

Inductive-Deductive Approach to Improve Mathematical Problem Solving for Junior High School

Mariam Ar Rahmah

Email: mariamarrahmah@gmail.com

Abstract. This research is experimental quantitative about quasi experiment that emphasize on improve mathematical understanding and problem solving for Junior High School students by inductive-deductive implementation. The population of this research are all of students at IX degree students in Subang 2012/2013. Two of nine classes were chosen as sample for this research. The topic which used is probability including random occurrence, basics of chance, relative frequency, calculation of probability, determining the value of probability, the expected frequency and the combined odds of two events. The instrument that was used are test and non-test. Mathematical understanding and problem solving were used as a test methods. Meanwhile questionnaire, and observation sheet were used as non-test methods. The data was analyzed by Mann-Whitney and t-test. According to whole analyze in this research, can be concluded: 1) the student improvement of mathematical understanding by using inductive-deductive approach is in middle quality, 2) there is no significant difference at improvement mathematical understanding between experimental class and control class, 3) the improvement of student's ability in mathematical problem solving that use inductive-deductive approach has a low quality, 4) there is no significant difference at mathematical problem solving between experimental class and control class, 5) most of students has positive responses to mathematic learning by inductive-deductive approach, although the students have many problems when learning takes place.

1. Introduction

In 21st century is a globalization era, the era of resulting technology products with abundant quantity and quality that increasingly sophisticated and dissemination of information flow is increasingly and unstoppable. This has led to intense competition among individuals who have skills and ability to think critic, systematic, logic, creative, and able to communicate creative ideas that will be part of it.

To create human who meets the above characteristics, it can be achieved through education, such as through mathematics education. By studying mathematics as a whole, the students will be able to have ability of understanding, communicating, connecting, reasoning, problem solving, logical thinking, systematic thinking, critical thinking, and creative thinking. This is because mathematics is a means of thinking, so that mathematics can be regarded as a "vehicle" for developing ability to think logic and higher cognitive skills for children [1].

Nevertheless, the research that examined on this study was on mathematical problem solving aspects. This was because mathematical problem solving ability is an ability that considered important on learning,



as proposed by Sabandar [2], that is mathematical problem solving is an ability that must be achieved, and improved mathematical thinking are the priority objectives of mathematics.

In addition to the opinion stated above, the importance of this ability can be seen from the regulation of the *Minister of National Education* of the Republic of Indonesia Number 20 of 2006 on the Standards Content [3] stated that the purpose of study mathematics is to make learners have the following capabilities:

- Understanding mathematics concepts, the relationship every concepts and apply concepts or algorithms as flexible, accurate, efficient, and precise in troubleshooting.
- Using the reasoning in the patterns and nature, perform mathematical manipulation in making generalizations, compile evidence, or explain mathematical ideas and statements.
- Problem solving, include the ability to understand the problem, construct a mathematical model, solve the model and interpret the obtained solution.
- Communicating the ideas with symbols, tables, diagrams, or other media to clarify situation or problem.
- Having a good respect of the usefulness mathematics when solving the problem, also confidence in problem solving.

But the reality has found in the field that the level of achievement of mathematical problem solving ability is not satisfactory. It is based on research conducted by Nurhadiyati [4] to the junior high school students in the Bandung city. Generally, the results of mathematical problem solving ability of junior high school students is not satisfactory, around 30% - 50% from the ideal score. Similar opinion was also expressed by Ahmad [5] that is based on case studies in mathematics subject probability and statistics conducted on 41 students of second grade in SMP Negeri 2 Purwokerto, it was found that the students are still experiencing difficulties in resolving problems that related with the ability of understanding mathematical and mathematical problem solving.

The failure of students to achieve mathematical abilities above is not impossible causing the formation to negative course. According to Suherman [6] mathematics is a formation of affectives mathematics towards to the formation of cognitive area, although sometimes the opposite occurs. For example, a student who often feel able to solve mathematics problems, they enjoyed and desire to get more mathematics problems. Conversely, if they quite often can not feel disable, it will lead them to scare and shy. This is proven on the reality that most of students have negative affectives to mathematics. As stated by Muijis and Reynolds [1] mathematics is usually regarded as the most difficult subjects for children and adults. At school, many students seems to be uninterest on mathematics, and often there is doubt about the relevance of so much time spent for teaching mathematics.

These problems occur not only due to the students factors but also it could be occur because of insufficiency facilities and infrastructures when learning takes place, the educational environment not supporting, and also because teachers could not maximize their competency as teachers. From all factors, a slight incompetence teacher in teaching lead to an enormous impact on the students' lack on mathematical ability. Besides from Gage and Berliner's opinion [7], teachers should be able to play as a role, in charge of, and responsible for: (1) Planning, which should be prepare what is needed in teaching and learning process; (2) Implementing, which should be create a situation, leaders, stimulate, mobilize, and direct the KBM according to plan; and (3) Assessor, who should be collect, analyze, interpret, and make a consideration of teaching and learning process based on defined criteria.

In this condition, teacher not only prepare physical things (eg props) but also teachers have to prepare non-physical things, like mastery material that will be delivered through learning approach. The approach adopted is not based on self-interest, for example, practicality or the approach of "it" is the most

controlled, but a teacher should use learning approaches that can stimulate interest and explore the knowledge of students, so it will impact on the emergence of students positive affectives towards mathematics. Such an approach is of course adapted to the material to be learned and the objectives to be achieved.

The ideal ways of learning that was expressed in Standard Process on the National Education Standards [8], is a process of learning in the educational unit organized in an interactive, inspiring, fun, challenging, motivating the students to actively participate and give enough room for innovation, creativity, and independence in accordance with their talents, interests, and physical and psychological development of learners.

Hamzah [9] suggested that in learning, students need to be active mentally, build a knowledge based on cognitive maturity they had. In other words, students are not expected to be like the little bottles ready to be filled with a variety of science in accordance with the will of the teacher. Meanwhile, Dahlan [10] also noted when the learning takes place, knowledge is not accepted passively. Knowledge gained through active activity in solving relationships, patterns, and make generalizations that are integrated in the new knowledge that obtained by the students, and learning is a social activity that occurs from the interaction of students with teachers and students with their peers. Such learning can be applied with inductive-deductive approach.

Inductive-deductive approach refers to activities undertaken by teachers so that teaching materials can be adapted by the students. Inductive-deductive approach according Mulyana [11] is the process of presenting a concept mathematical principle started by giving examples, followed by finding / construct the concept, constructing a conjecture, and ends with the giving exercise correspond to the stages of the concepts and principles that have been given. Through learning by using this approach students are trained to make generalizations.

To reach of making generalization stages, it needs capability to understand the relationship/linkages for given examples, problem solving plan, calculation process, and the process to re-examine the truth of the results obtained. These elements are an indicator of the ability of mathematical problemsolving. Based on the above, allegedly learning by using inductive-deductive approach could be improve students' mathematical problem solving ability.

2. Problem

Based on the introduction of the problems that have been described previously, the issues examined in this research are: (1) is the increase in mathematical problem solving ability of students to get math learning with inductive-deductive approaches are better than students who received conventional approaches? and (2) how is the students' affective using inductive-deductive approaches for mathematics learning?

3. Research Method

This research is a quasi-experimental research involving a group that has been formed to serve as the object of research with research design called non-equivalent control group design [12]. The population in this research were all students of third grade Junior High School in Subang Academic Year 2012/2013. Two of nine existing class was selected as research sample, that is the experimental group (the group that gets learning by using inductive-deductive approaches) and a control group (group with conventional learning). The formation of two classes aimed to determine the effect of learning mathematical problem solving ability. The instrument used is the ability tests, student questionnaire, and observation sheet.

4. Results And Discussion

Results and Discussion in this study are based on factors that were observed and found in the research include:

4.1 Description of Mathematical Problem Solving Ability Based on Learning (PSA)

Here are the results of descriptive statistics score students' mathematical problem solving ability.

Table 1 Descriptive statistic of PSA score

Test	Experiment Group				Control Group			
	<i>N</i>	\bar{X}	<i>S</i>	\bar{X}	<i>N</i>	\bar{X}	<i>S</i>	$\% \bar{X}$
Pre-test	35	10,11	5,465	25,28	35	7,69	4,234	19,23
Post-test	35	14,66	4,065	36,65	35	11,17	5,366	27,93
Ideal Maximum Score: 40								

Based on Table 1 shows that the average score of the pre-test of mathematical problem solving ability to the experimental class is 10.11, while for the control group was 7.69 with early abilities difference in the second grade reached 6.05%. However, based on nonparametric statistical test Mann-U Whitne obtained Sig. (2-tailed) is $0.055 > \alpha = 0,05$ so that H_0 is accepted. This means there is no difference in the average scores pre-test mathematical problem solving ability in the experimental class and control class.

While the average post-test score for an experimental class was 14.66 and the average for the control group was 11.17. Differences in the average scores in both classes is 3.52% with the highest average is in the experimental class. To prove that the mathematical problem solving ability score in experiment class is better than the control class there is a test of difference in the average score of N-gain using independent sample t-test, because the normal distribution of data and derived from a homogeneous variance. Here's a summary of the results obtained.

Table 2 Difference of Average Post test

t-test for Equality of Means		
T	df	Sig. (2-tailed)
3,152	68	0,003

Based on statistical tests above it can be concluded that there is the different mathematical problem solving ability between the students who got a math learning with inductive - deductive approach and conventional learning.

4.2 Enhance Mathematical Problem Solving Based Learning (PSA)

Table 3 below presents the average of mathematical problem solving abilities by learning N-gain.

Table 3 N-Gain Average and Clasification PSA

Class	N-gain Average	Clasification
Experiment	0,138	Low
Control	0,107	Low

From Table 3, although the classification of the enhancement in both classes is low, but the enhancement in mathematical problem solving ability of students in the experimental class is greater when compared with the increasing capability in the control class . To determine the significance then tested the nonparametric Mann - Whitney U because the results of the analysis show that the data are not normally distributed . Here's a summary of the results obtained.

Table 4 Difference of N-Gain Average Test

Statistic	Score	Explanation	Conclusion
Mann-Whitney U	521,000	Ho Accepted	Hipotesys rejected
Z	-1,081		
Asymp. Sig. (2-tailed)	0,280		
Asymp. Sig. (1-tailed)	0,140		

Thus, there are no significant differences between the average N-gain mathematical problem solving ability of students who got the inductive-deductive learning with students getting conventional learning. From the results, it can be concluded that there are no significant differences in mathematical problem solving enhancement abilities between students who study with inductive-deductive approach and conventional.

The discrepancy between the hypotheses are made with the results obtained made possible because of the inductive-deductive approach is less suitable for use in the classroom are the reasons:

First, students still unfamiliar implementing learning by using inductive-deductive approach. Workmanship in groups and provision of teaching materials about probability using tools to each student (in this case the coins, dice and cards bridge) was not enough to help the students to understand the material. Most of the students are still asking how to get a conclusion/ generalization of the examples above. Whereas Hudojo (Dahiana, 2010) states that, think math is a mental activity, which is in the process using generalizations. This indicates that the students thinking activity mathematically with inductive-deductive approach to the selected sample was not going according to what is expected. The students problems being unfamiliar with the way of learning using constructivist-based approach is confirmed by Dharmadasa (Muijis, D. and Reynolds, D., 2008), which suggests that a number of studies shows that many students thinks constructivist methods is quite difficult to be implemented. The same thing also expressed by Au and Carroll (Muijis, D. and Reynolds, D., 2008) stating that the teacher sees constructivist methods are burdensome and alarming effect on classroom discipline. They are not sure about the provision of appropriate materials, promoting experimentation, and started constructing the child's knowledge.

Second, there is lack of researcher that studies the class while the class is relatively large resulted not all students can be handled optimally. As a result, the students who have not been handled by researchers, conclusions/ formulas that have been made in the teaching materials is not based on an understanding of the premises above, it is obtained from the copying conclusion at the end of learning.

Third, the classic problem, is the limited time. Although researchers have designed a time as possible so that learning takes place in line with expectations, but the reality is different. Researchers do not have enough time to discuss the problems of mathematical problem solving for probabilities material, so there are still many students who are not accustomed to do problem solving mathematical problems contained in the post-test. This problem is recognized by Dharmadasa (Muijis, D. and Reynolds, D., 2008) based on the results of an informal interview to the implementation of programs designed to introducing constructivist methods shows that teachers consider a constructivist approach as a challenge and a concept hard to capture in a short time. These constraints may cause some differences of hipotesys and the result obtained.

5. Conclusions and Recommendation

Based on the results of research and discussion, it could be produced some conclusions as follows: (1) there is no significant difference between comprehension ability of mathematical problems solving in both of experimental group and control group; and (2) most of students have positive affective on learning mathematics by using an inductive-deductive approaches, even though in reality students have problems during and after the learning takes place.

The conclusion has been stated above, implies that: (1) learning mathematics by using inductive-deductive approaches could not improve mathematical problem solving skills significantly compared to conventional learning, and (2) learning mathematics by using inductive-deductive train students to socialize, communicate, and be unyielding before the goals are reached.

The recommendation after the course of this study are as follows: (1) Learning mathematics by using inductive-deductive can be applied in schools with high clusters and (2) teaching mathematics using inductive-deductive could be tested in a shorter period of time.

6. References

- [1] MuijisD and Reynolds D2008*Effective Teaching (TeoridanAplikasi)*(Yogyakarta: PustakaPelajar)
- [2] Kurniawan 2010 (Tidak ada di Referensi)
- [3] RegulationNomor 22Tahun 2006tentangStandar Isi (Jakarta: Depdikbud)
- [4] Anriani N2011*Pembelajaran dengan Pendekatan Resource Based Learning untuk Meningkatkan Kemampuan Penalaran dan Pemecahan Masalah Siswa SMP Kelas VIII*(Bandung: Thesis PPS UPI)
- [5] Ahmad2005*Kemampuan Pemahaman dan Pemecahan Masalah Matematika Siswa SLTP dengan Model Pembelajaran Berbasis Masalah* (Bandung: Thesis PPS UPI)
- [6] Suherman., et al2003*Strategi Pembelajaran Matematika Kontemporer*(Bandung: FPMIPA)
- [7] Makmun AS2007*Psikologi Kependidikan (Perangkat Sistem Pengajaran Modul)* (Bandung: Rosda)
- [8] National Education Standards (2009) (Tidak ada referensi)
- [9] Hamzah2001*Pembelajaran Matematik menurut Teori Belajar Konstruktivisme*
[Online:<http://depdiknas.go.id/jurnal/40/pembelajaran>]
- [10] Dahlan J
A2004*Meningkatkan Kemampuan Penalaran dan Pemahaman Matematik Siswa Sekolah Lanjutan Tingkat Pertama melalui Pendekatan Open Ended* (Bandung: Dissertation PPS UPI)
- [11] Mulyana T2005*Upaya Meningkatkan Kemampuan Berpikir Kreatif Matematika Siswa SMA Jurusan IPA Melalui Pembelajaran dengan Pendekatan Induktif-Deduktif*(Bandung: Thesis PPS UPI)
- [12] Ruseffendi ET2005 *Dasar-dasar Penelitian Pendidikan dan Bidang Non Eksakta Lainnya* (Bandung: Tarsito)
- [13] Hafriani2004*Mengembangkan Kemampuan Pemecahan Masalah Matematik melalui Problem Centered Learning* (Bandung: Thesis PPS UPI) (Tidak ada di badan teks)