THE EFFECTIVENESS OF TEAM ASSISTED INDIVIDUALIZATION LEARNING MODEL WITH REALISTIC MATHEMATICS APPROACH ON MATHEMATICAL PROBLEM-SOLVING ABILITY OF JUNIOR HIGH SCHOOL STUDENTS

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Abstract

This study aims to determine the effectiveness of Team Assisted Individualization learning model with realistic mathematics approach on mathematical problem-solving ability of Junior High School students. This research is quasi experiment with pretest posttest control group design. The subjects are 64 students from 3 Godean Junior High School which consist of class VIII F as the experimental class using Team Assisted Individualization learning model with realistic mathematics approach and class VIII D as the control class using expository learning model with deductive approach. Instrument that used are learning observation sheet and pretest-posttest items of mathematical problem-solving ability. Based on this research, it is conclude that Team Assisted Individualization learning model with realistic mathematics approach effective to the mathematical problem-solving ability of junior high school students. Furthermore Team Assisted Individualization learning model with realistic mathematics approach is more effective than expository learning model with deductive approach to the mathematical problem-solving ability of Junior High School students.

Keywords: Team Assisted Individualization, realistic mathematics approach, mathematical problem-solving ability

INTRODUCTION

In 21st century, the competition and challenges in all aspects of life are bigger, so people is required to have 21st century skills. Partnership for 21st Century Skills said that one of 21st century skills is critical thinking and problem solving. In line with it, *Peraturan Menteri Pendidikan Nasional Nomor 22 Tahun 2006* about Standard of Content said that one of the objectives of mathematics is the students are able to solve the problems including the ability to see the problem, the design of mathematical model, the effort to solve and interpret the solution. From the statement above, it is known that one of the students' ability to solve mathematical problem.

Ariyadi (2012: 58) said that there are two kinds of problems, routine problem and unroutine problem. Routine problem is a problem that tends to implicate rote as well as the awareness algorithms and procedures, so the routine problem is often considered low level. While the unroutine problems are classified as high level that requires the conceptual mastery and more complicated procedure.

According to Sumarmo (1994), problem solving is an activity to solve the questions, solve the unroutine problem, to apply mathematics in daily life, and to prove or to create or to test. There are four measures of problem solving in Polya (1985: 4) as follows: a) understanding the problem, b) devising a plan, c) carrying out the plan, and d) looking back.

One of international scale test that measures the mathematical problem solving ability is Programme for International Student Assessment (PISA). According to PISA results, the mathematical problem solving ability in Indonesian students is low, because only 0,3% of Indonesian students are categorized as high skill (OECD, 2013). Not only PISA, but also in National Examination for Junior High School there are several questions of problem solving. One of the material in National Examination for Junior High School is geometry. NCTM (2000) said that geometry is one of the topics that affects

students problem solving ability. According to the result of National Examination for Junior High School in 2014/2015, absorbing power of students in geometry is lower than others with the percentage of their mastery topic of 52,04% (Balitbang, 2015). The low mastery topic of geometry in National Examination for Junior High School also occurred to the students in 3 Godean Junior High School. The percentage of students mastery topic of geometry in 3 Godean Junior High School is 84,18%, it is lower than other topics.

Students in 3 Godean Junior High School received the learning material with KTSP curriculum which has steps of exploration, elaboration, and confirmation. In fact, result of students learning is not always the same with the goal of learning. The learning process in 3 Godean Junior High School is using the expository learning model with teacher as the center of learning. Erman Suherman (2001: 171) said that expository learning model means the lesson from teacher to students in the classroom in a manner of speaking at the beginning of the lessons, explaining the material and giving examples of the items question and answer, but, there are students who can not receive the lesson with this model, so it needs the learning model to facilitate students in learning mathematics.

A learning model that is recommended by educator is cooperative learning model. According to Slavin (1995), using the cooperative learning model can improve student learning achievements. Beside that, cooperative learning also satisfies the students need in critical thinking, problem solving, and integrating the knowledge based on experiences. Therefore, cooperative learning model is expected to improve the mathematical problem solving ability of students.

One of type of the cooperative learning model is Team Assisted Individualization. Team Assisted Individualization (TAI) is combining the advantage of cooperative learning and individual learning (Slavin, 2009: 194). Through the cooperative learning, students can interact and discuss also listen to the ideas from others in order to help the mastery of learning material. While through the individual learning, students can explore their own knowledge and experience to learn the material, so students have a meaningful learning.

Not only learning model but also learning approach is important to the student learning achievement. As we know that mathematics is abstract science and hard to imagine, it would be needed an approach that able to facilitate the students. One approach used to facilitate students is realistic mathematics approach. Realistic mathematics learning is developed based on Hans Freudenthal that said "Mathematics is human activity", so mathematics is suggested from human activity (Erman Suherman, 2003: 146). Atmini Dhoruri (2011: 513) said that the word "realistic" does not only mean a linkage with the fact but also contextual problem that has to be meaningful for the students. So, a learning that using realistic mathematics approach depart from student activity and accordance with context that can be felt and imagined by students.

Based on the description above, this research aims to determine: 1) the effectiveness of Team Assisted Individualization learning model with realistic mathematics approach on mathematical problem-solving ability of Junior High School students, 2) the effectiveness of expository learning model with deductive approach on mathematical problem-solving ability of Junior High School students, and 3) the comparison between Team Assisted Individualization learning model with realistic mathematics approach and expository learning model with deductive approach on mathematical problem-solving ability of Junior High School students.

RESEARCH METHOD

Type of Research

This research is a quasi experiment.

Time and Place of Research

This research was conducted on March 16th, 2016 until April 22nd 2016 in 3 Godean Junior High School.

Subject of Research

The research subject consists of 32 students from class VIII D and 32 students from class VIII F at 3 Godean Junior High School. Class VIII D is the control class by using expository learning model with deductive approach and class VIII F is the experimental class by using TAI learning model with realistic mathematics approach.

Variable of Research

There are two variables in this research, the learning model is free variable which consist the TAI learning model with realistic mathematics approach and expository learning model with deductive approach. Mathematical problem-solving ability is the bound variable.

Design of Research

This research is using the Pretest Posttest Control Group Design. In this design, the experimental class got treatment TAI learning model with realistic mathematics approach and the control class got treatment expository learning model with deductive approach. The pretest was given before the treatment, while posttest was given after the treatment.

Instrument and Data Collection Technique

The instrument in this research using instrument of test which consisted of pretest and posttest of mathematical problem-solving ability and learning observation sheet. Data collection technique is carried out by giving pretest before treatment and giving posttest after treatment in experimental class and control class. Pretest and posttest consisted of three items of mathematical problem-solving ability with score maximum is 100.

The instrument has been validated by expert judgment to know whether it is valid and can be used or not. The result of the instrument validation stated that research instrument can be used after revision. Test reliability of this instrument concludes that the instrument of pretest is in enough category and the instrument of posttest is in high category.

Data Analysis Technique

Data analysis technique in this research include analysis description, assumption analysis test, and hypothesis test. Analysis description consists the data of learning observation sheet and the data of mathematical problem-solving ability.

Assumption analysis test consists of normality test using Kolmogorov-Smirnov Test, homogeneity test using F-test. Normality test and homogeneity test were calculated using SPSS version 23 with significance value 5%.

The next step is testing the average difference in the students' initial ability by using the pretest score between the experimental class and control class. If the result is different between the two classes, the hypothesis testing will use gain score, but if the result is no different, the hypothesis testing will use pottest score.

The first hypothesis testing is used to determine the effectiveness of TAI learning model with realistic mathematics approach on mathematical problem-solving ability of Junior High School students. The second hypothesis testing is used to determine the effectiveness of expository learning model with deductive approach on mathematical problem-solving ability of Junior High School students. Both hypothesis testing are using One Sample T-Test with SPSS version 23.

Before the third hypothesis that is conducting, it is necessary to test the average difference in the students' posttest score to determine whether both classes have a difference of mathematical problem- solving ability. The third hypothesis testing is used to determine the effectiveness of the TAI learning model with realistic mathematics approach and expository learning model with deductive approach. This test used Independent Samples T-Test with SPSS version 23 at significance value $\alpha = 0,05$.

FINDING AND DISCUSSION

The learning in experimental class and control class were implemented 14 hours of lesson hours, consist of 2 lesson hours for the pretest, 10 lesson hours for the learning process, and 2 lesson hours for the posttest. Based on the

learning observation sheet, the learning performance percentage of the experimental class that uses the TAI learning model with realistic mathematics approach has reached 91,67% and control class that uses the expository learning model with deductive approach has reached 93,05%.

The description of the mean scores of the pretest and posttest in the experimental class and control class is presented in diagram 1 below.

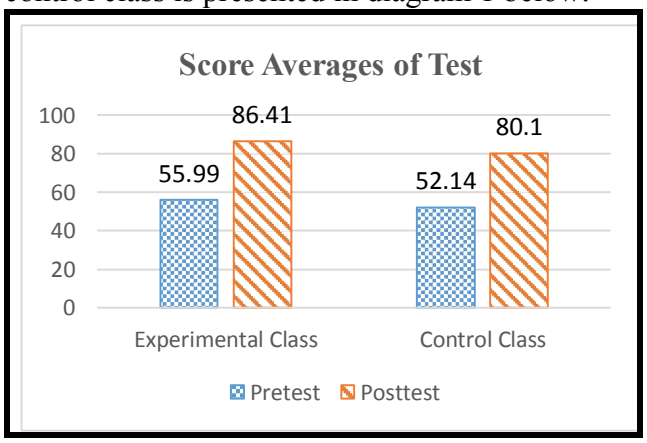

Diagram 1. The Mean Scores of the Pretest and Posttest in Experimental Class and Control Class

From the diagram 1, it can be seen that there is an increase in the mean score obtained during the posttest compared with the mean score during the pretest. On the data of the posttest, the mean score of the experimental class is higher than the mean score of the control class.

In addition, the description of the data were also conducted on each step of the mathematical problem-solving ability as shown in table 1 below.

Table 1. The Mean Scores of Mathematical Problem-Solving Ability on Each Step

Steps of Problem Solving Ability	Experimental Class		Control Class	
	Pretest	Posttest	Pretest	Posttest
Step 1	12,97	17,60	10	16,56
Step 2	15,47	28,59	16,46	26,30
Step 3	18,49	31,30	17,86	28,49
Step 4	9,06	9,91	7,81	8,75

Note:
Step 1: Understanding the problem
Step 2: Devising a plan
Step 3: Carrying out the plan
Step 4: Looking back

Table 1 above shows that each step of mathematical problem-solving ability of the students is increasing in both class.

In addition to the descriptive analysis, a statistical analysis is also conducted. Before a statistical analysis was conducted to test hypothesis, the assumption tests that were tested firstly are normality test and homogeneity test.

Based on normality test using Komogorov Smirnor Test with SPSS version 23 at significance level $\alpha = 0,05$, the result is data of the pretest and posttest scores in the experimental class and control class were derived from normally distributed population. The second test is homogeneity test using F test with SPSS version 23 at significance level $\alpha = 0,05$. From this test, it is concluded that the variance of the data on both pretest and posttest were the same (homogeneous).

Before the hypothesis test, it is necessary to test the average difference in the students' initial ability to specify what data will be used to the hypothesis test. The average difference in the students's initial ability test used Independent Samples T-Test with SPSS version 23 at significance value $\alpha = 0,05$. From this test, it is concluded that there is no difference on the initial mathematical problem-solving ability among the students of the experimental class and control class. Thus, the hypothesis testing is using the posttest score of the students' mathematical problem-solving ability.

The first hypothesis testing is used to determine the effectiveness of TAI learning model with realistic mathematics approach on mathematical problem-solving ability of Junior High School students. TAI learning model with realistic mathematics approach can be told effective on mathematical problem-solving ability when the score average of the experimental class at least reached the KKM of 75. This hypothesis test used One Sample T-Test with SPSS versi 23 at significance level $\alpha = 0,05$ with the results as shown in table 2 below.

Table 2. Effectiveness Test Result of TAI Learning Model with Realistic Mathematics Approach

Sig	α	Result
0,000	0,05	TAI learning model with realistic mathematics approach is effective

From table 2, it can be concluded that TAI learning model with realistic mathematics approach is effective on mathematical problem-solving ability of Junior High School students. It is relevant to the research by Bakhrodin (2013) which shows that Team Assisted Individualization (TAI) learning model with Contextual Teaching and Learning (CTL) effective on mathematical problem-solving ability.

After it, the second hypothesis testing is used to determine the effectiveness of expository learning model with deductive approach on mathematical problem-solving ability of Junior High School students. Expository learning model with deductive approach can be told effective on mathematical problem-solving ability when the score average of the control class at least reached the KKM of 75. This hypothesis test used One Sample T-Test with SPSS versi 23 at significance level α = 0,05 with the results as shown in table below.

Table 3. Effectiveness Test Result of Expository Learning Model with Deductive Approach

Sig	α	Result
0,0215	0,05	Expository learning model with deductive approach is effective

From table 3, it can be concluded that the expository learning model with deductive approach is effective on mathematical problem-solving ability of Junior High School students.

Based on the results of the first and second hypothesis testing, the result that the TAI learning model with realistic mathematic approach and expository learning model with deductive approach are equally effective on mathematical problem-solving ability of Junior High School students, so the third hypothesis was conducted to compare the effectiveness of both learning model. But, before the third hypothesis was conducted, it is necessary to test the average difference in the students' posttest score. The average difference in the students's posttest used Independent Samples T-Test with SPSS version 23 at significance value α = 0,05. From this test, it is concluded that there is difference average of posttest score on mathematical problem-solving ability between the experimental class dan the control class.

After it, the third hypothesis is conducted to determine effectiveness of the TAI learning model with realistic mathematics approach and expository learning model with deductive approach. This test used Independent Samples T-Test with SPSS version 23 at significance value α = 0,05 and shown in table 4 below.

Table 4. Comparison Effectiveness Test Result

Sig	α	Result
0,0195	0,05	TAI learning model with realistic mathematics approach is more effective then expository learning model with deductive approach

From table 4, it can be concluded that the TAI learning model with realistic mathematics approach more effective then expository learning model with deductive approach on mathematical problem-solving ability of Junior High School Students. In line with it, the research from Ana Kurniati (2009) which shows that the Team Assisted Indivualizatin (TAI) learning model is more effective than conventional learning model on problem solving ability.

CONCLUSION AND SUGGESTION

Conclusion

Based on the testing of hypothesis, the conclusion are: (1) Team Assisted Individualization learning model with realistic mathematics approach is effective to the mathematical problem-solving ability of Junior

High School students who have same characteristic with research subject, (2) expository learning model with deductive approach is effective to the mathematical problem-solving ability of Junior High School Students who have same characteristic with research subject, and (3) Team Assisted Individualization learning model with realistic mathematics approach is more effective than expository learning model with deductive approach to the mathematical problem-solving ability of Junior High School Students who have same characteristic with research subject.

Suggestion

Teacher is suggested to use Team Assisted Individualization learning model with realistic mathematics approach as the alternative in mathematics learning in order to improve mathematical problem-solving ability. The next research is expected to focus on the mathematical problem solving ability in broader material. The items of mathematical problem solving should be made better and unroutine, so the students can understand every step of mathematical problem solving well.

In addition, the researchers suggested to others to make advanced research to know the effectiveness of Team Assisted Individualization learning model with realistic mathematics approach by involving other aspects, as the mathematical conception-understanding ability and mathematical reasoning ability.

REFERENCES

Ana Kurniati. (2009). Efektivitas Penggunaan Model Pembelajaran Kooperatif Tipe Team Assisted Individualization (TAI) Terhadap Kemampuan Pemecahan Masalah Matematika Peserta Didik Kelas VIII SMP N 1 Ngadirejo Temanggung. *Skripsi*. Universitas Negeri Semarang.

Ariyadi Wijaya. (2012). *Pendidikan Matematika Realistik*. Yogyakarta: Graha Ilmu.

Atmini Dhoruri dkk. (2011). Developing Mathematics-Students Worksheet Based On Realistic Approach For Junior High School In Bilingual Program. *Proceeding*, International Seminar and the Fourth National Conference on Mathematics Education. Yogyakarta: FMIPA UNY.

Bakhrodin. (2013). Efektivitas Model Pembelajaran Kooperatif Tipe *Team Assisted Individualization* (TAI) dengan Pendekatan *Contextual Teaching and Learning* (CTL) Terhadap Kemampuan Pemecahan Masalah Matematika Siswa Kelas VII MTs Mu'allimin Muhammadiyah Yogyakarta. *Sripsi*. UIN Yogyakarta.

Balitbang. (2015). *Laporan Hasil Ujian Nasional SMP/MTs Tahun Pelajaran 2014/2015*. Jakarta: Kemendikbud.

Depdiknas. (2006). *Peraturan Pemerintah Pendidikan Nasional Nomor 22 tahun 2006 tentang Standar Isi*. Jakarta: Depdiknas.

Erman Suherman dkk. (2001). *Strategi Pembelajaran Matematika Kontemporer.* Bandung: Universitas Pendidikan Indonesia.

_____ (2003). *Strategi Pembelajaran Matematika Kontemporer.* Rev.ed. Bandung: Universitas Pendidikan Indonesia.

OECD. 2013. *PISA 2012 Results in Focus What 15-year-olds know and what they can do with what they know*. Diakses dari https://www.oecd.org. pada tanggal 08 Juni 2016, pukul 14.00 WIB.

Partnership For 21st Century Skills. *Learning for the 21st Century*. Diakses dari http://www.21stcenturyskills.org.

Polya, George. (1985). *How To Solve It: A New Aspect of Mathematical Method*. 2nd. Ed. New Jersey: Preceton University Press.

Slavin, Robert E. (1995). *Educational Psycology*. United States of America: Allan and Bacon.

_____ (2009). *Cooperative Learning: Teori, Riset dan Praktik*. Bandung: Nusa Media.

Sumarmo dkk. (1994). *Suatu Alternatif Pengajaran untuk Meningkatkan Pemecahan Masalah Matematika pada Guru dan Siswa SMA*. Laporan Hasil Penelitian FPMIPA IKIP Bandung.