

Influence of Auditory Intellectually Repetition (AIR) and Self Efficacy Learning Models on HOTS Problem-Based Problem Solving Ability

Rizal Kamsurya¹, Veni Saputri²

^{1,2}Program Studi Pendidikan Matematika, STKIP Media Nusantara Citra, Jakarta

¹rizal_kamsurya@stkipmnc.ac.id, ²veni.saputri@stkipmnc.ac.id

Abstract. This research aims to determine the differences in problem-solving skills in students taught using auditory intellectual repetition (AIR) learning models and conventionally reviewed from the self-efficacy level. The type of research used is a quasi-experimental design. The research population is high school students in the South Jakarta area. Determination of samples using random cluster sampling and stratified random sampling. The instruments used are problem-solving tests and non-test instruments that are questionnaires. Analyze data using two-lane Variance Analysis. Data analysis shows that; (1) there are significant differences in problem-solving skills in students using air learning models and conventional learning, (2) there are differences in problem-solving skills in students with high, medium, and low self-efficacy, (3) there is a significant interaction between AIR learning and self-efficacy to problem-solving ability, (4) there are significant differences in problem-solving skills between groups of students in AIR learning and conventional learning that have high self-efficacy, (5) there are significant differences in problem-solving skills between groups of students in AIR learning and conventional learning who have moderate self-efficacy, and (6) there are significant differences in problem-solving skills between groups of students in AIR learning and conventional learning who have low self-efficacy.

Keywords: Auditory Intellectually Repetition, Self Efficacy, Problem Solving.

Abstrak. Penelitian ini bertujuan untuk mengetahui perbedaan kemampuan pemecahan masalah pada siswa yang diajarkan dengan menggunakan model pembelajaran Auditory Intellectually Repetition (AIR) dan konvensional ditinjau dari level *self efficacy*. Jenis penelitian yang digunakan yaitu *quasi eksperiment design*. Populasi penelitian yaitu siswa SMA di daerah Jakarta Selatan. Penentuan sampel menggunakan *cluster random sampling* dan *stratified random sampling*. Instrumen yang digunakan yaitu tes pemecahan masalah dan instrumen non tes yaitu kuesioner. Analisis data menggunakan Analisis Varians dua jalur. Hasil analisis data menunjukkan bahwa; (1) terdapat perbedaan yang signifikan kemampuan pemecahan masalah pada siswa yang menggunakan model pembelajaran AIR dan pembelajaran konvensional (2) terdapat perbedaan kemampuan pemecahan masalah pada siswa yang memiliki self efficacy tinggi, sedang, dan rendah (3) terdapat interaksi yang signifikan antara pembelajaran AIR dan self efficacy terhadap kemampuan pemecahan masalah, (4) terdapat perbedaan yang signifikan kemampuan pemecahan masalah antara kelompok siswa pada pembelajaran AIR dan pembelajaran konvensional yang memiliki self efficacy tinggi, (5) terdapat perbedaan yang signifikan kemampuan pemecahan masalah antara kelompok siswa pada pembelajaran AIR dan pembelajaran konvensional yang memiliki self efficacy sedang, dan (6) terdapat perbedaan yang signifikan kemampuan pemecahan masalah antara kelompok siswa pada pembelajaran AIR dan pembelajaran konvensional yang memiliki self efficacy rendah.

Kata Kunci: Auditory Intellectually Repetition, Self Efficacy, Pemecahan Masalah

INTRODUCTION

The industrial revolution 4.0, students should have been provided with problem-solving skills and skills. Problem-solving is an essential ability for students because it will help students solve their environmental problems and

determine student success. Problem-solving ability is an ability possessed by a person to solve problems or problems that are not routine that originate from the real world by using the ability that has been owned before (Kamsurya, 2019). Problem-solving is an attempt to apply

knowledge gained or possessed by a person through a process into a new and unknown situation (Wardani et al., 2010). Problem-solving is critical to be trained on students in school because it will impact their excellent thinking ability, curiosity, and increased confidence in solving problems (Saputri, 2019). But until now, problem-solving skills are still a fundamental problem in math learning in schools. The study (Nur & Palobo, 2018) concluded that students' ability to solve problems is still relatively low. Students are less given real-world problems, and learning is not directed to train students to solve problems.

The solution to the above problems requires formal learning to help students understand the concept well and solve the problem by applying the Auditory Intellectually Repetition (AIR) learning model. AIR is a learning model that has three essential aspects: auditory (listening, listening, speaking, and arguing), intellectually (investigating, reasoning, finding, constructing, problem-solving, and being able to apply it) and repetition or repetition (Muhfida in Rahayuningsih, 2017). Auditory; learning is carried out by speaking, listening, presenting, arguing, expressing opinions, and giving positive responses. In the learning process, teachers should be able to get students to optimize their senses of hearing so that there is a connection between the ear and brain in analyzing every information obtained optimally (Asih & Nilakusmawati., 2017). Meier (in Hasnawati et al., 2016) reveals that intellectually related learning should be connected to the experience, making relationship meaning, determining the purpose of the experience in the learning process. Intellectuals in the learning process can be trained if teachers can invite students to engage directly in the problem-solving process, conduct analysis from experience, and create formulations of problems experienced. Repetition; repetition is needed in the learning process so that previously studied concepts can be well understood and can apply them in other concepts. The results of Talib et al., (2019) concluded that understanding the mathematical concepts of students taught using air learning models is better than understanding the concepts

of students taught using reciprocal teaching-learning models.

Khadija & Sukmawati (in Ulva & Resti Ayu Suri, 2019) suggest that the steps of the AIR learning model are as follows: (1) group students heterogeneously from 4 to 5 people, (2) the teacher explains the material studied, and the student listens carefully (auditory), (3) the teacher directs students to discuss material studied and record the results to be presented in front of the class by each group (auditory), (4) students are trained to think about resolving problems acquired during the discussion process through reasoning and problem-solving concerning intellectually studied material, (5) when the discussion is completed, students are given the repetition of the material through a quiz, thereby increasing their retention learned material (repeat).

In addition to learning models, an essential aspect of developing students' skills in problem-solving is self-efficacy. Self-efficacy is a person's belief in his ability to organize and perform a series of actions to achieve results (Bandura in Rahmi et al., 2017). Furthermore, Bandura (in Liu & Koirala, 2009) reveals that self-efficacy affects a person's motivation, persistence, effort, behavior in various fields. Fajri et al., (2017) concluded that students who have high self-efficacy would give birth to a positive learning attitude. According to Bandura (in Keşan & Kaya, 2018), self-efficacy four primary sources are connected. The four sources are personal experience, indirect experience, social persuasion, and psychological conditions. The self-efficacy indicators used in this study are a) confidence in their own abilities) confidence in the ability to adjust and deal with difficult tasks, c) confidence inability to the deal with challenges, d) confidence in the ability to complete specific tasks, and e) confidence in the ability to complete several different tasks.

Efforts to improve students' problem-solving skills, in addition to applying the right learning model, students must also be trained to solve problems. One way to achieve this is by using High Order Thinking Skills (HOTS) based questions. Hots problem is a form of question designed specifically to train high-level thinking skills that are solved by examining, connecting,

and evaluating all problems from various aspects (Rofiah in Yuwono & Pasani, 2018). HOTS is one of the skills in math defense that is oriented towards high-level thinking skills. Resnick (in Arifin & Retnawati, 2017) revealed that HOTS has characteristics such as non-algorithmic, complex, has more than one solution, has variations in its decision-making and interpretation, can apply many criteria, as well as its effortfully nature. Application of HOTS questions in learning (discussions, quizzes, and assignments), students will be accustomed to solving problem-solving problems, so it is expected that by applying the learning model of AIR by considering the level self-efficacy, it is expected to improve the mathematical problem-solving skills of high school students in DKI Jakarta.

METHOD

The type of research used is a quasi-experimental design using factorial design 2 x 3. The quasi-experimental design is a research design carried out using a control group but does not control the external variables that affect the experiment (Sugiyono, 2013). The study used two groups: the experimental group and the control group. Experiment groups were treated using Auditory Intellectual Repetition (AIR) learning models and control groups as comparisons using conventional learning models. The research design uses factorial design modifications (Sugiyono, 2013) as follows.

Table 1. Factorial Research Design

Experiment	R	X	Y ₁	O
Control	R		Y ₁	O
Experiment	R	X	Y ₂	O
Control	R		Y ₂	O
Experiment	R	X	Y ₃	O
Control	R		Y ₃	O

Description:

R : Randomly taken samples

X : Treatment (application of AIR learning)

Y₁ : Moderator variable (high self-efficacy)

Y₂ : Moderator variable (medium self-efficacy)

Y₃ : Moderator variable (low self-efficacy)

O : Final test of problem-solving

These research variables consist of free variables (AIR learning models and lectures),

moderator variables (self-efficacy), and bound variables (problem-solving abilities). The research design scheme and the relationship between variables are presented in table 2 below.

Table 2. Design Relationship between Variables

	AIR Learning Model	Conventional Learning
<i>Self Efficacy High (SEH)</i>	Student Problem Solving X SEH	Student Problem Solving X SEH
<i>Self Efficacy Medium (SEM)</i>	Student Problem Solving X SEM	Student Problem Solving X SEM
<i>Self Efficacy Low (SEL)</i>	Student Problem Solving X SEL	Student Problem Solving X SEL

The population in this study is all high school students in South Jakarta. Sample determination using two sampling techniques, namely cluster random sampling and stratified random sampling. The sample determination results will be obtained 6 classes consisting of 3 classes as the experiment class and 3 classes as control classes. The research instruments used are test instruments and non-tests. Test instruments are performed to measure students' mathematical problem-solving skills on the concept of equations and quadratic functions. The test instrument used is the final test with a non-routine form based on High Order Thinking Skills (HOTS). This is done to obtain accurate data on students' problem-solving skills after being treated to implement Auditory Intellectually Repetition (AIR), learning models. The non-test instrument used is a questionnaire to measure a student's self-efficacy. Before the instrument is used, first test the instrument to know the instrument's validity and reliability (reliability) to be used.

The data analysis technique used is to use a two-lane Variance Analysis conducted using SPSS program version 24. According to (Kadir, 2015) a two-way Anava is used to test hypotheses that state the difference in the average size of a sample using either two factorial design or treatment by level design. Before performing the data analysis first, the

data obtained is done a prerequisite test in the data normality test and data homogeneity test.

RESULT

Descriptive Statistical Analysis

Learning_Model	Self_Efficacy	Mean	Std. Deviation	N
AIR Learning Model	High	82.1750	6.97317	18
	Medium	77.1743	7.83232	23
	Low	53.3335	6.83956	20
Conventional Learning	Total	70.8333	14.39335	61
	High	72.9163	6.45454	16
	Medium	67.2841	7.46312	27
	Low	60.9647	6.69067	19
	Total	66.8010	8.22896	62
	High	77.8179	8.12344	34
Total	Medium	71.8336	9.04934	50
	Low	57.0513	7.71534	39
	Total	68.8007	11.82548	123

Table 3 shows that students' average score of problem-solving skills using the AIR learning model ($\bar{x}=70,83$) is higher than conventional learning models ($\bar{x}=66,80$). Based on self-efficacy levels, the average problem-solving ability of students with high self-efficacy ($\bar{x}=77,81$) performed better than students with low self-efficacy ($\bar{x}=57,05$). The highest score of problem-solving skills was achieved by a group of students who were given the treatment of the AIR learning model and had a high self-efficacy of 82,17. The lowest score of 53,33 achieved by the group of students taught using the AIR learning model and having low self-efficacy.

Analysis of prerequisite test

The prerequisite analysis test is the data normality test using the Kolmogorov-Smirnov test and the data homogeneity test using the Levene Test. The test results are presented as follows

Testing data normality

Normality test results on problem-solving skills data obtained by students during the defense process are presented in table 4 below

Tabel 4. Tests of Normality

	Kolmogorov-Smirnov ^a		
	Statistic	df	Sig.
Problem_Solving	.088	123	.19

Influence of Auditory Intellectually Repetition (AIR) learning model on HOTS problem-based problem-solving ability

Results of descriptive statistical analysis of students' problem-solving skills in learning using the AIR learning model based on students' level of self-efficacy are as follows.

Tabel 6. Tests of Between-Subjects Effects

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	11116,845 ^a	5	2223,369	43,765	.000
Intercept	568621,210	1	568621,210	11192,816	.000
Learning_Model	440,433	1	440,433	8,670	.004
Self_Efficacy	8464,938	2	4232,469	83,312	.000
Learning_Model * Self_Efficacy	1982,710	2	991,355	19,514	.000
Error	5943,874	117	50,802		

a. R Squared = .652 (Adjusted R Squared = .637)

a. Lilliefors Significance Correction

Table 4 shows the normality test results using the Kolmogorov-Smirnov test obtaining a statistical value of 0,888, $df= 123$ and significance (sig) = 0,19. This means a sig value of 0,05 or $0,19 > 0,05$, so it can be concluded that the student's problem-solving skills data with 123 samples are distributed normally

Data homogeneity testing

Homogeneity test results on students' problem-solving skills data during the defense process are presented in table 5 below.

Tabel 5. Levene's Test of Equality of Error Variances^a

Dependent Variable: Problem_Solving

F	df1	df2	Sig.
.321	5	117	.899

Tests the null hypothesis that the error variance of the dependent variable is equal across groups.

a. Design: Intercept + Learning_Model + Self_Efficacy + Learning_Model * Self_Efficacy

The data homogeneity test results using Levene's test obtained values $F = 0,321$, $df1 = 5$, $df2 = 117$, and significance (sig) value = 0,599. Thus the $sig >$ value is 0,05 or $0,899 > 0,05$ so that the data in the six sample groups have the same or homogeneous variance.

Hypothetical Test Results

The results of the two-track variance analysis test on HOTS problem-based troubleshooting ability are found in the following table 6.

The results of the analysis of student problem solving skills data based on HOTS questions in Table 6 obtained values mean square = 440,433, $df = 1$, $F = 8,670$, and significance values (sig)

= 0,004. Thus the sig value < 0.05 or 0.004 < 0.05, so H₀ is rejected. Based on the analysis, it can be concluded that there are significant differences in the problem-solving abilities of students who obtain the treatment of auditory intellectually repetition (AIR) learning models with conventional learning of equation concepts and quadratic functions. The average score of each treatment group was 70,83 and 66,80.

The influence of Self Efficacy on students' problem solving skills

The Table 6 shows a Mean Square value of 4232,469, df = 2, F = 83,312, and value of significance (sig) = 0,000. Thus the sig value is < 0.05 or 0,000 < 0,05, so it can be concluded that there are differences in problem-solving skills in students who have high, medium, and low self-efficacy. The highest average score of problem-solving skills was in the group of students with high self-efficacy of 77.81 with the lowest in the low self-efficacy group of 57,05

The influence of Auditory Intellectually Repetition (AIR) and self efficacy learning model interactions on HOTS-based student problem solving skills

Based on Table 6 data on the shared influence between air learning models and self-efficacy obtained mean square values of 991,355, df = 2, F = 19,514, and significance values (sig) = 0,000. Thus the sig value < 0,05 or

0,000 < 0,05, so H₀ is rejected and can be concluded there is a very significant interaction between air learning models and self-efficacy to students' mathematical problem-solving skills based on HOTS questions. The effect of learning model variables, self-efficacy, and interaction of both variables on problem-solving ability is 65,20%

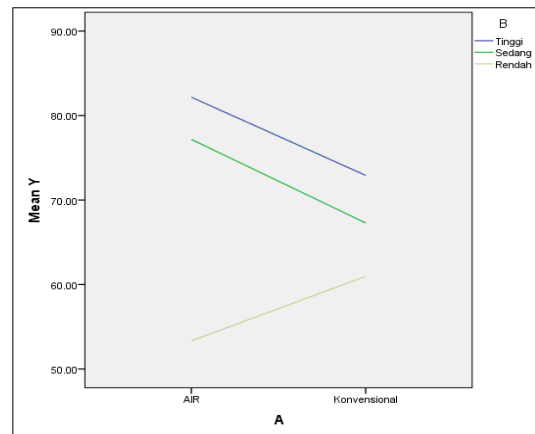


Figure 1. Interaction between AIR learning models and self-efficacy to HOTS-based problem-solving ability

Furthermore, simple effect testing was carried out on learning model variables and self-efficacy to determine the differences between each treatment group. Data analysis results are presented in Table 5 below.

Tabel 7. Contrast Tests

Problem_Solving	Assume equal variances	Contrast	Value of Contrast	Std. Error	t	df	Sig. (2-tailed)
ving	x	A ₁ B ₁	1	9.2588	2.44898	3.781	.000
		A ₂ B ₁	2	5.0007	2.24302	2.229	.028
	x	A ₁ B ₂	3	-4.2581	2.32033	-1.835	.069
		A ₂ B ₂					
	x	A ₁ B ₃					
		A ₂ B ₃					

Differences in problem-solving skills between groups of students in air learning models and conventional learning that have high self-efficacy

The simple effect test results between group A1B1 and A2B1 in Table 5 obtained a value of t = 3,781, df = 117, p-value (sig) = 0,000/2 = 0,000. Thus the p-value (sig) value < 0,05 or 0,000 > 0,05 then H₀ is rejected. Based on the results of the analysis, it can be concluded that there are significant differences in problem-solving skills between the group of students in

the AIR learning model (\bar{x} =82,17) and conventional learning (\bar{x} =72,91) which has high self-efficacy

Differences in problem-solving skills between groups of students in air learning models and conventional learning that have moderate self-efficacy

Testing the simple effect between group A1B2 and A2B2 on obtained values t = 2,229, df = 117, p-value (sig) = 0,028/2 = 0,014. Thus the p-value (sig) value of < 0,05 or 0,014 < 0,05 then H₀ is rejected, so it can be concluded that there is a significant difference in problem solving skills between the group of students in the AIR learning model (\bar{x} =77,17) and conventional learning (\bar{x} =67,28) that has moderate self efficacy.

Differences in problem-solving skills between groups of students on AIR learning models

and conventional learning that have low self-efficacy

Testing the simple effect between group A1B3 and A2B3 on obtained values $t = -1,835$, $df = 117$, $p\text{-value (sig)} = 0,069/2 = 0,345$. Thus the $p\text{-value (sig)}$ value of $< 0,05$ or $0,345 > 0,05$ then H_0 is rejected, so it can be concluded that there is a significant difference in problem solving skills between the group of students in the air learning model ($\bar{x}=53.33$) and conventional learning ($\bar{x}=60.96$) which has low self efficacy.

DISCUSSION

Differences in problem solving skills between student groups incarcerated using air and conventional models

The data analysis results showed that there were differences in problem-solving ability in the experiment group and the control group. The average score of problem-solving skills in the experiment class (AIR learning model) was 70,83 higher than the control class (conventional learning) of 66,80. The difference in achievement between the two groups is due to the AIR learning model of students trained to understand learning materials and present materials, use concepts in problem-solving and repeat the material to master the concept to the maximum (Asih & Nilakusmawati., 2017). The application of AIR learning models can improve cognitive learning outcomes because students are directly involved in problem-solving in learning (Rahayuningsih, 2017; Luthfiana & Wahyuni, 2019; Oktavianti & Buwono, 2015). The results of Anti & Kesumawati (2019) reveal that the application of AIR learning model can develop students' mathematical problem-solving skills to achieve maximum learning results.

Differences in problem solving skills between groups of students with high, moderate, and low self-efficacy levels

Anava's two-track analysis showed differences in problem-solving skills between students with high, medium, and low self-efficacy. This is based on the value $F=83,312$ and $\text{sig}<0,05$ or $0,000<0,05$. The highest average score of problem-solving skills was in the high self-efficacy group of 77,81 and the

lowest in the low self-efficacy group, with an average of 57,05. The average score of problem-solving skills in the group of students who have self-efficacy is high compared to other groups because students in learning have a good level of confidence in themselves. Students who have high self-efficacy have a great business spirit in solving problems, obstacles, and completing tasks, and do not give up easily, thus achieving maximum learning results (Agustiana et al., 2019; Risnanosanti, 2016). The lowest average score of problem-solving skills is in the group of students who have low self-efficacy due to lack of confidence in themselves to try or solve problems (Adicondro et al., 2012), and easily give up in the face of various problems, especially in math learning (Subaidi, 2016). The study Nurseha & Apiati (2019) shows that students with low self-efficacy have not achieved maximum problem-solving.

Interaction between AIR learning model and self efficacy on problem solving ability

The data analysis results showed a positive interaction between the AIR defense model and self-efficacy against the student's problem-solving abilities indicated with a value of $F = 19,514$, and value of significance ($\text{sig} = 0,000$). The positive interaction is due to the application of air learning models to improve students' understanding of teaching materials and use them in the problem-solving process and the high self-confidence of students in problem-solving. The combination of the two aspects has an impact on the level of achievement of students' problem-solving skills that are better at solving equations and quadratic functions.

Differences in problem solving skills of students who have high self efficacy in classes that apply AIR and conventional learning models

The results of the simple effect test in Table 7 show differences in problem-solving skills in groups of students who have high self-efficacy and are given the treatment of air learning models and conventional learning. The $t\text{-values}$ obtained are 3,781, $df = 117$, and significance values ($\text{sig} = 0,000$). The highest problem-solving ability is in students who have high self-efficacy and are taught using AIR learning model with an average score of 82,17.

The high problem-solving skills in the group due to the application of AIR learning model can train and develop students' problem-solving skills during the learning process and are supported by a high level of confidence in that group of students to affect the learning outcomes achieved positively.

Differences in problem solving skills of students who have moderate self efficacy in classrooms that implement AIR and conventional learning models

The simple effect test results showed a significant difference in problem-solving skills in the group of students who had moderate self-efficacy taught using air learning models and conventional learning. The difference in problem-solving skills between the two groups of students is due to applying the learning model and the level of self-confidence that students have. The better the student's confidence level will increase the resilience of the student in solving the problem.

Differences in problem solving skills of students with low self efficacy in classes that implement AIR and conventional learning models

The data analysis showed significant differences in students' problem-solving abilities who had low self-efficacy in the group of students taught using air learning models and conventional learning. The highest average score of the students taught with conventional learning was 60,96 compared to the group of students taught using the AIR learning model of 53,33. The student group's high problem-solving skills use conventional learning (lectures) because, in learning, students are directed gradually in understanding concepts and guided by teachers to solve problems. Compared to air learning models, students are more directed and trained independently in solving problems that form problem-solving so that students who have low self-efficacy are less able to adapt to the learning model. As a result, problem-solving skills in groups of students taught using conventional learning models (lectures) received better results compared to the AIR learning model.

CONCLUSION

Based on the results of the above research, it can be concluded that:

1. There were significant differences in the problem-solving abilities of students who received the auditory intellectually repetition (AIR) learning model treatment with conventional learning of equation concepts and quadratic functions with an average score of 70,83 and 66,80.
2. There are differences in problem-solving skills in students with high, medium, and low self-efficacy. The highest average score of problem-solving skills was in the group of students with high self-efficacy of 77,81 with the lowest in the low self-efficacy group of 57,05.
3. There is a very significant interaction between air learning models and self-efficacy to students' mathematical problem-solving skills based on HOTS.
4. There were significant differences in problem-solving skills between groups of students in the AIR learning model ($\bar{x} = 82,17$) and conventional learning ($\bar{x} = 72,91$) that had high self-efficacy.
5. There were significant differences in problem-solving skills between groups of students on the AIR learning model ($\bar{x} = 77,17$) and conventional learning ($\bar{x} = 67,28$) who had moderate self-efficacy.
6. There were significant differences in problem-solving skills between groups of students in the AIR learning model ($\bar{x} = 53,33$) and conventional learning ($\bar{x} = 60,96$) that had low self-efficacy.

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