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Think Pair Share Learning Model Assisted By Virtual Simulation on Vibration, Wave and Sound Material: Its Impact on Students' Critical Thinking Skills

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ABSTRACT. This study aims to describe how the differences in improving students' critical thinking skills through the application of cooperative learning model think pair share assisted by virtual simulation on vibration and wave material. The study was conducted using a quasi-experiment with pretest posttest control group design . The research objects were 63 students in grade VIII with a sample of two classes selected using the random sampling class method . Data collection was carried out Data collection was carried out by providing a pretest and posttest to determine the differences in improving students' critical thinking skills through the application of cooperative learning model type think pair share assisted by virtual simulation on vibration and wave material. Hypothesis testing was carried out using the Mann Whitney test Based on the results of the analysis, it was concluded that the sig value (2-tailed) was 0.000 < 0.05 so it can be concluded that Ha is accepted and Ho is rejected. With Thus, it can be said that there is a difference in the application of the cooperative learning model type Think Pair Share (TPS) assisted by virtual simulation to improve critical thinking skills of junior high school students on vibration and wave material. Thus, it can be concluded that the application of the cooperative learning model type think pair share assisted by virtual simulation can significantly improve students' critical thinking skills more than classes that do not use the cooperative learning model type think pair share assisted by virtual simulation on vibration and wave material.

Keywords: *Critical Thinking Skills, Think Pair Share, Virtual Simulatin*

INTRODUCTION

Nowadays, the learning process applied in schools refers to the Regulation of the Minister of National Education of the Republic of Indonesia No. 41 of 2007 concerning Process Standards. According to this regulation, the learning process consists of an introduction, core, and closing. The introduction is an initial activity that aims to motivate and focus the attention of students to actively participate in the learning process (Jauhari & Pujianto, 2018). The core activity is a learning process to achieve basic competencies, which is carried out interactively, inspiringly, fun, challenging, motivating students to actively participate, and providing sufficient space for initiative, creativity, and independence according to the talents, interests, and physical and psychological development of students. Closing is an activity carried out to end learning activities that can be done in the form of a summary or conclusion, assessment and reflection, feedback, and follow-up. The learning process that has been set out in this regulation is very ideal for application in the classroom. Learning activities have been directed to be student-centered Hasanuddin (2018).

Based on the low critical thinking skills of students, students indicate that there are problems in the learning process. According to(Subeki et al., 2022), one of the problems currently facing the world of Indonesian education is the weak learning process. The learning process until now is still dominated by teachers and does not provide access for students to develop independently through discovery in their thinking process. This This applies to all subjects

including science. This is supported by the results of research by (Sukadana, 2022) which states that the dominant learning model or strategy used by teachers in the science learning process is the conventional model (Anjani et al., 2023).

From the statements and facts above, it can be seen that students' critical thinking skills are still relatively low, learning carried out by teachers does not involve students in the learning process. This causes learning to be less enjoyable and not challenging. This fact is certainly not in accordance with Government Regulation No. 19 of 2005 Chapter IV Article 19 paragraph 1 which states that "The learning process in educational units is organized interactively, inspiringly, pleasantly, challenging, motivating students to participate actively and providing sufficient space for initiative, creativity, and independence according to the talents, interests, and physical and psychological development of students. This shows that teaching designed by teachers must be oriented towards student activities. Therefore, innovation is needed in the learning process, one of which is by using innovative learning models(Lukitasari, 2014).

Science education have been carried out in recent times. This is an effort to teach students so that they can learn optimally. One of the learning models that can be used to improve students' critical thinking skills , make learning fun, and develop a cooperative attitude is the cooperative learning model (Slavin, 2011). In cooperative learning, students learn together as a team in completing group tasks to achieve common goals, so that each group member has the same responsibility for the success of their group. There are several variations in the cooperative learning model, namely STAD, Jigsaw, Group Investigation (GI), Teams Games Tournaments (TGT), Think Pare Share (TPS), and Numbered Head Together (NHT) (Nurussofi et al., 2022).

Cooperative learning model type think pair share is an effective cooperative learning model to create variations in the atmosphere of discussion patterns. The procedures used in the think pair share model can give students more time to think, respond and help each other (Trianto, 2017) . According to (Jauhari & Pujianto, 2018)), cooperative training can be done with simple grouping, namely with two students in one group who are assigned to complete cognitive tasks. This model is the simplest way in social organization. Thus, the think-pair-share learning model is ideal for teachers and students who are new to collaborative learning. The think pair share learning model gives students the opportunity to work alone and collaborate with others. Another advantage of this model is the optimization of student participation. This model gives each student more opportunities to be recognized and show their participation to others(Amaliyah et al., 2019).

Several research results state that the think pair share learning model can improve. As (Hotman et al., 2018) stated that in science learning , there is an influence of the think pair share learning strategy. on student retention, and there is an interactive influence of the think pair shar learning strategy e and academic ability towards critical thinking skills of students' cognitive students. (Zakiah & Lestari, 2019) proved that in chemistry learning, the average critical thinking skills of students in the group of students who received the think pair share method better than the group of students who received the conventional method. (Rahma, 2021) stated that students' mastery of concepts and critical thinking skills increased significantly as seen from the gain value after applying the cooperative learning model of the think pair share type (Anisa et al., 2020). The results of Su narti's research (2023) also showed that the cooperative learning model of the think pair share type has a positive influence on students' critical thinking skills(Miftahul Huda, 2013).

Think pair share learning model consists of three stages, namely the think stage , pair stage , and share stage . At the think stage Students must think for themselves about the answers to the problems given by the teacher. Thinking is a cognitive process, namely a mental activity to gain knowledge. When you have to think, there will be a dialogue with yourself. At the pair stage , students will pair up to discuss the results of their previous thinking. In discussing, several thinking skills are needed, including: recognizing problems; finding ways that can be used to deal

with these problems; collecting and organizing the necessary information; understanding and using appropriate and clear language; analyzing data; and drawing conclusions. These thinking skills are the foundation for critical thinking. While at the share stage , students will share with the whole class. At this stage, the ability to say something with confidence is needed. Thus, each stage in the think pair share learning model are thinking skills, the basis of critical thinking, and the definition of critical thinking skills. So that the stages in the think pair share learning model running well then students' critical thinking skills are very necessary. Critical thinking is a directed and clear process used in mental activities such as solving problems, making decisions, persuading, analyzing assumptions, and conducting scientific research. Critical thinking is the ability to express opinions in an organized manner (Fauzi et al., 2021)

In science learning, there are several abstract conceptual materials that make it difficult for teachers to explain the material in detail and students find it difficult to digest the material (Sunarti et al., 2023). One of them is the material on vibrations and waves which is an abstract conceptual material (Suseno, 2014) . For example, when observing ocean waves, what is actually observed is changes in sea level, so waves cannot be observed if there is no sea water and when students have to determine vibrations at amplitudes, what is actually observed is the frequency of the vibrations. This is relevant to (Rusilowati, 2007) which states that the main points of one of the vibration, wave, and sound materials are included in abstract science materials (Sanjaya, 2016).

With the cooperative learning model of the Think Pair Share type assisted by virtual simulations, teachers will not have difficulty and will make it easier for teachers to explain the material, because with the Think Pair Share strategy , students can carry out simulations and think deeply, namely thinking individually and thinking with their partners in discussing how the media used to answer the questions given by the teacher works (Antika et al., 2019).

From the explanation above, it can be concluded that critical thinking skills possessed by students will affect the success of the think pair share learning model assisted by virtual simulations used to improve critical thinking skills of science students. The higher the critical thinking skills possessed by students will strengthen the learning model applied in order to improve students' critical thinking skills. Thus, the critical thinking skills variable becomes an important factor to consider in this study (Surraya, 2014).

METHOD

This study is a quasi-experimental study with a Posttest Pretest Control Group Design. The population in this study were all students of class VIII IPA, with a sample of 2 classes, namely the experimental class with 3 1 students who received treatment with the *Think Pair Share* learning model , while the control group class with 3 2 students who received treatment with the conventional learning model. The study consists of independent variables and dependent variables (Sugiyono, 2013). The independent variables consist of two treatment variables, namely the *Think Pair Share learning model.* (TPS) in the experimental group and conventional learning model in the control group , while the dependent variable is students' critical thinking skills. The data collected in this study are students' critical thinking skills , the data will be collected with a critical thinking skills test in the form of a description totaling 10 questions .

This learning method uses two groups, namely the experimental group and the control group which are selected randomly. The experimental group is a group of students who receive learning with the application of the cooperative learning model type *think pair share* assisted by virtual simulation while the control group is a group of students who are not given treatment of the application of the cooperative learning model type *think pair share* assisted by virtual simulation. The two groups were given a pretest and posttest to see the difference in the increase in students' critical thinking skills between before and after the application of the learning model.

Table 1 Pretest Posttest Research Design

Sampling	Group	Pretest	Treatment	Posts
Random	Experiment	O_1	X	O_2
Random	Control	O_3	Y	O_4

Source: (Trianto, 2017)

Information:

X : Treatment with cooperative learning model type *think pair share* assisted by virtual simulation

Y : No treatment

O_2 : Giving *pretest* to experimental class

$O_{1:}$ *Posttest* administration for experimental class.

O_3 : Giving *a pretest* to the control class

O_4 : Administration of *posttest* to control class

The population in this study were students of grade VIII of junior high school which has 7 classes with a composition of 30-35 students in each class. Sampling was done using the "random sampling class" method. The random technique was carried out by drawing lots. The sample drawing was carried out in all classes, because each class has the same opportunity to be selected as a sample so that one class was obtained as an experimental class and one class as a control class through drawing lots. The sample in the study was class VIII as an experimental class and class X MIA 4 as a control class. To obtain research data, the research instrument used is a critical thinking skills test in the form of essay questions that are in accordance with the indicators of critical thinking skills being studied. The test items that were developed were then consulted and assessed by experts, and tested to measure test reliability, discriminatory power, and the level of test ease. The critical thinking skills test was conducted twice, namely at the pretest to see students' initial abilities and the second at the posttest with the aim of measuring the effects of the application of the learning model. In order to produce good research quality, a quality research instrument is needed for data collection. Therefore, a good instrument must meet the criteria for construct validity from experts, high reliability, a good level of difficulty, and good discriminatory power. Therefore, before the instrument is used in the study, a judgment is first carried out by experts in order to achieve the validity of the instrument's construction, then an instrument trial must also be carried out so that the instrument has good and quality reliability, level of difficulty, and discriminatory power. A comparison of the dominant gain increase to indicate the increase in students' critical thinking skills on vibration and wave material can be presented in the following table:

Table 2. N-Gain Categories

<g> value	Percentage Value <g>	Criteria
$\langle g \rangle \geq 0.7$	$\langle g \rangle \geq 70$	Tall
$0.3 \leq \langle g \rangle < 0.7$	$30 \leq \langle g \rangle < 70$	Currently
$\langle g \rangle < 0.3$	$\langle g \rangle < 30$	Low

Comparison of the increase in students' critical thinking skills between the experimental class with the implementation of the cooperative learning model type *think pair share* assisted by virtual simulation and the control class with the implementation of the conventional learning model can be seen based on the normalized gain value of each class. The hypothesis testing

carried out is a two-way test of the average difference of the normalized gain value of critical thinking skills obtained by students with the aim of knowing the significant difference between the average normalized gain of the experimental class and the control class.

In this study, the normality test was conducted using the *Shapiro-Wilk normality test* using SPSS Statistics 16.0 with a confidence level of 95% ($\alpha = 0.05$) and the homogeneity test was conducted using *the Levene Test (Test of Homogeneity of Variances)* with a significance level ($\alpha = 0.050$). Hypothesis testing using parametric statistics is carried out if the data is normally distributed and has homogeneous variance. The hypothesis test used is the one-tailed t-test. This t-test uses SPSS Statistics 16.0 software with *the Independent-sample t-test.* The t-test uses *independent sample t-test* with SPSS Statistics 16.0 has two outputs, namely output for both homogeneous variances *(equal variances assumed)* and for both inhomogeneous variances *(equal variances not assumed)* with the hypothesis $H0 : \mu1 \leq \mu2$ against $HA : \mu1 > \mu2$. In the results of this test, there are t-value and p-value outputs so that to find out the hypothesis results can be done in two ways. The first way is to compare the calculated t_{value} with the t_{Table}. If $t_{count} > t_{Table}$ then H_0 is rejected and H_A is accepted, and vice versa. The second way is to compare *the p-value* with the level of confidence taken, namely. The resulting *p-value is a two-sided test, so the p-value results* are divided by two and compared with the level of confidence. If p-value/2 <0.05 then H_0 is rejected and H_A is accepted.

RESULT AND DISCUSSION

Based on the results of the analysis and processing of the average *pretest, posttest,* and *gain score data* normalized <g>critical thinking skills of students in the experimental class and control class, then the results of the comparison of scores obtained in the experimental class and control class can be presented in the following image :

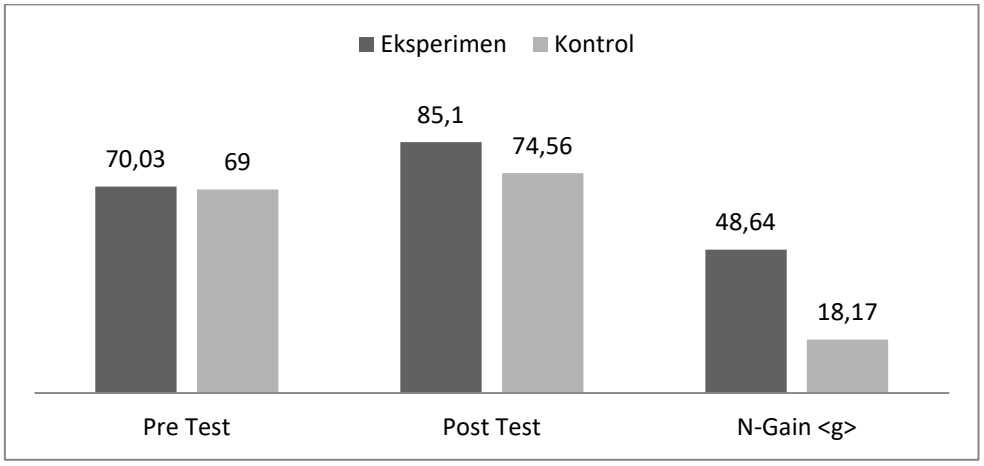

Figure 3. Comparison graph of the average *pretest, posttest* and normalized *gain scores <g>*

Based on Figure 4.1, it is known that the average pretest score of critical thinking in the control and experimental classes has almost the same score, namely 70.03% in the experimental class and 69.00% in the control class. For the average posttest score of critical thinking in the experimental class is 85.1% and the control class is 74.56%. The ideal score for the pretest and posttest of critical thinking is 100%. The increase in students' critical thinking can be seen from the average normalized gain score <g>. The percentage of the average score of the normalized gain <g> of students' critical thinking on the vibration and wave material in the experimental class is 48.64% with a moderate increase category, this shows that students' critical thinking on the vibration and wave material has increased after following the learning process with the application cooperative learning model type *Think Pair Share* (TPS) assisted by virtual simulation

compared to the average score of gain <g> of the control class which is 18.17% with a low increase category. Thus it can be described that the increase in critical thinking of students on the vibration and wave material of the experimental class and the control class both experienced an increase, but in the experimental class the increase was much more significant compared to the control class (Dewi & Yahya, 2022).

In this study, the homogeneity test was conducted to determine whether the variance between data groups was the same. The homogeneity test was conducted using the *Levene test,* the results of which are presented in the following table:

Table 3.
Results of the Homogeneity Test of Critical Thinking of Experimental and Control Class Students

Test of Homogeneity of Variance				
Results Based on Mean	Levene Statistics	df1	df2	Sig.
	4,851	1	61	.031

Since 0.031 is more than 0.05, the hypothesis H0 is rejected which states that the variance between groups is not homogeneous. This result indicates that there is a significant difference in the variance between the data groups analyzed, so it is necessary to consider the use of non-parametric statistical methods.

Hypothesis testing is conducted after the prerequisite test is conducted. Based on the results of the prerequisite test analysis, it is known that the experimental posttest data is not normally distributed and the homogeneity test shows that the variance between groups is not homogeneous, so that the hypothesis test is conducted using a non-parametric hypothesis test. The non-parametric test is conducted using the Mann Whitney test. More details can be seen in Appendix F1. The test results can be seen in the following table:

Table 4.
***Mann Whitney* Test Results**

	Pretest	Post Test
Mann-Whitney U	464.500	166.500
Wilcoxon W	992.500	694.500
Z	-.433	-4.564
Asymp. Sig. (2-tailed)	.665	.000

Test Statistic output , it is known that the Sig (2-tailed) value is 0.000 because the significance value produced is 0.000 <0.05, so it can be concluded that the Ha hypothesis is accepted. Thus, it can be concluded that there is a significant difference in increasing critical thinking skills between the experimental class that applies the *Think Pair Share cooperative learning model* assisted by virtual simulation and the control class that applies the conventional learning model on vibration and wave material.

The recapitulation of the results of the analysis of the average pretest, posttest and normalized gain scores for each indicator of critical thinking skills in the experimental and control classes can be seen in Appendix F1. The comparison of the average normalized gain

scores <g> for each critical thinking indicator obtained by students in the experimental and control classes can be explained in the following figure:

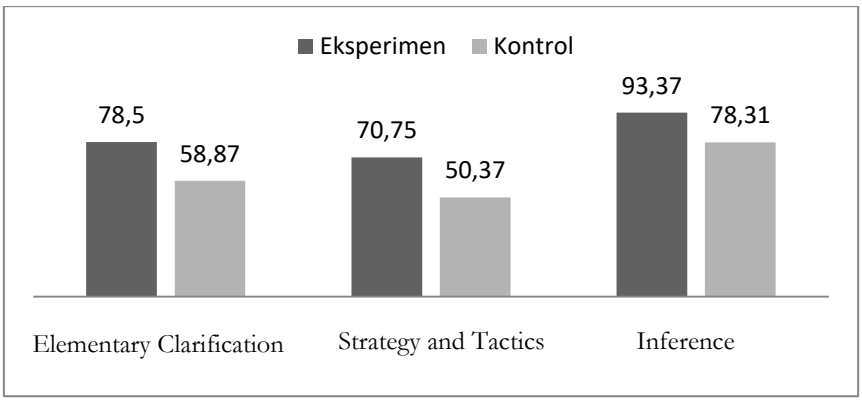

Figure 4. Improvement of Critical Thinking Skills Indicator Aspects

Based on the graph in Figure 4.2, it can be seen that there are aspects of critical thinking indicators in the experimental class whose average score percentage is in the very high category, namely the indicator of concluding with a score of 93.37, while the strategy and tactics indicator aspect is 70.75 and providing a simple explanation is 78.5 which is in the high category. In the control class, there is one critical thinking indicator whose average score percentage is in the high category, namely the indicator of concluding with a score of 78.31, while the aspect of the indicator providing a simple explanation with a total score of 58.87 and strategy and tactics with a score of 50.37 are in the low category.

In general, based on the graph presented, it can be seen that the critical thinking skills of students in the experimental class have a higher average score percentage compared to the control class, so that overall the average score percentage of the experimental class is higher.

CONCLUSION

Based on the results of the study conducted with a hypothesis test, a sig value (2 tailed) of 0.000 <0.05 was obtained, thus meaning that there was a significant difference in increasing critical thinking skills between the experimental class that implemented the Think *Pair Share* (TPS) cooperative learning model assisted by virtual simulation and the control class that implemented the conventional learning model on vibration and wave material.

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