the starting point of learning to understand the concepts, principles and develop problem-solving skills. According to Dodson & Hollander (Setyabudhi, 2003), through discussion, the students can express ideas and thoughts according to their stage of cognitive development.

In order for these skills to develop well, a comfortable learning situation for the students is required; it is also necessary to make the students present in the class (both physically and mentally), to create comfortable mathematics learning environment, to encourage students' curiosity, self-confidence, concentration and willingness to learn mathematics.Therefore, a proper method to prepare the students in learning is hypnoteaching method.

Almatin (2010) stated that hypnoteaching is a learning designed to create a comfortable and pleasant situations in a controlled environment to be able to get into subconscious mind. In addition, Noer (2010) states that hypnoteaching is a teaching process that provides positive suggestions to students. Hypnoteaching, as we all know, is not a hypnosis that makes people sleep and subconsciously do everything ordered by the hypnotizer, but hypnoteaching is a subconscious learning that lower brain waves of the students from beta to alpha.

Of the several theories of problem-based learning and hypnoteaching, this research created a design of problem-based learning with hypnoteaching method as follows:

1. Start teaching by making students focus well with an inspiring story or video shows (focusing).
2. Perform relaxation and imagination.
3. Divide students into groups (grouping), each group discusses, share knowledge, and do teach and praise.
4. Solve the problem given in worksheet through observation, discovery, making an example and not theirs, which is guided by the lecturer with the following stages:
   a. Orienting students to the problem.
   b. Organize students to learn.
   c. Guide individual investigation.
   d. Develop and present the work result.
   e. Analyze and evaluate the problem-solving process.
5. State something positive from the students (affirmation).
6. Perform repetition of words full of inspirational motivation (repeating).
7. Evaluate the students progress and reflect on the learning experience.

3. Research Method

The research was conducted at the Department of Mathematics of Education on an islamic university in Jakarta. The population in this research was fourth semester students. From the fourth semester students of three parallel classes, two classes were taken randomly to serve as the research sample.

This research used a type of quasi-experimental research. The learning used is problem-based learning with hypnoteaching method (PBLH), while the result of which will be seen is the students' mathematical intuitive-reflective thinking ability. Experimental design used in this study was *The Pretest-Posttest Control Group Design*. To obtain the data in this research, several research instruments were developed, namely: intuitive-reflective thinking ability test, journal, and the scale of the response of students to PBLH.

The techniques of data analysis performed in this study are as follows:

b. Calculate the average score and standard deviation on the pretest and posttest of mathematical reflective thinking ability test results in the experimental group and the control group.
c. Conduct normality and homogeneity test between the experimental group and the control group.
d. Calculate the test statistic and the testing criteria corresponding to the problem in the context of hypothesis testing. If it is known that the data were normally distributed and varied homogeneously, then test differences two-way ANOVA will be used.
e. Calculate the percentage of students' journal during learning.
f. Calculate the percentage of students' response scale results.

4. Finding and Discussion

This chapter represents an overview about implementation PBLH, achievement and enhancement of mathematical intuitive-reflective thinking ability between students who worked under PBLH and students who worked under CLH.

4.1 Mathematical Intuitive-Reflective Thinking

Mathematical intuitive-reflective thinking ability (MIRTA) is determined based on the final achievement and the increase or the average MIRTA N-Gain. For more details, description of mathematical intuitive-reflective thinking ability test results and experimental group and control group mathematical proofing are presented in Table 1 below.

Table 1
MIRTA Data Description Based on Learning Approach and MPK

MPK		PBLH			CLH		
		Pre	Post	<g>	Pre	Post	<g>
High	$\bar{x}$	2.89	15.67	0.75	2.77	13.00	0.60
	s	0.78	1.87	0.11	2.13	2.42	0.12
Medium	$\bar{x}$	2.48	14.83	0.71	2.11	13.21	0.62
	s	1.29	2.18	0.11	0.99	2.51	0.14
Low	$\bar{x}$	2.00	12.58	0.59	1.83	11.42	0.53
	s	1.21	2.43	0.13	1.03	1.51	0.07
Total	$\bar{x}$	2.43	14.37	0.68	2.23	12.66	0.59
	s	1.19	2.45	0.13	1.44	2.33	0.12

MIRTA ideal score: 20

Table 1 shows that MIRTA based on achievement and enhancement, students who worked under PBLH obtain higher score than CLH when viewed as a whole. Enhancement and achievement of MIRTA based on MPK (high, medium, and low) showed that the students who worked under PBLH obtain higher score than the students who worked under CLH. In addition, the final achievement and enhancement of MIRTA in medium MPK category of the students who worked under PBLH was higher than the students enhancement of MIRTA in high MPK category compared to the students who worked under CLH.

4.2 The Enhancement and Achievement of Mathematical Intuitive-Reflective Thinking Ability

To determine if there is a difference of the enhancement and the achievement between the experimental group and the control group, the two-way analysis of variance (ANOVA) test is performed if both of the two group data were normally distributed and homogeneous. If one or both of the group data is not normally distributed, the non-parametric analysis test (Kruskal-Wallis test and Mann-Whitney test) is performed instead.

Table 2
The Enhancement and Achievement of MIRTA based on Learning Approach with MPK

Test	Source	Square total	df	Square average	F	Sig.	H_0
Enhancement	Learning	0.193	1	0.193	13.734	0.000	Rejected
	MPK	0.204	2	0.102	7.266	0.001	Rejected
	Learning*MPK	0.024	2	0.012	0.841	0.435	Accepted
Achievement	Learning	65.434	1	65.434	13.230	0.000	Rejected
	MPK	79.565	2	39.783	8.044	0.001	Rejected
	Learning*MPK	6.671	2	3.336	.674	0.512	Accepted

Table 2 shows that there is an influence of learning approaches to the enhancement and the achievement of intuitive-reflective thinking ability of the students at $\alpha = 0.05$. In addition, there is also the influence of the students' MPK to the enhancement and achievement of the intuitive-reflective thinking ability of the students at $\alpha = 0.05$. There was no interaction between learning approaches and the students' MPK on the enhancement and achievement of the students' intuitive-reflective thinking ability at $\alpha = 0.05$.

4.3 The Students' responses who worked under PBLH

The data resulted from the students' responses to PBLH shows that the average is 3.88 or 77.62% of the students expressed very happy to learn using problem-based learning approach with hypnoteaching method (PBLH). In other words, most of the students responded positively to PBLH.

In addition to the scale of the response of the students, the students are also given a daily journal which shows the response of students to PBLH; most of them expressed positive responses (91.67%), a small fraction equal to 5.95% expressed negative response, and the remainder (2.38%) expressed neutral (do not give comments).

Of the two instruments developed were the attitude scale and the students' daily journal, the students' response to BLH is considered high. In other words, the students responded positively to PBLH.

4.4 Discussion

From the description of the calculation results of MIRTA average, it is known that the students who worked under PBMH have an average score higher in all aspects than the students who worked under CLH. This suggests that the enhancement in intuitive-reflective thinking ability and mathematical proofing in the experimental group using PBLH is higher than in the control group using CLH.

This occurs as a result of giving the students a problem that must be completed through the exchange of thoughts/sharing. According to Dodson & Hollander (Setyabudhi, 2003), through discussion, the students can express ideas and thoughts according to their stage of cognitive development. The students are not fixated on one procedure that must be accepted unwittingly an absolute truth, because problem-based learning can foster the ability to identify the most important element and to choose the correct procedure. The students are encouraged to perform a variety of manipulations; although many of the answers proposed are less related to the given problem, there are important things that they do not realize; they have a wealth of ideas, dynamics, building knowledge through a process just like in which a scientist discovers a theory.

4.4.1 The findings related to Enhancement and Achievement of MIRTA

The two-way analysis of variance test was conducted to see the effect of the two treatments given to the students' ability. The two treatments referred in this research are the learning using PBL with hypnoteaching method and conventional learning method. From the two-way analysis of variance conducted on the experimental group and the control group, it is found that there are differences in the enhancement in intuitive-reflective thinking ability and mathematical proofing between the students who worked under PBLH and the students who worked under CLH.

From the results obtained, it is stated that problem-based learning approach with hypnoteaching method developed in this research has a positive effect on the enhancement of the intuitive-reflective thinking skills and mathematical proofing on receiving the students. Rejection of H_0 on differences of enhancement and achievement of mathematical intuitive-reflective ability, both in overall and MPK, indicates that MPK has an

effect on the enhancement of mathematical intuitive-reflective ability. This coincides with Galton's opinion (Ruseffendi, 1991) that differences in skills, the ability to govern, height, weight, etc, all of them will normally distributed. Thus, in the group of the student there are a number of the students that are greatly talented or smart, mediocre, and less. Problems that arise in learning mathematics usually is that the students who have low ability that tends to learn mathematics slower and cannot learn mathematics at the same rate as the students who have medium or high ability.

There is no interaction between learning approaches and MPK on the enhancement of the students' mathematical intuitive-reflective thinking ability. This coincides with Noer's (2010) and Nindiasari's (2012) research, which stated that no interaction between learning approaches and MPK on the enhancement of students' mathematical critical, creative, and reflective thinking ability. Therefore, PBLH approach is suitable for all category of the students' ability in enhancing the students' mathematical intuitive-reflective thinking ability.

4.4.2 The findings related to MIRTA on each Indicator

Mathematical intuitive-reflective thinking ability (MIRTA) test given in the beginning (pretest) and the end (posttest) of learning is purposed to determine the enhancement and achievement of the students' mathematical intuitive-reflective thinking ability (MIRTA) after a problem-based learning with hypnoteaching method (PBLH) approach is used. The mathematical intuitive-reflective thinking ability which is being studied in this research consists of five indicators: 1) to identify mathematical concepts involved in mathematical problems that are not simple, 2) to arrange problem solving using a variety of solving strategy and choose the most appropriate strategy to solve it, 3) to evaluate the correctness of an argument or reason based on the concept/mathematical properties used, 4) to determine the general rules or conclude from the data presented and correctness of the conclusion and why, and 5) to construct or declare a problem or argument in another form with the same meaning. Further information on the achievement of MIRTA on each indicator are presented on the following Figure 1.

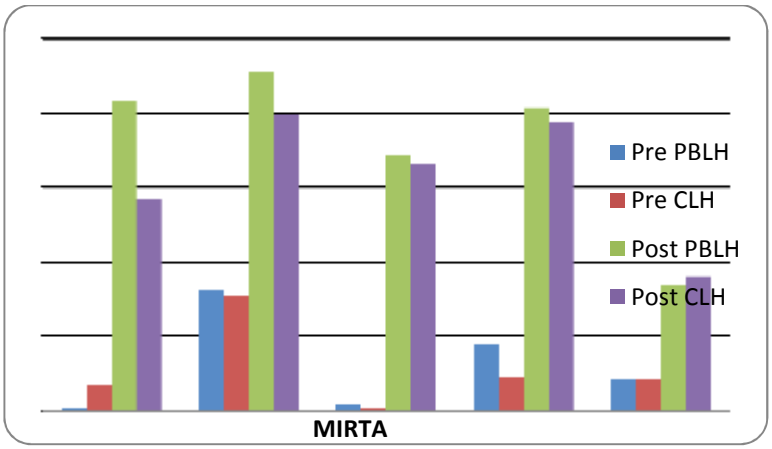

Figure 1

The Percentage of Students' MIRTA Achievement on each Indicator on PBLH and CLH

From Figure 1, it is seen that the students' MIRTA achievement on each indicator, the students who worked under PBLH are higher than the students who worked under CLH, except on the fifth indicator.

On the first indicator, that is to identify the mathematical concepts involved in mathematical problems that are not simple, the percentage of enhancement of the students who worked under PBLH is classified high and the students who worked under CLH are classified as low. This is because of the effect of learning approach used (PBLH); because in learning using that approach, the students used to solve problems, so that they able to solve any complex problems, because of their learning experience/habit. The students are used to explore the problems, linking between concepts and to find the solving strategy. This is in accordance with the opinion of Jonassen (2010) that connected cases help the students to identify the root or the main source of the problem which will have the impact of arising another problem and the enhancement of the students' thinking ability.

In aspect of arranging problem solving using a variety of solving strategy and selecting the most appropriate strategy in solving the problem, the percentage of the students who worked under PBLH is classified as high. This is because in PBLH, the students were trained to find all solving alternatives through discussion with friends or finding relevant resources. This is in accordance with the opinion of Jonassen (2010) that the flexibility in PBL can cultivate divergent thinking creativity in representing problem. From the problems established by the students, they can expand problem-solving steps, they can propose logical solution. Those ideas can be discussed first in a small group before implementing.

In aspect of evaluating the correctness of an argument or reason based on the concept or mathematical properties used, the percentage of the students who worked under PBLH is classified as moderate. This happens because

there is a process of discussion in the PBLH that makes the students to re-examine their findings after exchanging opinions with friends.

In aspect of determining the general rules or conclude from the data presented and determine the correctness of the conclusion and why, the percentage of the students who worked under PBLH is classified as high. This is in accordance with the opinion of Jonassen (2010), stating that modeling is a knowledge that gives the means to think and analyze, organize, and provide a way to express their understanding of a phenomenon. Modeling helps the students to answer the questions "what do I know" and "what does it mean".

In aspect of constructing or declaring a problem or argument in other form with the same meaning, the student percentages of both groups are still classified low. This is because the students with low MPK on both the groups, normally can't solve problem, because their understanding is low and their memory capability was also low. So, they can't see the analogyc between existing problems and with the problems they had learned; as a result, their understanding or knowledge of concepts earlier will not play a role.

4.4.3 The findings Related Students' Responses to Learning Approach using PBL with Hypnoteaching Method

Based on the answers to the students' responses toward learning with the PBLH approach, in general, an average of 3.88 or 77.60% of the students were happy with the learning method used, that is PBLH. This states that components of the learning activities (PBLH) can foster the students' confidence in learning mathematics and the opportunity to develop ideas and varying solving strategies so that the ability of the students in thinking creatively, critically, logically, innovatively, can be more developed in learning.

In addition, PBL with hypnoteaching method can develop habits or tendency of the students to think. This suggests that the PBLH is very likely to develop the students' tendency or disposition towards mathematical intuitive-reflective thinking ability. Thus, most of the students responded positively to this PBLH. This suggests that the PBLH approach can stimulate the students to learn mathematics independently and actively finding his own knowledge.

Conclusion

From the results of the processing and analysis of the data obtained, it can be concluded that:

1. The enhancement and achievement of mathematical intuitive-reflective thinking ability of the students who worked under the problem-based learning with hypnoteaching method is higher than the students who worked under conventional teaching viewed from the whole students and mathematical prior knowledge.
2. There is no interaction between learning approaches and the students' mathematical prior knowledge on the enhancement mathematical intuitive-reflective thinking ability.
3. The students have positive responses towards the problem-based learning with hypnoteaching method.

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