THE EFFECTIVENESS OF REMEDIAL TEACHING BASED DIAGNOSTIC ASSESSMENT ON THE ACHIEVEMENT STUDENT MATHEMATICS LEARNING OUTCOMES IN INQUIRY LEARNING MODEL

Kartono[1], Akhmad Nur Rizki [2], Suhito[3]
[1]*Departemen of Mathematic, Semarang State University, Indonesia*
[2]*Departemen of Mathematic, Semarang State University, Indonesia*
[3]*Departemen of Mathematic, Semarang State University, Indonesia*
pakarunnes@yahoo.com

ABSTRACT

This aims of the research determine the effectiveness of remedial teaching on the achievement of students' mathematics learning outcomes in the inquiry model and the average difference with other treatments. The population in this research is the second semester of eighth grade students of SMP Negeri 22 Semarang academic year 2015/2016. Sampling was done by random sampling technique. With this technique, there are four classes as an experimental class is class VIII A as first experimental class treatment with remedial teaching in inquiry model, a class VIII B as second experimental class with remedial teaching in conventional models, a class VIII G as third experimental class with inquiry model, and VIII H as fourth experimental class with conventional models. The data collection is done by the method of documentation, written tests and interviews. Furthermore, the data were analyzed using the proportion test, the average similarity test, anova test factorial design and advanced test of Scheffe. The conclusion of this study showed that the remedial teaching in the inquiry model effectively to the learning outcomes of students with average results over 75 and the mastery proportion more than 75%. In addition, remedial teaching is more effective than not remedial, inquiry model is more effective than conventional models, and the treatment in the first experimental more effective than the treatment in the experimental class to another.

Keywords : *Diagnostic Assessment, Learning Outcomes, Inquiry, Remedial Teaching*

1.Introduction

Learning outcomes are behavioral changes obtained learners after they have experienced learning activities. Learning outcomes is divided into three domains, namely the cognitive, psychomotor, and affective domains (Rifa'i, 2012). This study only examined the cognitive domain. Learning outcomes on cognitive covers aspects of conceptual understanding, mathematical reasoning and communication, as well as problem solving (Rifa'i, 2012). The learning outcomes is parameter of a successful learning.

However, in fact learning outcomes of mathematics in Indonesia is still low. This can be seen by TIMMS of the Ministry of Culture and Research and Development Board that results stated that Indonesia in 2003 was ranked 35rd out of 46 countries with a score of 411, in 2007 was ranked 36rd out of 49 countries with a score of 397, and in 2011 was ranked 36rd out of 40 countries. This is a proof that mathematics is considered difficult subjects, both for children and adults. It is also said by Muijs, et al. (2008) that children who have a misconception, when developing other concepts will one continuously. Teachers should resolve this problem early.

Based on the preliminary study were imposed on 62 students of grade VIII G ang VIII H SMP Negeri 22 Semarang on mathematics learning outcomes, found that the average results of students' mathematics learning only 54. The proportion of students who achieve completeness criteria was 25%. This proves that mathematics include subjects that are considered difficult for students of SMP Negeri 22 Semarang. The difficult of mathematics was also felt by adults. In a study conducted The Basic Skill Agency (Muijs, et al., 2008), the proportion of British people who have low basic numeracy skills over adults who are illiterate. Whereas mathematics is one of the underlying science technology development. Ability of teachers to identify students; mathematics learning outcomes is a very important role in the success of the lessons.

According Widdiharto (2008), essentially the work of teachers is the same as the work of doctors. Before treating a patient, the doctor will look for the cause of the pain suffered by patients through intensive examination. Once the cause of the disease is known, the doctor will give you the right medicine to cure the patient. Effort of physicians in finding the cause of the pain suffered by patients through intensive examination called the diagnosis. Therefore, researchers chose one of the evaluation of learning called a diagnostic assessment that continued therapy adapted the conditions of students, referred to as remedial teaching.

Diagnostic assessment by Supriyadi (2003), was used to detect the weaknesses of the student. While remedial according Kunandar (2014) word derived from the word remedy (English), meaning that the drug, fix or help. Remedial teaching is learning that nature cure, treat, and improve learning outcomes of students from low and under the criteria determined by the teacher or school.

Moreover, the weakness factor is the students' mathematics learning outcomes learning model used is not made active students who ultimately make the student develops math skills. Based on the results of interviews conducted to teachers of mathematics at SMP Negeri 22 Semarang and of the results obtained RPP in these schools that still use the model of learning expository. Learning is still teacher-centered. Teachers are the resources and the students as recipients of informationa. So that students become less active in their learning and they are not trained to find the concept itself. It affects student learning, which is due to students only receive information from teachers.

Based on research conducted by Pawestri, et al. (2013), teachers' explanations that do not emphasize the concept of understanding can lead to misconceptions in students. This is caused by a week ability of students' understanding of the concept. Therefore, the need for an innovative learning model and is able to activate the students. In this case, researchers used a guided inquiry learning model.

According Suherman (2003), in the inquiry model, the teacher only as guidance and resources necessary data. Students still have to collect additional information, create hypotheses, and test. Thus, students can understand the mathematical concepts learned through the learning model.

The problem of this study were: (1) whether learning with teaching remedial treatment based diagnostic assessment in inquiry learning model if effective against the students mathematics outcomes?; (2) whether there is an average difference between learning with remedial teaching based diagnostic assessment in inquiry learning model, remedial teaching based diagnostic assessment in conventional learning model, inquiry learning model without diagnostic assessment, and conventional learning model without diagnostic assessment?

The aims of this study are determine the effectiveness of remedial teaching on the achievement of students' mathematics learning outcomes in the inquiry model and the average difference between learning with remedial teaching based diagnostic assessment in inquiry learning model, remedial teaching based diagnostic assessment in conventional learning model, inquiry learning model without diagnostic assessment, and conventional learning model without diagnostic assessment.

2.Methodology

This research is done in SMP Negeri 22 Semarang on the material circle. This study design is posttest-only control group. Population used is grade VIII SMP Negeri 22 Semarang academic year 2015/2016. Using the technique of random sampling, determined grade VIII A as first experimental class, grade VIII B as second experimental class, grade VIII G as third experimental class, and grade VIII H as fourth experimental class. The independent variables in this study is a model of learning and assessment of learning. While the dependent variable is mathematics learning outcomes. The first experimental class is given remedial teaching based diagnostic assessment in inquiry learning model, the second experimental class is given remedial teaching based assessment diagnostic in conventional learning model, third experimental class is given inquiry learning model without diagnostic assessment, and fourth experimental class is given conventional learning model without diagnostic assessment.

The first procedures were performed in this study were researchers gave the treatment of learning models specific to each experimental class. Treatment in the form of inquiry learning model implemented with the following

steps. (1) Orientation, namely the stage where teachers do steps to foster a conducive learning atmosphere. (2) Formulate problems, which is a step in the student reading an issue. (3) Formulate hypotheses, namely temporary answer of a problem being studied. (4) Collect data, namely the stage containing the activity choosing the information needed to test the hypothesis. (5) Test the hypothesis, which shows the process of determining the answer considered acceptable according to the data or information obtained. (6) Formulating its conclusions, the process of describing the findings obtained by the test result hypothesis (Sanjaya, 2008).

After the experimental class was given treatment, first experimental class and second experimental class is given diagnostic tests, and third experimental class and four experimental class is given formative tests. Diagnostic tests carried out in order to determine the strength and weaknesses of the students (Hughes dalam Suwarto, 2013). Detection of errors experienced by students, is used as a reference in the implementation of remedial teaching at the next meeting. According Mulyadi (2008), remedial teaching is a form of teaching that are healing or repair.

Methods of data collection in this study conducted by the method of documentation, testing, and interviews. Form of the instruments used in the form of a syllabus, lesson plan, worksheets learners, diagnostic tests, formative tests, and math achievement test. Data errors experienced by the students obtained from analyzes using diagnostic tests and interviews. While the research data result of learning mathematics were statistically analyzed parametric calculated by t test and proportions to determine the completeness of the results of students 'mathematics learning individually and classical, test anava factorial design to determine the difference in the average results of students' mathematics learning given different treatment, and Scheffe further test to compare the average results of students' mathematics learning first experimental class with second experimental class, third experimental class, and fourth experimental class.

3.Result

The following is a classical completeness and test each individual experimental class.

Table 1. Description Statistics Group Experiments

Treatment		n	Average $(\bar{x})$	Standard Deviation (s)
Diagnostic	Inquiry	30	91.67	7.46640
	Conventional	26	82.5	10.70047
Without Diagnostic	Inquiry	26	77.31	12.01922
	Conventional	31	75.97	9.95150

Tabel 2. Individual Mastery Test

Treatment		t	t_{table}	Decision	Information
Diagnostic	Inquiry	12.2264	1.699	H_0 accepted	Completely Individual
	Conventional	3.574	1.708	H_0 accepted	Completely Individual
Without Diagnostic	Inquiry	0.979	1.708	H_0 accepted	Completely Individual
	Conventional	0.5414	1.697	H_0 accepted	Completely Individual

Tabel 3. Classical Mastery Test

Treatment		z	z_{table}	Decision	Information
Diagnostic	Inquiry	3.1623	1.64	H_0 accepted	Completely Classical
	Conventional	0.6794	1.64	H_0 accepted	Completely Classical
Without Diagnostic	Inquiry	−1.1323	1.64	H_0 accepted	Completely Classical
	Conventional	−0.5185	1.64	H_0 accepted	Completely Classical

From Table 2 and Table 3 is that all the experimental groups meet individually completeness and classical. Thus, it can be concluded that the treatment given to all experimental groups are effective in improving students' mathematics learning outcomes. Here are the results of a factorial design ANOVA test.

Table 4. Design of Factorial Analysis of Variance Summary

Source	Df	Sum of Squares	Mean Square	F	F_{table} 5%
Corrected Model	3	4510.009	1503.336	14.814	2.687908
Assessment	1	3045.336	3045.336	30.008	3.928195
Learning Model	1	765.942	765.942	7.547	3.928195
Interaction	1	429.833	429.833	4.236	3.928195
Within of group	109	11061.673	101.483		
Total	112	15571.681			

Based on the results of a factorial design ANOVA test with significance level 0:05 obtained as follows.

a. There is an average difference between the experimental group treated with remedial teaching based on diagnostic assessment and without a diagnostic assessment. When viewed from the average, the experimental group treated with remedial teaching based diagnostic assessment ie 87.4107 better than without the use of diagnostics is 76.5789.
b. There is an average difference between the experimental group with the treatment model of inquiry learning with conventional learning models. When viewed from the average, the experimental group treated with remedial teaching based diagnostic assessment is better at 85 than using formative assessment is 78.95.
c. There is an average difference between the experimental group treated with remedial teaching in the diagnostic assessment based inquiry learning model based diagnostics remedial teaching in conventional learning models, inquiry learning model without diagnostic assessment, and conventional learning models without diagnostic assessment.

Because there is an average difference between groups of samples, the test is followed by a further test of Scheffe. Here is a summary of the results of a further test Scheffe.

Table 5. Inter-group Scheffe Test Results

Group	S	S_α	Criteria	Conclusion
The First and Second Experiment	3.398	2.84	H_0 rejected	There is a difference
The First and Third Experiment	5.319993		H_0 rejected	There is a difference
The First and Fourth Experiment	6.085266		H_0 rejected	There is a difference
The Second and Third Experiment	1.857558		H_0 accepted	There is no difference
The Second and Fourth Experiment	2.437511		H_0 accepted	There is no difference
The Third and Fourth Experiment	0.5		H_0 accepted	There is no difference

Likewise, when seen from the average mathematics learning outcomes between groups of samples produce the same calculations as in Table 6 below.

Table 6. Mathematics Outcomes Average Summary

	First Experiment	Second Experiment	Third Experiment	Fourth Experiment
Average	91.67	82.5	77.31	75.97

It can be concluded that the results of students' mathematics learning in the sample group were given treatment remedial teaching based diagnostic assessment in inquiry learning model is more than the result of learning mathematics are given treatment remedial teaching based diagnostic assessment in a model conventional learning, inquiry learning model without diagnostic assessment, as well as learning models without conventional diagnostic assessment.

Completion of the learning outcomes in the sample group treated with remedial teaching in the diagnostic assessment based inquiry learning model because this treatment is suitable to improve student learning outcomes. In the experimental group, the researchers provide a treatment in the form of diagnostic assessment, so that the weaknesses of students' learning outcomes, especially in the subject matter can be detected with a good circle.

This is in line with the statement Suwarto (2013) that the diagnostic test is useful to know the learning difficulties faced by students, including learning outcomes error. Suwarto also revealed that the diagnostic test function to provide information to teachers on the concept that has been or has not been understood by the students so that they can be fixed and can be addressed properly.

Zhao (2013) also states that the diagnostic tests are used to determine the strengths and weaknesses of students and teachers become a reference in making decisions related to improving the learning process. Furthermore Leighton, et al. (2007) suggest that the cognitive diagnostic assessment is designed to measure the structure of specialized knowledge and skills of students so that processing can provide information about the student's cognitive strengths and weaknesses. Zeilik as cited in Suwarto (2013) revealed that diagnostic tests are used to assess students' understanding of the concept of the basic concepts on a particular matter, especially on a concept still misunderstood..

Therefore, the results of students' mathematics learning can increase and lead to an experimental class with the treatment can meet the learning completeness. This is because the diagnostic assessment is used as a reference in the implementation of remedial teaching.

This is in line with research conducted by Geller, et al. (2009) concludes that the decision-makers in a model learning model, the results of diagnostic tests are increasingly used to guide the design of instruction improvements, which in this case is remedial teaching.

It is also in line with research conducted by Saputra, et al. (2015) concludes that remedial teaching adaptive strategy effective in overcoming the difficulties of learning mathematics learners.

Research on the effectiveness of remedial teaching were also investigated by Selvarajan, et al. (2012) and the research concluded that the remedial learning is effective in improving students' ability in Tamil Language and Mathematics.

Based on research conducted by Othman, et al. (2013) concludes that remedial learning is effective in improving the ability of EFL / ESL students at the university level in Arabic. This shows that the remedial learning is effective in improving students' abilities. As for the class of experiments that did not receive treatment diagnostic assessment, the difficulties experienced by students can not be detected properly. Thus, the treatment given can not be given in accordance with the difficulties experienced by the students, which led to the difficulties experienced by students can not be resolved properly.

The completeness in classical as well as individually in the experimental class also due to the use of inquiry learning model. Thoroughness in improving student learning outcomes due inquiry learning model requires students to find its own concept, so the concept can be studied deeply embedded.

In the implementation of inquiry learning model, researchers agree with Sanjaya (2008) that there are six learning steps, namely (1) orientation, (2) to formulate the problem, (3) proposed a hypothesis, (4) collecting data, (5) to test the hypothesis and (6) to formulate conclusions. According to Brown, et al. (1982) in Oguzer, et al. (2011) states that the implementation of guided inquiry learning model requires students to be more active in the learning process. Teachers guide students quite extensive. Most of the planning, the students did not formulate its own problems. Therefore, the inquiry learning model is effective in improving students' mathematics learning outcomes.

This is in line with the results of research conducted by Ifeoma, et al. (2013) which concludes that guided inquiry method provides a positive effect in improving the ability of students to the student social curriculum in Anambra, Nigeria.

Rosvita, et al. (2015) which examines the learning outcome through guided inquiry learning, provide results that inquiry learning model can improve student learning outcomes class XD MAN 3 Banjarmasin on the concept of damage to the environment and its preservation.

Inquiry learning model has advantages as disclosed by a psychologist, as quoted by Anam (2015), namely: (1) students will understand the basic concepts and ideas better, (2) help in using memory and transfer situations learning new ones, (3) encourage students to think the initiative and formulate the hypothesis itself, (4) encourage

students to think and work on his own initiative, (5) provide satisfaction is intrinsic, and (6) the situation learning process more stimulating.

During the learning process by using inquiry learning model, students learn to analyze and solve the problem given by the teacher. Students are required to actively search for information using instruments that are confrontational, namely in the form LKPD as expressed by Rustaman that support system in inquiry learning model is a set of teaching materials that are confrontational.

4.Conclusion

Based on the results of research and discussion, it was concluded that a class VIII SMP Negeri 22 Semarang, especially on the material circle:

Remedial teaching based diagnostic assessment in inquiry

1. Remedial teaching based diagnostic assessment in inquiry learning model is effective in improving students' mathematics learning outcomes. It can be seen from the thoroughness of individual achievement and classical with average ability student learning outcomes at 91.67 and the proportion of students who achieve mastery of 100%.
2. Remedial teaching produce results based diagnostic assessment of mathematics learning is better than no diagnostic assessment, inquiry learning model mathematics learning yield better than conventional learning models, treatment remedial teaching in the diagnostic assessment based inquiry learning model produces better mathematics learning outcomes than the treatment of remedial teaching in the model-based diagnostic assessment conventional learning, inquiry learning model without diagnostic assessment, and conventional learning models without diagnostic assessment.

Reference

Anam, Khoirul. 2015. *Inquiry Based Learning Methods and Applications.* Yogyakarta: Pustaka Pelajar.

Geller, Leanne R. Ketterlin & Paul Yovanoff. 2009. Diagnostic Assessments in Mathematics to Support Instructional Decision Making. *Practical Assessment, Research & Evaluation*. 14(16): 1-11.

Ifeoma, Olibie Eyuiche & Ezeoba Kate Oge. 2013. Effects of Guided Inquiry Method on Secondary School Students' Performance in Social Studies Curriculum in Anambra State, Nigeri. *British Journal of Education, Society & Behavioural Science*. 3(3): 206-222.

Kunandar. 2014. *Authentic Assessment (Assessment of Learning Outcomes of Students Based Curriculum 2013)*.Jakarta: PT Raja Grafindo Persada.

Leighton, Jacqueline P & Mark J. Gierl. 2007. *Cognitive Diagnostic Assessment for Education*. New York: Cambridge University Press.

Muijs, Daniel & David Reynolds. 2008. *Effective Teaching Teori dan Aplikasi*. Translated by Soetjipto, Helly Prajitno & Sri Mulyantini Soetjipto. 2008. Yogyakarta: Penerbit Pustaka Pelajar

Mulyadi. 2008. *Diagnostic Learning Difficulties.* Malang: Nuha Litera

Oguzer, Nkasiobi S. & J. Opara. 2011. Inquiry Instructional Methode and The School Science Curriculum. *Current Research Journal of Social Sciences.* 3(3): 188-198.

Othman, Fadel H.M. & Khaled M. Shuqair. 2013. Effectiveness of the Remedial Courses on Improving EFL/ESL Students' Performance at University Lebel in the Arab World. *International Journal of Higher Education*. 2(3): 132-138

Pawestri, Ungky, et al. 2013. Analysis of Mathematical Learning Difficulties with the Introduction of English at Material logarithm in Class X SMAN Karangpandan Karanganyar 2012/2013. *Jurnal Pendidikan Matematika Solusi*. 1(1): 1-7.

Rifa'i, Achmad & Catharina Tri Anni. 2012. *Educational Psychology* Semarang: UPT Unnes Press.

Rosvita, Nurul Husna & Rabiatul Adawiyah. 2015. Improving Student Results Through Guided Inquiry Learning. *Jurnal Pendidikan Hayati*. 1(1): 7-11.

Rustaman, Nuryani Y. *Developing Learning Model (MIPA)*. Paper presented at the National Seminar on Mathematics Learning Development and Implementation on the implementation of the KBK. FMIPA IKIP PGRI Semarang.

Saputra, Avika Dias & Suhito. 2015. Remedial Teaching Effectiveness Adaptive Active Learning Strategy Set to Overcome Difficulties Learning Math IPS Programs. *Unnes Journal of Mathematics Education*. 4(1): 1-10.

Selvarajan, Poongothai & Thuyagarajah Vasanthagumar. 2012. The Impact of Remedial Teaching on Improving The Competencies of Low Achievers. *International Journal of Social Sciences & Interdisciplinary Research*. 1(9): 49-58.

Suherman, Erman, *et al*. 2003. *Contemporary Learning Strategy*. Bandung: Universitas Pendidikan Indonesia

Supriyadi. 2003. *Study of assessment on learning chievement of Physics*. Universitas Negeri Yogyakarta

Suwarto. 2013. Development of Diagnostic Tests. *Jurnal Pendidikan*. 22(2): 187-202.

Widdiharto. Rachmadi. 2008. *Diagnosis of mathematics learning difficulties of junior high school and remedial alternative processes*. Yogyakarta: Pusat Pengembangan dan Pemberdayaan Pendidik dan Tenaga Kependidikan Matematika.

Zhao, Zhongbao. 2013. An Overview of Studies on Diagnostic Testing and its Impplications for the Development of Diagnostic Speaking Test. *International Journal of English Linguistics*. 3(1): 41-45.