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Improving Students' Problem Solving Abilities through the Application of Auditory Intellectually Repetition Model

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Abstract

The purpose of this study is to know the improvement of students' problem solving ability through the Application of auditory intellectually repetition (AIR) model. This research method uses the quantitative method by taking one experimental class. Samples were assigned from one Public Vocational School in Indramayu, by a purposive technique, based on the selection of teaching teachers. They were from X TKJ2 consisting of 29 students. Data retrieval uses a pretest and posttest of problem solving abilities. Based on the results of data analysis: (i) the student's pretest got the lowest and highest score respectively 6 and 23, and the average was 14.42, (ii) the student's posttest got the lowest and highest score respectively 21 and 38, and the average was 31.17. The maximum score for the pretest and posttest is 40. Based on the hypothesis test using the *t*-test obtained the observation value of *t* was 6 and the critical value of *t* was 2.03, because of that the AIR model was effectively implemented in learning in the classroom. Furthermore, a gain score test was carried out, and then the results were obtained by using the AIR model to improve students' problem solving abilities.

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INTRODUCTION

According to Suherman (in Afrida & Handayani, 2018), problem solving is part of the mathematics curriculum which is very important because in the learning process and its completion, students are expected to gain experience, use the knowledge and skills they already have to apply to problem solving that is not routine. One of the problems in learning mathematics is the low level of students' ability to solve problems related to daily life. These results are in line with the researcher's preliminary study of mathematics students and teachers conducted at the vocational school where the research was carried out. The results of the preliminary study obtained information that the problem solving ability of most vocational high school students is still low. Based on an initial interview conducted by researchers to one of the teachers, that one of the causes of low problem solving abilities is due to the lack of practice questions given to students. In addition, according to mathematics teachers, it is stated that the models used in mathematics learning are still not effective. One of the methods used by teachers

in teaching is to use conventional methods, namely teachers teach with lectures and discussions and then give practice questions. In the process of learning mathematics, students only memorize the knowledge provided by the teacher and are less able to use this knowledge if they encounter problems in real life (Lestari, Andinny, & Mailizar, 2019). So that a learning model is needed that can make students hear and repeat the material that has been taught by the teacher. Thus students not only memorize, but can understand the material.

National Council of Teacher of Mathematics (in Mariani & Susanti, 2019; NCTM, 2000), set five standards of mathematical ability to be able to realize goals in mathematics learning, namely problem solving ability, reasoning and proof, communication, connection and representation abilities. In addition, the results of The Third International Mathematics and Science Study (TIMSS) and the Programme for International Student Assessment (PISA) also reflect the low mathematics problem solving ability of students. From the results of TIMSS 2015, Indonesia is in 44th position out of 49 countries with a score of 397, the score obtained by Indonesia is below the average international score of 500 (Mahmudah, 2018). Based on the results of PISA 2015 Indonesia is ranked 61st for reading material, 63rd for mathematical material and 62nd for science material from 69 participating countries (Pratiwi, 2019).

One of the abilities needed by students to solve problems is to familiarize students with creative thinking (Diyanah & Firdausi, 2018; Ismunandar et al., 2020). In the initial interviews that have been carried out by researchers, data were obtained that students' problem solving abilities were still lacking. This happens because in mathematics learning students ask the teacher to provide the fastest formula so that students can solve math problems. Another reason, the lack of students' problem solving abilities is that during group discussions, students are less focused on discussing the material so that when given problems that are similar to the examples given by the teacher, students have difficulty discussing the material so that when given problems that are similar to the examples given by the teacher, students have difficulty. The learning method carried out by the teacher is appropriate in developing students' problem solving abilities, but it is necessary to have a learning model that can support the teacher's method. Mathematical problem solving abilities can develop, if there is interactive or exchange of opinions in solving problem solving problems (Rostika & Junita, 2017).

Siwono (in Mawaddah & Anisah, 2015), argues that problem solving is a process or effort by individuals to respond to or overcome obstacles or obstacles when an answer or method of answer is not yet apparent. In addition, Ruseffendi (in Rahayu, Anggo, & Fahinu, 2019) stated that, problem solving abilities are very important in mathematics, not only for those who will later explore or study mathematics, but also for those who will apply it in other fields of study and in everyday life. The importance of mathematical problem solving abilities to be possessed by students is also stated by Sumarmo (in Ariawan, 2016), namely the possession of problem solving abilities in students is important, because problem solving ability is the goal of teaching mathematics, even as the heart of mathematics. Through problem solving, it is hoped that students can find the mathematical concepts learned (Putra et al., 2018).

Polya divides four main steps of solving mathematical problems, namely understanding the problem, finding a plan (devising a plan), implementing the plan (carry out your plan), and looking back (Lestari et al., 2019). According to Sumarmo (in Rahayu & Afriansyah, 2015), problem solving ability can be detailed with the following indicators: (1) identify existing information for troubleshooting; (2) create appropriate mathematical models to solve the problem; (3) select and use appropriate strategies to solve problems; (4) Explain or interpret the results obtained, and check the correctness of the completed results; (5) applying mathematics meaningfully. Poyla explained the problem solving indicators (Rostika & Junita, 2017), including:

Table 1. Problem Solving Indicators According to Poyla

Problem Solving Stage	Indicators
1. Understanding the problem	Identifying known elements, the questionand the adequacy of the necessary elements.
2. Drawing up a problem solving plan	Formulating a mathematical problem or drawing up its mathematical model.
3. Implement a problem solving plan	Applying strategies for solving various problems inside or outside of mathematics.
4. Double-check results	Explain or interpret the results according to the problem of origin.

Based on the description above, it can be concluded that problem solving ability is one of the important abilities in mathematics, because this ability allows students to find ways of the problems faced both in learning activities and in daily life. Indicators of problem solving ability in this study are understanding problems, drawing up problem solving plans, implementing problem solving and re-examining.

One learning model that can improve problem solving abilities is Auditory Intellectually Repetition (Awaliyah, Soedjoko, & Isnarto, 2016). Using this method, mathematics learning carried out in the classroom involves students to speak, listen, analyze experiences, do problem planning creatively, and repeat so that the understanding received is broader and deeper. So that with this method students can improve problem solving abilities.

RESEARCH METHODS

The research method used in this study was One Group Paired Design, because in this study there was only one experimental group and were given pretests and posttests. The following was a design of this research which cited Senjaya (2017).

$$R: \quad O_1 \quad T \quad O_2$$

At the design, R is for the randomization of sampling, T is a treatment, O_1 is an observation before treatment (pretest), and O_2 is an observation after treatment (posttest)

The population in this study was grade students in 10^{th} from the one Public Vocational School in Indramayu for the 2019/2020 academic year. The material

taken in this study is a system of two-variable linear equations. The sampling technique in this study used purposive sampling, while to measure students' problem solving ability, researchers used test questions. Test questions are given at the time before the material is given (pretest) and after the material is completed (posttest) to improve students' problem solving abilities. Data analysis carried out, using the help of PESTRIPP software (Senjaya, 2017) with a significant degree α=0,05.

RESULT AND DISCUSSION

The following are the results of pretests and postes of applying the AIR model to the problem solving ability shown by the frequency distribution like Table 2 and Figure 1.

Table 2. Pretest Data in Frequency Distribution

Interval	Frequency
6 - 8	1
9 - 11	5
12- 14	13
15 - 17	13
18 - 19	1
20 - 23	3
Total	36

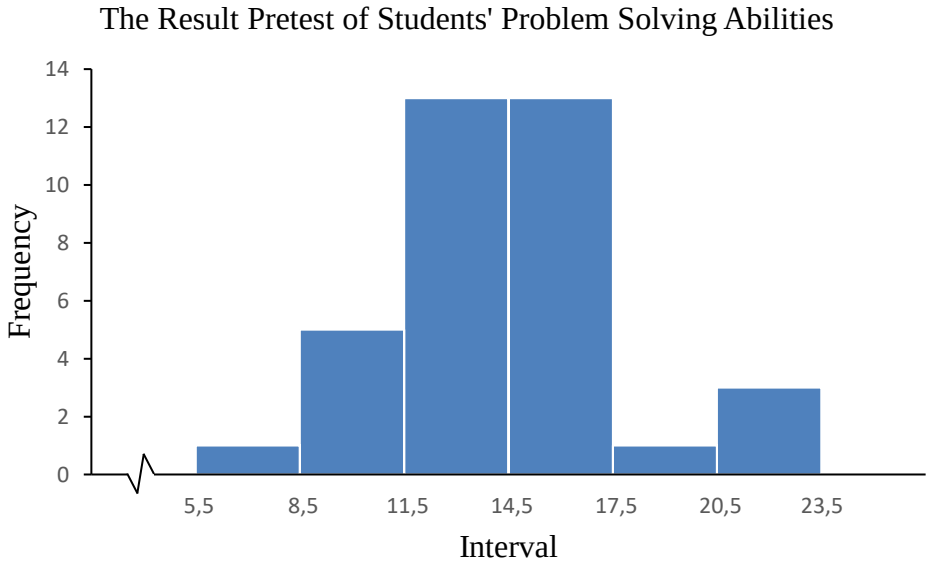

Figure 1. The Result Pretest of Students' Problem Solving Abilities

From the frequency distribution in Table 2 and Figure 1 above with a total of 36 students, it can be seen that the results of the problem solving ability pretest have a minimum score of 6-8, namely 1 student, the maximum score at intervals 20-23 is 3 students, and the highest frequency is at intervals 12-17, namely 26

students. At the following shown by the frequency distribution Table 3 and Figure 2 as the descriptive data for the posttes result.

Table 3. Posttest Data in Frequency Distribution

Interval	Frequency
21 - 23	1
24 - 26	3
27 - 29	10
30 - 32	8
33 - 35	7
36 - 38	7
Total	36

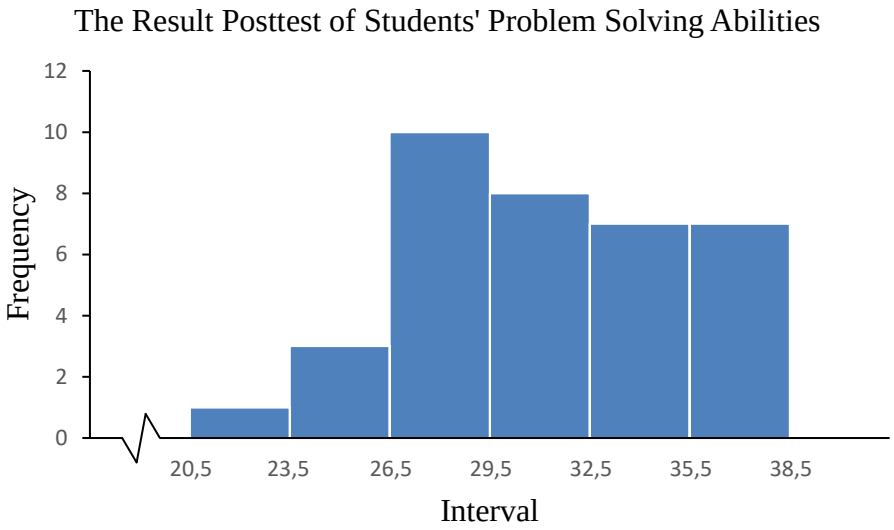

Figure 2. The Result Posttest of Students' Problem Solving Abilities

Based on the frequency distribution table and histogram of postes above with a total of 36 students, it can be seen that the results of problem solving ability postes have a minimum score of 21-23, namely 1 student, the maximum score at intervals 36-38 is 7 students, and the most frequency is at intervals 27-29, namely as many as 10 students. In this study, Table 4 is the results of the normality test were obtained as follows.

Table 4. Normality Test Results

	L_0	$L_{(0,05;36)}$	Description
Pretest	0,137	0,1454	Normal
Posttest	0,122	0,1454	Normal

Based on Table 4, it shows that in the pretest obtained L_0=0.137 and $L_{(0.05;36)}$=0.1454, on the posttest obtained L_0=0.122 and $L_{(0.05;36)}$=0.1454, because $Lo<L_{(0.05;36)}$, failed to reject/accept H_0. This means that the sample comes from a normally distributed population.

Based on the calculation of the normality test, it was concluded that the pretest and posttest data are normally distributed. Then the next alternative using the gain test is the *t*-test. The data obtained from this study include pretest, posttest and Gain score data. The data can be seen in Table 5 and Figure 3.

Table 5 Research Data

Data	Pretest	Posttest	Gain Score
Lowest Score	6	21	16,67
Highest Score	23	38	
Average	14,42	31,17	

The *t*-test value obtained $\bar{d} = 16.67$, $sd = 4.45$, $n = 36$ to a significant extent α=0.05 with degrees of freedom $db = n - 1 = 36 - 1 = 35$. Next we take the value of the distribution of t from the sample t_{obs}=6 and the critical value of t is (t_{α}=2.03), if $t_{obs} > t_{\alpha}$ so it can be concluded that learning that applies the AIR model is effective for improving problem solving abilities.

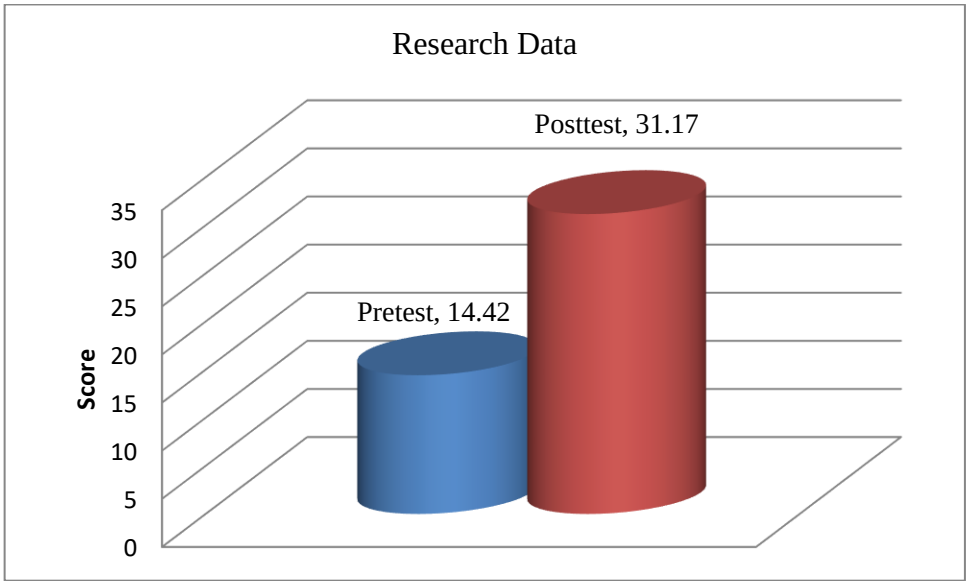

Figure 3. Gain Decreasing Results

During the first learning process, only a few students dared to express their opinions when the researcher asked because there were still many students who did not understand the material of the two-variable linear equation system, during the process of doing the questions some students could do it even though the steps in working on the questions were still not right and some others still remembered how to answer the questions and could do the questions in a longer time.

During the second learning process, many students have been more active in learning activities, not just answering questions from researchers, but also daring to ask and respond to questions from fellow students, during the process of working on questions, many students already understand how to answer questions with sequential steps unlike during the first learning process where many students still remember when doing questions. Research that is almost similar to this study is that the use of the AIR model using a lesson study approach is better than the

use of AIR in conventional learning (Agustiana & Putra, 2018). In addition, according to Ulva and Suri (2019), the use of the AIR model also affects students' mathematical abilities. In other studies, the use of the AIR model also affects the mathematical solving ability of junior high school students (Widyazuniarti, Misdalina, & Marhamah, 2019).

CONCLUSION

Based on the results of research, data processing and analysis as well as hypothesis testing, the conclusions of these research results are (1) the results of problem solving ability before the implementation of the AIR model have the lowest score of 6, the highest score of 23 with an average of 14.42, while the results of problem solving ability after the implementation of the AIR model have the lowest score of 21, the highest score of 38 with an average of 31.17; (2) The application of the AIR model can improve problem solving abilities.

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