

# The Influence of Guided Inquiry Learning Model on Students' Mathematical Problem Solving Ability

1<sup>st</sup> Rizki Kurniashih  
 Department of Mathematics  
 Universitas Negeri Padang  
 Padang, Indonesia  
 kurniashih@gmail.com

2<sup>nd</sup> Hendra Syarifuddin  
 Department of Mathematics  
 Universitas Negeri Padang  
 Padang, Indonesia  
 hendrasy@yahoo.com

3<sup>rd</sup> Darmansyah  
 Department of Education Technology  
 Universitas Negeri Padang  
 Padang, Indonesia  
 darmanpasca2008@yahoo.co.id

**Abstract**—The purpose of this study is to determine the effect of guided inquiry learning model on mathematical problem solving ability according to initial abilities. The research method used was quasi-experimental. The research's subjects were 66 students at grade 7 students of MTsN Tanjung Raya Kabupaten Agam, Indonesia. Data were collected through problem solving tests and then it was analyzed by using t-test. The results showed that the mathematical problem-solving ability in the experimental class is better than the control class both high, medium and low initial abilities. It can be concluded that the guided inquiry learning model contributes to the improvement of mathematical problem solving abilities.

**Keywords**—guided inquiry, mathematical problem solving ability, initial ability

## I. INTRODUCTION

Mathematics is a universal science that underlies the development of modern technology, has an important role in various disciplines and advances the power of human thought.[1] Mathematics is used throughout the world for problem solving in all life, that is, as an important tool in several fields including natural sciences, engineering, medical and social sciences.

Learning mathematics is essentially a process of understanding facts and relationships, so the task of the mathematics teacher is not just to convey concepts, but how to train intellectual abilities, stimulate learning motivation. This can happen if the teacher can condition students to experience meaningful learning. This process can occur when students actively process knowledge through what they hear, see, feel and do or experience.[2]

Mathematics is a basic science that has an important role both in daily life and in the development of science and technology. But mathematics is not an easy subject for most students. Although students memorize multiplication and division, sometimes they are confused when dealing with story questions involving multiplication and division. This can be caused by students having difficulty understanding the story questions, namely problem solving. [3]

The problem is personal, because a problem for someone is not necessarily a problem for others. According to problems can be interpreted as a situation or question faced by an individual or group when they do not have certain rules, algorithms / procedures or laws that can be used to determine the answer. In other words the problem arises because individuals do not have rules to be able to solve it. [3]

Mathematical problem solving is one important part that must be developed in mathematics learning. The purpose of learning mathematics in the Indonesian curriculum is one of the ability to develop students' mathematical problem solving. In learning mathematics, students must have problem solving, reasoning and proof skills, communication, connections, and representations. [4]

In line with this, concerning Basic and Secondary Education Content Standards, mathematics learning aims for students to have mathematical skills as part of life skills that must be possessed by students, especially in the development of reasoning, communication, and problem solving faced in everyday life. [5]

According to the evaluation results conducted by TIMSS (Trend in International Mathematics and Science Studies) in 2007, Indonesia ranks 36th out of 49 countries. Achievements in TIMSS Mathematics 2011 were even more concerned because the average score of class VIII decreased to 386, compared to 2007, which was 397. In 2011, 95% of Indonesian students were only able to reach the middle level, while nearly 50% of Taiwanese students were able to reach the level high and advance. [6]

Problem solving skills are needed in dealing with problems of daily life, especially in mathematics learning. Solving problems can be seen as a process of finding combinations of rules that have been learned that are used to solve problems. [2]

Mathematical problem solving is a process in which someone is faced with concepts, skills, and mathematical processes to solve mathematical problems. This requires the design and application of a series of steps to achieve goals in accordance with the given situation. Baroody expressed the opinion that mathematical problem solving provides benefits to students in the form of: (1) Can show how material related to real life, (2) To introduce and enhance discussion on a topic, (3) To motivate students to learn and master a material. [7]

To measure students' problem solving abilities, a problem solving problem is used. Problem is called a problem if the question contains questions that are not routine and challenging to answer, mathematical problem solving is a mathematical problem that requires good reasoning and logic that challenges the mind and is not fast (automatically) known how to solve it.[2]

This is because in its completion it involves selecting mathematical procedures to solve the problem. The teacher

should not give too far a solution, let students guess before the teacher teaches it.[2]

Related to problem solving, mathematical problem solving is a complex cognitive activity.[8] That mathematical problem solving is a complex cognitive activity accompanied by a number of processes and models.[9] Mathematical problem solving as a number of separate activities such as explaining problems, creating patterns, interpreting images, developing geometric constructions and proving theorems. [10]

There are four steps in solving problems. [9] They are: (1) understanding problem (understanding the problem); (2) making plans (preparing plans); (3) implementing plans (implement plans); (4) checking back (look back).

One of the causes of this problem is possible because the way to manage learning that still does not provide many opportunities for students to develop mathematical problem solving skills. Students tend not to get used to building their knowledge through practice questions. As a result, knowledge gained by students is less meaningful and easily forgotten.

Based on the problems that have been explained, to develop mathematical problem solving skills required serious efforts by teachers in managing the learning process by providing opportunities for students to be actively involved in material studies and can build knowledge with their own abilities. To overcome this problem requires a learning model that can enhance the role of students in learning. One learning model that can overcome these problems is a guided inquiry learning model. The guided inquiry learning model is a student-centered learning model, in which students learn to find and find their own knowledge, while the teacher acts as a mentor, instructor and facilitator in helping students find new knowledge based on the old knowledge of students.

In this learning model, students are encouraged to think so that they can find general principles based on the material or data provided by the teacher. The extent to which students are guided depends on their abilities and on the material being studied. With this learning model, students are faced with a situation where he is free to investigate and draw conclusions; the teacher encourages students to make guesses, intuition, and trial and error. The teacher acts as a road guide to help students find ideas, concepts, and skills that they have learned before. [10]

In general "inquiry is a process in scientists asking questions about the nature of the world and how they systematically seek answers " From this understanding, it can be interpreted clearly that inquiry model uses the principle of scientific method in finding a principle, law, or theory. [11]

When the teacher applies the component of inquiry in learning, the teacher must hold the following principles 1). oriented on intellectual development, 2) principles of interaction, 3) The principle of asking. [12]

In addition, guided inquiry learning models are learning models in which students are guided to carry out activities by giving initial questions and directing the discussion situation.[13]

Guided inquiry is one of the important components of the contextual and constructivist learning model that has developed rapidly in the process of education reform in Indonesia today.

In applying the guided inquiry learning model, the teacher should be able to formulate learning steps according to the level of development of the basic competencies of students. In accordance with the still needed role of the teacher in the learning process, the research formulated guided inquiry learning steps [14]. They are (1) formulating the problem clearly with sufficient data, (2) students composing, processing, organizing, and analyze the data, (3) students compile estimates from the results of the analysis, (4) if necessary check student estimates, (5) students compile conjunctual verbalization and (6) students do the exercises.

The guided inquiry learning model is an inquiry learning model that is organized more structured, where the teacher controls the entire interaction process and explains the research procedures that must be carried out by students. Students obtain guidelines as needed. These guidelines are usually in the form of questions that guide students to find solutions to problems. In guided inquiry learning the teacher does not just let go of the activities carried out by students [14].

Teachers must provide guidance and guidance to students in carrying out activities so that students who think slowly or students who have low intelligence are still able to follow the activities being carried out and students who have high thinking skills do not monopolize activities [14].

Mathematics learning with a Guided Inquiry model including at the level of first inquiry is inquiry activity where the problem is raised by the teacher or sourced from a textbook then students work to find answers to the problem under intensive guidance from the teacher.[14]

In the process of thinking critically and analytically students are directed to find and find their own answers to a mathematical problem in question. Guided inquiry in mathematics learning is used primarily for students who have not experienced learning with the inquiry model.[14]

In the early stages of teaching, more guidance is given, namely in the form of guidance questions so that students are able to find their own direction and actions that must be done to solve the problems presented by the teacher.[14]

Inquiry based mathematics learning is inductive learning, beginning with observation in order to understand a concept. Inquiry-based learning provides real and active experiences to students. Students are expected to take their own initiative on how to solve problems, make decisions and get skills [15].

Learning with inquiry spurs the desire of students to know, motivates them to continue their work so that they

find a solution to the mathematical problems they face. Inquiry learning process directs students to identify problems, find solutions, form questions, conduct experiments, analyze, study groups, and make conclusions. [14]

Inquiry helps students to think creatively . [16] The habit of students to think creatively will make a student use more representation in learning. The creativity will have a very large effect on the ability of representation in the learning process. Besides being able to increase students to think creatively, learning with inquiry approaches focuses on the problem solving process.[17] Problem solving refers to the inquiry learning process in which students seek answers to relevant questions from students [18].

The conventional learning intended in this study is the Direct Learning model. This learning model is a learning model that is more teacher-centered and prioritizes effective learning strategies in order to expand information on teaching material, conventional learning integrates various methods including lecture, question and answer, and assignment methods.

Other factors that can affect students' ability to solve problem solving problems are initial abilities. Initial ability is also considered to play an important role in improving students' mathematical abilities, therefore, to receive material further students must have good initial abilities to get optimal learning outcomes. Usually students with high initial abilities have more enthusiasm for learning so that their learning outcomes are better and more active in class compared to students with low initial abilities.

Someone will more easily learn something when learning is based on what has found that person. [19]. Therefore, to learn new material, the past learning experience from someone will influence the learning process of the mathematics material.

From the description above, the researcher wants to see the extent to which guided inquiry learning models can affect students' problem solving abilities. Therefore, research is carried out with the title "The Influence of guided inquiry Learning Models on Problem Solving Ability Based on the Initial Ability of Students of Class VII SMP / MTs Negeri Kecamatan Tanjung Raya".

The guided inquiry learning model is expected to be able to encourage students to understand how students problem, then think how students give or make a temporary guess of a phenomenon or situation. Then students collect data, make observations and investigations to provide answers to the allegations that have been formulated. The guided inquiry approach is similar to the inquiry approach except that in the learning steps in the inquiry approach there is teacher intervention in each step of the learning.

The research questions in this study are stated as follows: 1) Is the mathematical problem solving ability of the students who were taught using guided inquiry learning model higher than those who were taught using conventional learning? 2) Is the mathematical problem solving ability of high initial abilities students who was

taught using guided inquiry learning model higher than those was taught using conventional learning? 3) Is the mathematical problem solving ability of medium initial abilities students who was taught using guided inquiry learning model higher than those was taught using conventional learning? 4) Is the mathematical problem solving ability of low initial abilities students who was taught using guided inquiry learning model higher than those was taught using conventional learning?

The hypothesis of this research is as follows: 1) the mathematical problem solving ability of the students who were taught using guided inquiry learning model is higher than those who were taught using conventional learning. 2) the mathematical problem solving ability of high initial abilities students who was taught using guided inquiry learning model is higher than those was taught using conventional learning. 3) the mathematical problem solving ability of medium initial abilities students who was taught using guided inquiry learning model is higher than those was taught using conventional learning. 4) the mathematical problem solving ability of low initial abilities students who was taught using guided inquiry learning model is higher than those was taught using conventional learning.

## II. METHOD

This study was a quasi-experimental research aimed at comparing the influence of guided inquiry model to the conventional learning on the students' mathematical problem solving ability. The variables involved in this research were mathematical problem solving abilities as independent variable, guided inquiry model as dependent variable, and initial abilities as moderator variables

The research design can be seen in table I

TABLE I. RESEARCH DESIGN

CLASS	TREATMENT	TEST
EXPERIMENTAL	X	T
CONTROL	-	T

Note: X (Treatment with Guided InquiryModel), T (Test)

Table I indicates that the treatment given in the experimental class; the researchers applied the guided inquiry model in the learning. While in the control class, researchers did not apply the guided inquiry model in learning but applied conventional learning. The sample was obtained randomly by using the lottery.

The population of this study was the students at grade 7 MTsN Tanjung Raya registered in the school year 2018/2019 consisting of 6 classes and amounted to 198 students. Sampling was done randomly, selected as experimental class is 7.5 with 33 students and 7.4 as control class with 33 students.

The data of the research were collected using test. This test is used to measure students' mathematical problem solving abilities. This test was validated by three mathematicians, then it was tested to a group of seventh grade students to meet the validity and reliability criteria. The score of students' ability in solving mathematical problems is determined by using a rubric scoring made [8]. Mathematical problem solving indicators used in the test are (1) understanding the problem which includes: identifying

known data, identifying the data being asked, identifying the data being asked, (2) planning a solution or choosing a model, (3) carrying out calculations or solving problems, (4) re-examine the correctness of the results or answers. Furthermore, the data were analyzed by using t-test after conducting a series of normality and homogeneity tests.

**III. RESULTS AND DISCUSSION**

After the students' mathematical ability tests were carried out, data were obtained about the results of problem solving tests of students with initial ability, high and low on experimental and control classes.

TABLE II. THE RESULT OF STUDENT TESTS □ MATHEMATICAL PROBLEM SOLVING ABILITY ACCORDING TO THEIR INITIAL ABILITY IN EXPERIMENTAL AND CONTROL CLASSES

CLASS/ INITIAL ABILITY	PROBLEM SOLVING ABILITY				
	N	$\bar{x}$	STANDARD DEVIATION	XMAX	XMIN
EXPERIMENTAL	33	39,67	10,75	52	23
HIGH	7	50	2,38	52	46
MEDIUM	16	43,88	6,52	46	34
LOW	10	25,54	8,05	30	23
CONTROL	33	30,54	11,60	51	20
HIGH	7	45,71	3,65	51	42
MEDIUM	17	29,11	10,13	46	21
LOW	9	21,67	1,65	24	20

Note: Experimental (Applied Guided Inquiry Model), Control (Applied Conventional Learning)

From the table II, it can be seen that the average score of the experimental class is higher than the average score of the control class. The average score of the experimental class is 39.67 and the average score of the control class is 30.54. It means that the test results of problem solving ability in the experimental class are better than the control class. Meanwhile, the average score for students with high ability in the experimental class was 50. Meanwhile in the average score of control class was 45.71. It means that the results of the students' problem solving ability with high abilities in the experimental class are better than the control class. Furthermore, the average score for students with medium initial ability in the experimental class is 43.88 while in the control class is 29.11. It means that the results of the students' problem solving ability with medium initial abilities in the experimental class are better than the control class. The next, the average score for students with low initial ability in the experimental class is 25.54 while in the control class is 21.67. It means that the results of the students' problem solving ability with low initial abilities in the experimental class are better than the control class.

After conducting a series of normality and homogeneity tests, it was concluded that t- test was used for three hypothesis testing. The summary of the hypothesis testing, with the help of SPSS program, is presented in the two following table III.

TABLE III. THE RESULTS OF HYPOTHESIS

Hypothesis	Sig	H <sub>0</sub>
Hypothesis 1	0,000	Reject
Hypothesis 2	0,016	Reject
Hypothesis 3	0,000	Reject
Hypothesis 3	0,000	Reject

From the table III, it can be seen the test results show that a significant value = 0.000 less than  $\alpha = 0.05$ . It means that H<sub>0</sub> is rejected and H<sub>1</sub> is accepted. Thus, problem solving ability of students who learn with guided inquiry is better than the problem solving ability of students who learn with conventional learning. Furthermore, in the second hypothesis the results obtained were significant = 0.016 less than  $\alpha = 0.05$ . It means that H<sub>0</sub> is rejected and H<sub>1</sub> is accepted. It indicates that the mathematical problem solving ability of high initial ability students taught by using guided inquiry models is better than the mathematical solving abilities of high initial ability students taught with conventional learning. Whereas for the third hypothesis in getting results that significant value = 0,000 less than  $\alpha = 0,05$ . This means that H<sub>0</sub> is rejected and H<sub>1</sub> is accepted. It means that the mathematical problem-solving ability of medium initial ability students taught by using guided inquiry models is better than the mathematical ability of students with medium initial abilities taught by conventional learning. Whereas for the fourth hypothesis in getting results that significant value = 0,000 less than  $\alpha = 0,05$ . This means that H<sub>0</sub> is rejected and H<sub>1</sub> is accepted. It means that the mathematical problem-solving ability of low-initial ability students taught by using guided inquiry models is better than the mathematical ability of students with low initial abilities taught by conventional learning.

**IV. CONCLUSION**

Based on the results of research conducted in classes 7.5 and 7.4 MTsN Tanjung Raya can be concluded students 'mathematical problem-solving ability with apply guided inquiry model in learning is better than students' mathematical problem-solving ability with conventional learning for high initial abilities , medium initial abilities and for low initial abilities.

Thus, it is evident that the mathematical problem-solving ability of students in the learning guided inquiry models is better than the the mathematical problem solving ability of students in the learning conventional.

**REFERENCES**

- [1] Ibrahim et al. *Mathematics Learning Strategies*. Success Offset. Yogyakarta, 2008.
- [2] Meidawati, Yenny. *Influence Of Supervised Instructional Enquiry Approach On Mathematical Problem Solving Ability Of Junior High School Students* . Journal of Education and Teacher Training Vol. 1 No. 2, 2014, article 1. ISSN : 2356-3915
- [3] Wardani, Asizah Kurnia. *Ability Of Problem Solving From Differences of Sex*. Journal of STKIP PGRI Sidoarjo Mathematics Education Vol.2, No.1, March 2014 . ISSN: 2337-8166
- [4] NCTM. *Principles and Standards for School Mathematics*. NCTM: USA, 2000.
- [5] BSNP. *RI Minister of Education and Culture No. 21 of 2016 concerning Content Standards for Primary and Secondary Education Units*. Jakarta: Ministry of Education and Culture, 2016.
- [6] Afandi Ahmad. *The Effectiveness of the Guided Inquiry Approach Judging from the Problem Solving Ability of Middle School Students*. Journal of Mathematics and Mathematics Education, Volume 2, October 2013, p. 22,2013.
- [7] Uno, Hamzah. *Learning Model. Creating a Creative and Effective Teaching and Learning Process*, Jakarta: Bumi Aksara, 2008

- [8] Zhu, Zhen. *Gender Differences In Mathematical Problem Solving Pattern: A Review Of Literature*. Internatinal Education Journal. ISSN 1443-1475. Vol 8. No 2. 2013
- [9] Polya. G. *How To Solve It :New Aspect Of Mathematical Method*. Pricenton:University Press, 1973.
- [10] Zulkarnain, Iskandar and Amalia Sari, Noor. *Guided Discovery Model with Mind Mapping Technique to Improve the Understanding Ability of Mathematical Concepts of Middle School Students*. EDU-MAT Journal of Mathematics Education, Volume 2, Number 3, October 2014, pp. 240 – 249, 2014
- [11] Ristanto, Rizhal Hendi. *Guided Inquiry Based Learning with Multimedia and Real Environment Viewed from Achievement Motivation and Initial Ability*. Surakarta: Sebelas Maret University, 2010.
- [12] Sanjaya, W. *Education Process Oriented Learning Strategies*. Jakarta: Kencana., 2008.
- [13] Nurfausiah, Suhardiman. *Effect of Guided Inquiry Learning Models on Learning Outcomes*. Journal of Physics Education Vol. 4 No. 1, March 2016. ISSN 2355-5785, 2016.
- [14] Meidawati, Yenny. *The Influence of Guided Inquiry Learning Approaches to Increasing Mathematical Problem Solving Ability of Middle School Students*. Padang: Padang State University, 2014.
- [15] Nurhadi, et.al. *Contextual Learning and Its Application in CBC*. Malang: UM Press, 2004.
- [16] Kuhltau, C.C., Maniotes, L. K., & Caspari, A. K . . *Guided Inquiry: Learning In the 21st Century*. London: Libraries Unlimited, 2007.
- [17] Hwang, W.Y., Chen, N. S., & Dung, J. J., et al. *Multiple Representation Skills and Creativity Effects on Mathematical Problem Solving using a Multimedia Whiteboard System. , 2007.*
- [18] Orlich, Donald. C. *Teaching Strategies: A Guide to Effective Instruction*. New York: Houghton Mifflin Company, 2007.
- [19] Hudoyo, H. *Learning Mathematics According to the Constructivism View*. Paper presented in the National Seminar on Efforts to Improve the Role of Mathematical Education in Facing the Globalization Era. PIP IKIP Malang, 1998.