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The Effects of the Implementation of Auditory, Intellectual, Repetition (AIR) Learning Model in Mathematical Problem Solving Ability

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ABSTRACT
The research aim of this study was to evaluate the effects of the Auditory, Intellectually, Repetition (AIR) learning model on students' mathematical problem-solving ability. The type of research is a quasi-experimental with the form of a nonequivalent control group design. The population in the research were all students of class XI MIA MAN 1 Majene. The sample in the research was taken with the saturated sample technique by direct selection so that class XI MIA 1 was chosen as the control class consists of 18 students and XI MIA 2 chosen as the experimental class consists of 20 students. Data collection techniques used include observation and problem-solving tests. Meanwhile, the data analysis technique used descriptive analysis and inferential analysis. Descriptive statistical analysis used N-Gain with the results of the average score of students mathematical problem-solving ability of 0.71 for the experimental class whereas in the control class the average score obtained from students mathematical problem-solving ability is 0.40. The results of the average *N-Gain* score show that the mathematical problem-solving ability of students taught using AIR model is higher than that of conventional learning models. Moreover, the analysis of the hypothesis test used is the T-test (independent Sample Test) with a significance value of 0.000 < 0.05. Therefore, it can be concluded that mathematical problem-solving ability of students taught using the auditory intellectual repetition learning model is higher than that of conventional learning models.

Keywords: *AIR Model, Problem Solving Ability, Mathematical.*

1. INTRODUCTION

Mathematics is a very important field of study, this is one of the causes so that the field of mathematics is taught at all levels of education and is always tested in the implementation of the national exam. The importance of mathematics can also be seen in everyday life, for example, to build a house, calculations are needed as well as when we want to make buying and selling transactions, calculating the distance traveled to a place per hour, and many other activities that we do that require calculations.

The National Council of Teachers of Mathematics (NCTM) sets five standards of mathematical ability that must be possessed by students, namely problem solving, communication, connection, reasoning, and representation [1]. One ability that is closely related to mathematics is problem-solving ability. Corckcroft in [2] states that problem-solving ability is a tool that can be used to improve thinking skills. The problem-solving process is a complex process that requires flexible and dynamic thinking. Students can use a variety of ways in determining the right solution to the problem at hand.

Polya [3] states that how to find a solution to a difficulty and reach a desire that cannot be achieved immediately through 4 stages, namely: 1) understanding the problem, 2) devising a plan, 3) carrying out the plan, and 4) looking back. The problem-solving stages proposed by Polya are the stages that are often used in learning mathematics.

There are several reasons why problem-solving skills are very important to be developed in learning mathematics, namely: in learning mathematics problem-solving ability is one of the competencies that must be possessed by students because the mathematical problem-solving ability is one of the benchmarks for students to be able to develop and train [4]. In addition, the problem-solving ability is an ability that must be instilled in students, especially secondary education students because it is a general goal that must be achieved in learning mathematics [5]. In addition, the main point of assessment in international studies such as Trends in International Mathematics and Science (TIMSS) and program for International Students Assessment (PISA) is students' problem-solving ability [6].

The mathematical problem-solving ability of students in Indonesia still requires special training and attention. This is because the mathematical problem-solving ability of students in Indonesia is still in the low category. Mullis ([6]) stated that the report on the result of Trends in International Mathematics and Science (TIMSS) in 2015 showed that the achievement level of Indonesia students in mathematics was 50% for the low level, 20% for the intermediate level, 3% for the secondary level, high 0% for advanced level. Furthermore, he stated that problem-solving skills were included in the high level, which was only 3%. Then in the 2015 Program for International Students Assessment (PISA) study in mathematics, Indonesian students scored 386 out of an average international score of 490 OECD, and the mathematics questions in the PISA study mostly measured reasoning, problem-solving, and argumentation skills [4].

In addition to the data regarding the result of the TIMSS and PISA studies above, the same situation was also obtained from the result of the interview with the mathematics teacher class XI MIA MAN 1 who said that cause of the low student learning outcomes was the lack of problem-solving ability. Students' math problem, this can be seen from the learning outcomes of students in class XI MIA who achieved the Minimum Completeness Criteria (KKM) only 15 students out of a total of 44 students, if percentages students who completed only 37.5% and students who did not complete 62.5%. Another factor that causes the lack of students' mathematical problem-solving ability is the learning model used by the teacher, namely conventional learning with direct learning models. The application of conventional learning models makes students unmotivated, this is caused by monotonous learning dominated by teachers. Similarly, Ibrahim [7] stated that the conventional learning model is teacher-centered, prioritizing results not processes, students are placed as objects and not subject of learning so that students find it difficult to express their opinions.

In addition, the method used is inseparable from the lecture method, division of tasks, and exercise as a form of repetition and deepening of teaching material. Seeing this situation, innovative learning models are needed to overcome the problems that occur, namely learning models that can improve students' problem-solving abilities. Some of the learning models that are expected to improve mathematical problem-solving skills in the Auditory, Intellectually, Repetition (AIR) learning model.

Auditory, Intellectually, Repetition (AIR) learning model considers that learning will be effective if it pays attention to three things, namely: 1) Auditory, namely learning must be through listening, listening, speaking, presenting, arguing, expressing opinions, and responding 2) Intellectually, namely learning by practicing thinking skills through reasoning exercises, constructing knowledge, submitting opinions, asking questions, applying ideas, and completing a task problems, 3) Repetition, namely repetition of material at the end of learning through giving quizzes or giving homework [9]. This AIR learning model aims to make learning comfortable so that learning objectives are achieved, namely effective and efficient learning.

Some other researchers have conducted research using the Auditory Intellectually, Repetition, (AIR) learning model. Agustiana [9] examines the effect of Auditory. Intellectually Repetition (AIR) with a lesson study approach on mathematical problem-solving abilities at MTs N 1 Lampung Selatan and also Suwarman [10] examines the effect of the Auditory Intellectual Repetition (AIR) learning model on students' mathematical problem-solving abilities at MAN 3 Tanggerang. From this study, it was found that the AIR model can improve students' mathematical problem-solving abilities better than using conventional learning models.

Based on the description of the problem above, researchers are interested in examining the AIR learning model, this is limited by examining the effect of using the Auditory Intellectually Repetition (AIR) learning model on the mathematical problem-solving ability of XI MIA MAN 1 Majene students.

2. RESEARCH METHODS

This research was conducted in class XI MIA MAN 1 Majene. The research method used in this study is an experimental research method. In this research, the type of research is quantitative in the form of quasi-experimental, there are 2 classes, there is experimental and control class. The experimental class was given learning using the Auditory Intellectually Repetition (AIR) learning model and the control class using the conventional learning model (direct learning) on linear programming material. Furthermore, a pre-test is given to each class after the learning is done. The populations in this study were all students of class XI MAN 1 Majene, which consisted of 2 classrooms, where all classes had the same level of ability which tended to be below, with a total of 38 students.

In this research, the number of samples used was 38 students, that is 20 students for the experimental class and 18 students for the control class. The research instrument used was a test sheet. That is used to measure the level of students' mathematical problem-solving ability in the form of essays with the same types and form of questions between classes. The data hypothesis test was carried out after conducting normality and homogeneity test on the data resulting from mathematical problem-solving abilities. Data analysis for testing research hypotheses used parametric with a significance level of 5%.

3. RESULT AND DISCUSSION

3.1. Result of the research

Descriptively, the data on the result students ' mathematical problem-solving abilities in the experimental class and control class was taken from the results of the pre-test given to the research samples as many as 5 essay questions obtained data as follows.

Table 1. The result of the pre-test experimental and control class

Data	Experimental Class	Control Class
Highest score	45	42
Lowest score	20	20
Mean	29.25	28.72
Standard Deviation	6.812	5.889

As shown in Table 1, the highest pre-test value of the experimental class is 45 and the lowest is 20, while the highest pre-test value of the control class is 42 and the lowest is 20. The average pre-test of the experimental class is 29.25 and the standard deviation is 5.889. From the description of the data, it can be seen that the average value obtained by the experimental class is higher than the control class. However, the experimental class data have the same trend values as the control class. The data from the post-test result for the experimental class and the control class can be seen in the following table.

Table 2. The result of the post-test experimental and control class

Data	Experimental Class	Control Class
Highest score	95	79
Lowest score	65	32
Mean	79.40	56.78
Standard Deviation	9.133	12.81

Based on Table 2 above, it can be seen that the highest post-test score for the experimental class is 95, and the lowest is 65, while the highest post-test score for the control class is 79 and the lowest is 32. The average post-test score for the experimental class is 79.40 and the standard deviation is 9.133. Meanwhile, the average post-test score for the control class was 56,78 and the standard deviation was 12.81. From the description of the data, it can be seen that the average value obtained by the experimental class is higher than the control class. Thus, it can be concluded that the result of the experimental class data is better than the control class.

Table 3. N-Gain category experimental class and control class

Data	Result of problem-solving ability	
	Experimental class	**Control class**
Mean	0.71 (High)	0.4 (Middle)
Total students	20	18

After conducting descriptive analysis of the pre-test and post-test of each group, the *N-Gain* value was calculated based on the average pre-test and post-test scores. Based on table 3 above, the mean N-Gain score in the experimental class is higher than the control class. It can be seen from the average *N-Gain* score for the control class, which is 0.4, at the index $0.30<g\leq 0.70$, which means it is in the medium category, while the average *N-Gai*n score for the

experimental class is 0.71 at the g index > 0.70 which means it is in the high category.

After the *N-Gain* test was carried out, it was continued with the prerequisite test, that is the normality test and the homogeneity test for the experimental class. The result of the normality test for the experimental class and the control class on the pre-test data each obtained a significant value of 0.172 and 0.209, in the post-test data each obtained a significant value of 0.488 and 0.687. Based on the result of the normality test for the experimental class and control class, the significant value of pre-test and post-test in the experimental class and control class is greater than a significant value 0f 0.05, thus it can be concluded that the population data in both groups are normally distributed.

The result of the homogeneity test between the experimental class and control class on the pre-test data is 0.710 and the post-test data is 0.164. Based on the results of the homogeneity test between the experimental class and control class, it was obtained that the pre-test and post-test significant values were greater than the significant value of 0.05, thus, it can be concluded that both of the data have homogeneous variance. After did the perquisites test then continued with hypothesis testing with an independent sample t-test with Sig < 0.05 criteria. The result of the independent sample t-test obtained a significant value of 0.001 < 0.05 then H_0 is rejected and H_1 is accepted, thus it can be concluded that the mathematical problem-solving ability of students who are taught using the Auditory Intellectually Repetition (AIR) learning model is higher than the ability to solve problems in student mathematics who are taught by using conventional learning models.

3.2. Discussion

In this research, the author acts as an educator in implementing the Auditory Intellectual Repetition (AIR) learning model in class XI MIA 2 MAN 1 Majene as a control class, educators use conventional learning models (direct learning). Before applying the learning model used in the study, the researcher first conducted a pre-test in the experimental class, and at the end of the meeting the researcher conducted a post-test in both classes. The result of the pre-test and post-test were then analysed descriptively and inferentially.

Through the descriptive analysis of *N-Gain* data, the average *N-Gain* score of mathematics learning outcomes using the Auditory Intellectually Repetition (AIR) learning model with a scientific approach is 0.71 > 0.40 the average *N-Gain* score of mathematics learning outcomes using conventional learning model (direct learning).

Based on the *t-test* hypothesis testing (Independent Samples Test) the significance value for the post-test experimental class and control class is 0.000, which is smaller than the 0.05 significance level, that’s means the average value of the experimental class is higher than the average value of the control class after being given treatment. This shows that H_1 is accepted and H_0 is rejected which means that the mathematical problem-solving ability of students who are taught using the Auditory Intellectual Repetition (AIR) learning model is higher than the mathematical problem-solving ability of students who are taught using the conventional learning model.

Based on the results of the data analysis above, the alternative hypothesis which states that the mathematical problem-solving ability of students who are taught using the Auditory Intellectually Repetition (AIR) learning model is higher than the mathematical problem-solving ability of students who are taught using the direct learning model is accepted this research is in line with previous research including research conducted by Suwarman [10] showing that the Auditory Intellectually and repetition (AIR) learning model influences improving students' mathematical problem-solving abilities. Learning that uses the Auditory Intellectually and Repetition (AIR) learning model with a scientific approach provides opportunities for students to be more active in learning and have a positive attitude towards mathematics. In addition, the same thing is also shown by Agustiana (2018) that there is a difference in increasing problem-solving abilities between students who receive learning using the Auditory, Intellectually, and Repetition (AIR) learning model with a scientific approach, and students who receive conventional learning. The research conducted by Erny et al [11] shows that the problem-solving ability of mathematics taught using a scientific approach is better than conventional learning.

Based on the research result obtained, it can be concluded that the use of the Auditory, Intellectually, and Repetition (AIR) learning model can be applied in the learning process which aims to increase student's knowledge, abilities, and activeness in learning so that can improve the result of mathematical problem-solving abilities.

4. CONCLUSION

Based on the discussion, it can be concluded that the mathematical problem-solving ability of class XI MIA MAN 1 Majene students who were treated using the Auditory, Intellectually, and Repetition (AIR) learning model was higher than the mathematical problem-solving ability of class XI MIA MAN 1 Majene students who were given treatment using conventional learning models.

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