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Article

The Effectiveness of Think Pair Share Model with Science Literacy Approach in Improving Students' Argumentation Ability

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ABSTRACT

Argumentation ability is an important skill in learning. However, in classroom learning, there are still many students who have difficulty in constructing strong arguments. One strategy that can be applied to improve students' argumentation skills is the Think Pair Share type cooperative learning model with a science literacy approach. This model encourages students to think independently, discuss with peers, and share understanding with the group, so that they are more active in building concepts and presenting scientific arguments. The type of research used was quantitative with a quasi-experimental design. The population in this study were VIII grade students at MTs Darul Huda Mayak Ponorogo with research samples in class VIII.2 with 30 students and class VIII.3 with 30 students. The data collection technique was carried out by pretest and posttest of students' argumentation skills. The results showed that the implementation of learning got a percentage of 92.30%, including in the very good category. The average posttest score of the experimental class was 76.80, while the control class was 58.27. The results of the independent sample t-test also showed a significant difference in students' argumentation skills between the experimental and control classes. While the N-Gain test shows a result of 58.8556 which is included in the moderately effective category. These findings indicate that the Think Pair Share type cooperative learning model with a science literacy approach can be a strategy that can improve students' scientific argumentation skills in learning science actively and meaningfully.

INTRODUCTION

21st century education demands the development of student competencies not only focus on mastery of material, but also on the ability of Communication, Creativity, Critical Thinking, and Collaboration (working together) (Mulyasari, Yuliani, and Dewi 2020). Skills that can be built to change students to be able to contribute to society by applying the knowledge gained and having good communication skills (Putri 2018). One of the skills that students must have is argumentation ability. This is important to enable students to relate scientific concepts to everyday life and solve problems rationally.

Teacher competence plays an important role in shaping an effective science learning process (Hamid 2016). Good pedagogical skills can increase students' interest and motivation to learn science because competent teachers not only understand the material but can also apply learning strategies that are in accordance with student characteristics. This is important because science education requires students to be able to analyze, apply, and evaluate scientific information (Pratiwi, Cari, and Aminah 2019). Student characteristics such as learning styles, interests, and educational background also affect the way they receive science materials. Students with science interests tend to be more active in learning and more easily understand the material (Nurlaili, Ilhamdi, and Astria 2023). Thus, teachers need to adjust teaching methods to the characteristics of students.

Effective science education must also pay attention to student development. Students with diverse characteristics require different approaches in learning activities. In this case, the teacher acts as a supportive and inclusive facilitator. By integrating an understanding of student characteristics and teacher competencies, science education can produce students who not only understand science, but also develop scientific attitudes and skills, one of which is argumentation skills.

Scientific argumentation skills are very important for students. On the one hand, argumentation skills also train students to make rational decisions, have a clear perspective, and make good arguments. Students' argumentation skills in science learning will help them explain the phenomena of everyday life using science concepts or theories (Karlina and Alberida 2021). The argumentation provided is supported by various valid evidence both in terms of theory and data to support the opinion of a problem. In science learning, argumentation skills are important for students. One of the main objectives of this argumentation skill is for students to understand scientific explanations of natural phenomena, use them to solve problems, and understand new findings.

One of the most important activities to be developed at school is argumentation skills. Although teachers are expected to be able to activate learning and develop argumentation skills, in reality in the learning process, students lack confidence in expressing their ideas and opinions because learning is only focused on the teacher and not given the opportunity for students to actively participate. If this is not addressed, there will be no interaction between teachers and students. Argumentation ability is a process carried out by someone to analyze information and then the results are communicated to others (Gunawan et al. 2021).

Argumentation skills based on Toulmin's Argument Pattern (TAP) model are defined as statements accompanied by logical reasons, consisting of six main components, namely claims, data, warrant, backing, qualifier and rebuttal (Wahyunan Widhi et al. 2021). Through the warrant component, TAP provides a conceptual framework for linking empirical data with relevant theories, so that the claims submitted are not only descriptive, but also theoretically justified. The backing component plays an important role in strengthening justification through scientific references or previous research results. On the other hand, the rebuttal component encourages evaluation of the potential weaknesses of the argument, which can improve students' critical and reflective thinking skills. Therefore, the application of TAP is expected to improve the quality of students' argumentation through activities that encourage the search for evidence and the preparation of logical and theoretically integrated arguments (Pritasari, Dwiastuti, and Probosari 2016).

Research shows that students construct complete arguments with some writing claims, but face challenges in presenting data, justification, support, refutation, and qualification (Rahayu et al. 2022). Other research shows that students' argumentation skills are still classified as weak and sufficient, with only a few students achieving strong and very strong qualifications (Hardini and Alberida 2022). These findings underscore the importance of improving students'

proficiency in scientific argumentation by emphasizing the development of a comprehensive argument structure.

According to preliminary findings in one of the schools in Ponorogo with a focus on students' argumentation skills, it shows that students' argumentation skills with indicators of claim, data, warrant, backing are in the moderate category with an average of 66.37. Out of 31 students, only 9 students have scores of 75-85, and the rest are in the range of scores 56-74. In addition to the lack of argumentation skills possessed by students, there are several things that are of concern including the fact that there are still many students who are not focused during the learning process, it is characterized by students playing alone, sleeping in class and so on (Susilo 2024).

The existence of low student argumentation skills requires a deep understanding of scientific concepts. Students tend to just memorize facts without really understanding how to compose logical and critical arguments. With the science literacy of students with the help of appropriate learning models, students are expected to be able to discuss well.

Students' argumentation skills can be further improved through the application of appropriate learning models, one of which is the application of the Think Pair Sahre (TPS) type Cooperative learning model. Through the Think Pair Sahre type Cooperative learning model can form more interaction between students so as to provide more time in thinking to respond and help each other in problem solving in a discussion pattern atmosphere (L. Surayya, I W. Subagia 2014).

Students have the opportunity to cooperate with each other during the discussion in the Think Pair Share cooperative learning model. Cooperative learning emphasizes cooperation between students and is responsible for group learning activities, so that each member can understand the material well (Nisa 2014). Students benefit from the Think Pair Share type of cooperative learning model because it helps them to understand each other and share their ideas in improving mutual understanding.

The advantage of the Think Pair Share type cooperative learning model is the maximization of student participation because it provides more opportunities for each student to show their participation. In the TPS stages consisting of thinking focuses on students who must think in finding answers to the problems given (Nuyami, Suastra, and Sadia 2014). The pairing stage encourages students to discuss the results of thinking aimed at solving problems together. The sharing stage provides time for students to share information. In the sharing stage, interaction is expected to occur which trains students' argumentation skills. This pairing and sharing process forms the foundation for critical thinking, one of which is the emergence of argumentation skills in the learning process.

In the learning process using the Think Pair Sahre type cooperative model, it is necessary to have students' abilities in science literacy, because science literacy is the basis of science education (Sengul 2019). Science literacy involves components of concepts, contexts, and consequences. Science literacy includes knowledge and understanding of science concepts and processes as well as involvement in making decisions and community participation. Learning in primary and secondary schools should be interactive, inspiring, challenging and motivate students to actively participate. This process allows students to develop creativity, initiative and independence according to their talents, interests and physical and psychological development. In this way, learning becomes a beneficial activity for students in maximizing their potential (PERMENDIKNAS RI No.41 2007). This approach not only increases students' participation in the learning process, but also improves their understanding of the material taught through a more enjoyable and challenging way. Through a supportive learning environment, students are encouraged to actively participate and explore new ideas, thus creating a more dynamic and productive learning atmosphere.

Oriented to science literacy requires a learning approach that is in accordance with the principles of science, where learning activities do not only focus on memorizing information, but also on developing scientific attitudes. Indeed, science literacy is the ability to use scientific knowledge to describe conclusions based on scientific facts (Rohana, Asrial 2020).

Based on this background, this study aims to analyze the effectiveness of the Think Pair Share type cooperative learning model with a science literacy approach to improving students' argumentation skills in science learning. This research is expected to contribute to the development of learning strategies that can encourage students to think critically, compose arguments logically, and understand and relate scientific concepts to the context of real life.

METHODS

This research uses a quantitative approach which is a method used to answer numerical data problems and statistical programs (Wahidmurni 2017). The research method used was a quasi-experiment with a pretest and posttest design in the experimental class using the Think Pair Share type cooperative learning model with a science literacy approach, while the control class used a conventional learning model. In research, the quasi-experiment method is used to identify the impact of a treatment. The quasi-experiment research scheme is shown as follows: (Abraham and Supriyati 2022)

Table 1. Quasi-Experimental Research Design

Group	***Pretest***	***Treatment***	***Posttest***
Experiment	X_1	O	X_2
Control	X_3		X_4

Description:
X1 : Pretest for experimental group
X2 : Final test (posttest) for the experimental group
X3 : Pretest for control group
X4 : Final test (posttest) for the control group
O : Treatment to students in the form of Cooperative learning model type Think PairShare with science literacy approach.

This research was conducted at one of the schools in Ponorogo Regency, namely MTs Darul Huda Mayak Ponorogo. This research was conducted in January 2025. The population in this study were VIII grade students at MTs Darul Huda Mayak Ponorogo. The research sample was taken from class VIII.3 with 30 students as the experimental class and class VIII.2 with 30 students as the control class. The experimental class will be treated with the application of the Think Pair Share type cooperative learning model while the control class uses conventional learning.

The instruments used in this study are: learning implementation observation sheet, student activeness observation sheet, and argumentation skill test questions. The argumentation ability test question instrument is prepared based on the indicators contained in the research variable, namely the argumentation ability including: claim, data, warrant, backing. The question items that have been made are validated by expert lecturers and subject teachers, then tested on respondents.

After all learning device instruments are validated by expert lecturers and subject teachers, the next step is to test the pretest questions and posttest questions. This question trial was conducted once on students who were not included in the research sample. The trial was conducted on class VIII.1 students with a total of 31 students. After the data from the trial results are collected, the validity test and reliability test can be carried out. The results of the validity test of pretest questions and posttest questions conducted using SPSS 25 for Windows show that 16 items of pretest and posttest questions tested on 31 students have a value of r count greater than r table. Thus, it can be stated that the pretest and posttest questions used in this study meet the validity criteria and are suitable for use by researchers in collecting data.

The reliability test of the test questions in this study was used to determine whether an instrument used was reliable or not. The following are the results of the reliability test for pretest and posttest questions conducted in class VIII.1:

Table 2. Reliability Test Results of Pretest and Posttest Questions

Pretest **Reliability Statistics**		***Posttest*** **Reliability Statistics**	
Cronbach's Alpha	N of Items	Cronbach's Alpha	N of Items
,674	16	,729	16

Based on table 3, the results of the reliability test conducted using SPSS 25 for Windows show that the Cronbach's Alpha value obtained from the pretest question is 0.674 while the posttest question is 0.729. Referring to the table of reliability levels according to (Dina Hajja Ristianti dan Irwan Fathurrochman 2020), the value between 0.601 to 0.80 is categorized as reliable. Thus, the reliability value of pretest questions and posttest questions is included in the reliable category. So from the results of the reliability test on the pretest questions and posttest questions, it can be interpreted that the measuring instruments in this study can be trusted or reliable.

The implementation of the Think Pair Sahre type cooperative learning model with a science literacy approach was analyzed based on the results of the observation score. The observation score was then converted into a percentage. Students' argumentation skills can be analyzed based on test data obtained from experimental and control classes, then testing is carried out including normality test, homogeneity test, hypothesis test, independent sample t-test, n-gain test, and Cohen's effect size.

RESULTS AND DISCUSSION

This research is a study that aims to determine the effectiveness of the Think Pair Sahre type cooperative learning model with a literacy approach to improve students' argumentation skills. The data results in the research conducted at MTs Darul Huda Mayak Ponorogo in class VIII.2 as the experimental class and class VIII.3 as the control class as follows:

Learning activities carried out by researchers were observed by an observer. The purpose of this observation is to ensure that the implementation of learning in the experimental class is in accordance with the steps of the Think Pair Share type cooperative learning model. In its implementation, it is divided into three stages, namely introduction, core, and closing. Overall, the learning implementation received a percentage of 92.30%, so it can be stated that the learning implementation is classified as very good.

In the first stage, namely the introduction, learning activities begin with the opening, where the teacher opens the learning by saying greetings and continued with praying together. After that, the teacher checked the students' attendance.

In the second stage, the core learning activities were carried out by adjusting to the syntax of the Think Pair Share type cooperative learning model with a science literacy approach. Before the learning activity takes place, the teacher gives pretest questions which aim to determine the level of students' initial understanding of the material. After that, the teacher implements learning in accordance with the syntax of the Think Pair Share type cooperative learning model with a science literacy approach. In the first syntax, namely Think (thinking) the teacher provides a question related to the learning material, thus stimulating students on the material to be learned. At this stage, students are also able to understand concepts and analyze problems individually before discussing with the group. The second syntax is Pair, in this syntax the teacher divides students into groups, in order to answer questions in the LKPD that the teacher has prepared. At this stage, students discuss with each other by exchanging their thoughts to answer the questions on the LKPD. Students give each other feedback, ask questions and give their opinions so that they can improve their understanding and strengthen their arguments. The third syntax is Share, in this syntax students in pairs come together to present

the results of their discussions to the whole class. Students learn to be able to argue clearly and structured so that they can train in argumentation. At this stage students benefit in the form of listening to the same concept conveyed in different ways by different individuals..

Next, in the final stage, namely the closing, the teacher together with the students conclude the learning outcomes that have been carried out, and provide a learning evaluation. At this stage, the teacher gives relevant questions to measure the level of student understanding of the material that has been studied (posttest).

The student scores in the experimental class and control class are as follows:

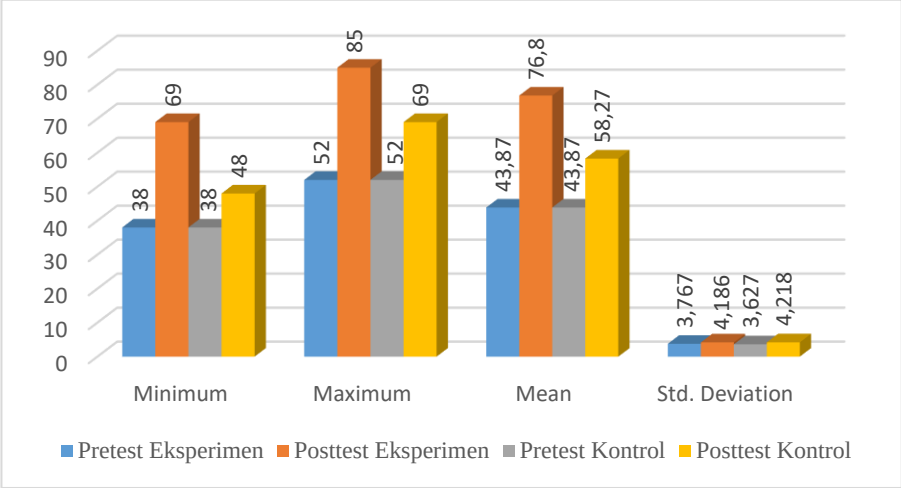

Figure 1. Pretest and Posttest Score Recap Results

Based on Figure 1, it can be seen that the minimum values in the pretest and posttest of the experimental class are 38 and 69 while the maximum values are 52 and 85. In the control class, the minimum pretest and posttest values are 38 and 48, while the maximum values are 52 and 69. The average pretest value, both the experimental class and the control class have the same value, which is 43.87. However, after the posttest, the experimental class showed an average of 76.80, while the control class only achieved an average of 58.27. In the standard deviation section, in the experimental class the standard deviation is 3.767 for the pretest value and 4.186 for the posttest value, while in the control class it is 3.627 for the pretest value and 4.218 for the posttest value.

The research data were then analyzed using a normality test. The normality test was carried out to determine whether the data obtained from the pretest and posttest results in the experimental class and the control class were normally distributed or not. The following are the results of the normality test calculated using SPSS 25 for Windows software.

T**able 3.** Normality Test Results for Pretest and Posttest Questions

Tests of Normality

	Group	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
Result	Pre Experiment	,123	30	,200*	,957	30	,266
	Post Experiment	,116	30	,200*	,977	30	,755
	Pre Control	,130	30	,200*	,954	30	,217
	Post Control	,131	30	,200*	,967	30	,457

Based on the results of the normality test in table 5, the Shapiro-Wilk test value on the experimental class pretest questions has a significance value (Sig.) of 0.266 where the sig. value 0.266 > α = 0.05, while the posttest questions have a significance value (Sig.) of 0.755 where the sig. value 0.755 > α = 0.05. In the control class, the significance value (Sig.) of the pretest questions is 0.217 where the sig. value 0.217 > α = 0.05, while the posttest questions have a significance value (Sig.) of 0.457 where the sig. value 0.457 > α = 0.05. Based on the results of the normality test, the Sig. value > 0.05 so that it can be stated that the pretest and posttest questions in the experimental and control classes are normally distributed. The homogeneity

test was conducted to determine whether the data obtained from the pretest and posttest results in the experimental class and the control class were distributed homogeneously or the data came from the same data. Before conducting the homogeneity test, the first step taken was the normality test to ensure that the data obtained was normally distributed. The homogeneity test was conducted using SPSS 25 for Windows software with the following results:

Table 4. Results of Homogeneity Test of Pretest and Posttest Questions

Test of Homogeneity of Variance					
		Levene Statistic	df1	df2	Sig.
Hasil	Based on Mean	,231	3	116	,875
	Based on Median	,193	3	116	,901
	Based on Median and with adjusted df	,193	3	111,138	,901
	Based on trimmed mean	,224	3	116	,880

Based on the results of the homogeneity test analysis presented in table 6, it shows that the pretest and posttest values in the experimental and control classes show similar variances (homogeneous). This is evidenced by the significance value (Sig.) 0.875. The Sig. value is greater than the significance level $\alpha = 0.05$ ($0.875 > 0.05$). Thus, the null hypothesis (H_0) is accepted, so that the pretest and posttest data in both research groups come from a homogeneous population.

Independent sample t-test is a statistical method applied to analyze significant differences between the average posttest scores in the experimental and control groups. The results of this statistical test illustrate the significance of the differences between the experimental and control groups, with a 95% confidence level ($\alpha = 0.05$). The following is complete data from the Independent Sample T-Test processing presented in the results table from the analysis using SPSS 25 for Windows software:

Table 5. Independent Test Results of Posttest Questions

Independent Samples Test										
		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference Lower	Upper
Hasil	Equal variances assumed	,017	,898	17,113	58	,000	18,56667	1,08492	16,39496	20,73837
	Equal variances not assumed			17,113	57,997	,000	18,56667	1,08492	16,39496	20,73837

Based on the results of the independent sample t-test in table 7, it can be seen that the posttest value has a t count of 17.113 with a Sig. (2-tailed) value of 0.000, with that P = 0.000 <0.05, then Ha is accepted and H0 is rejected. So it can be stated that there is an influence with a significant difference between the average posttest results of students in classes using the Think Pair Share type Cooperative learning model with a science literacy approach and classes using conventional learning models.

Furthermore, the N-Gain test is used to determine the effectiveness of the Think Pair Share type Cooperative learning model with a science literacy approach to students' argumentation skills. To determine this effectiveness, the analysis is carried out by comparing the average (mean) scores of the pretest and posttest results between the experimental class and the control class. This analysis process was carried out using SPSS 25 for Windows software with the following results:

Table 6. N-Gain Score Test Results

Group Statistics					
	Group	**N**	**Mean**	**Std. Deviation**	**Std. Error Mean**
NGain_Score	Eksperimen	30	,5886	,06249	,01141
	Kontrol	30	,2549	,07557	,01380
NGain_Persen	Eksperimen	30	58,8556	6,24877	1,14086
	Kontrol	30	25,4944	7,55739	1,37979

Based on table 8, it shows the average value of the N-Gain score for the experimental class that applies the Think Pair Share type Cooperative learning model with a scientific literacy approach of 58.8556 which is included in the fairly effective category. While the average value of the N-Gain score for the control class of 25.4944 is included in the ineffective category. Therefore, it can be stated that the Think Pair Share type Cooperative learning model with a scientific literacy approach is quite effective in improving students' argumentation skills.

Effect size is used to determine the extent of the influence of the application of the Think Pair Sahre type Cooperative learning model with a scientific literacy approach on students' argumentation skills. The analysis process was carried out using the Chohen's d formula according to (Cohen, L., Manion, L., & Morrison 2018) with the following results:

$$ES = \frac{76{,}8333 - 58{,}2667}{4{,}2018}$$

$$ES = \frac{18{,}5666}{4{,}2018}$$

$$ES = 4{,}4186$$

Based on the results of the effect size above, it shows a result of 4.4186 which is based on the criteria of effect size greater than 0.8 (has a large effect), so it can be stated that the Think Pair Share type Cooperative learning model with a science literacy approach has an effect on improving students' argumentation skills.

The Think Pair Share type of Cooperative learning model allows students to first think individually (Think), then discuss with the group (Pair), and share their thoughts or answers in large groups (Share) to build structured arguments based on scientific literacy (Alfian 2018). This is in accordance with research by Okumus (2021) which states that the cooperative learning model can improve students' critical thinking and argumentation skills because it provides them with the opportunity to interact, exchange ideas, and build a deeper understanding of the material being studied (Okumuş 2021).

The integration of the scientific literacy approach in the Think Pair Share Cooperative learning model also provides a more meaningful and applicable context for students. Scientific literacy includes an understanding of scientific concepts, critical thinking skills, and scientific communication skills in making decisions based on evidence. Scientific literacy plays an important role in the development of argumentation skills because it accustoms students to analyzing information, evaluating evidence, and formulating claims supported by data (Yulianti, Probosari, and Sunarno 2023). In the context of research, the scientific literacy approach allows students to be more critical in processing information and more confident in expressing their opinions (Alden and Miranda 2024). In addition, research by Maulidia et al. (2019) shows that the Think Pair Share Cooperative model containing scientific literacy is able to improve students' knowledge, attitude, and skill competencies in science learning, especially in the reproductive system material (Maulidia et al. 2019). This shows that the scientific literacy approach encourages students to think scientifically, connect concepts with reality, and convey arguments based on evidence. Strong scientific literacy also supports students in critically evaluating information and being accountable for the arguments they present during the learning process.

The application of the Think Pair Share Cooperative learning model with a scientific literacy approach not only has a positive impact on the cognitive aspect, but also on the affective

aspect of students. Research by Gillies (2016) shows that learning that involves social interaction and discussion can increase students' learning motivation (Gillies 2016). In this study, students involved in the Think Pair Share Cooperative learning model showed a more enthusiastic attitude in learning and were more enthusiastic in conveying arguments. This shows that this model not only improves academic skills but also provides a more interesting learning experience with a more active learning atmosphere (Hasanah and Himami 2021).

The Think Pair Share Cooperative learning model has been shown to have a positive influence on students' argumentation skills. This is in line with the results of research by Siswati et al. (2023) which found that the Think Pair Share Cooperative learning model significantly improved critical thinking skills and learning outcomes of elementary school students (Siswati, Rahman, and Sukmayadi 2023). In this context, students are invited to not only passively understand concepts, but also actively build knowledge through individual thinking processes, discussions, and sharing ideas that form the basis for strengthening scientific arguments. Interaction in in-depth discussions also opens up space for students to develop claims and support them with data and logical justification.

Furthermore, the effectiveness of the Think Pair Share Cooperative learning model is also reflected in the increase in students' argumentation skills on complex science materials. Recent research by Novita and Setyorini (2024) found that the application of the Think Pair Share Cooperative learning model significantly improved students' argumentation skills on chemical equilibrium material (Novita and Setyorini 2023). This finding strengthens the evidence that the Think Pair Share structure, when combined with an evidence-based and science-based approach, not only improves students' cognitive abilities but also forms systematic and logical argumentative thinking patterns. Thus, the application of this model has great potential to be an effective learning strategy in equipping students with 21st-century skills, especially in the aspects of critical thinking and scientific argumentation.

Therefore, the application of the Think Pair Share type Cooperative learning model with a scientific literacy approach in the learning process can improve students' argumentation skills. This model provides an opportunity for students to think independently, discuss, and convey their thoughts in a more structured and scientific evidence-based manner. In addition, the scientific literacy approach also provides additional benefits in increasing student motivation to learn and involvement in the learning process. Therefore, the Think Pair Share type Cooperative model with a scientific literacy approach can be an alternative learning strategy that can be applied especially in science learning**.**

CONCLUSION

The results of the study indicate that the application of the Think Pair Share type Cooperative learning model with a scientific literacy approach is quite effective in improving students' argumentation skills, especially in science learning. This is evidenced by the average posttest score of the experimental class of 76.80, while the control class was 58.27. The results of the independent sample t-test also showed a significant difference in students' argumentation skills between the experimental class by implementing the Think Pair Share type Cooperative learning model with a scientific literacy approach and the control class with a conventional learning model. While the N-Gain test showed a result of 58.8556 which is included in the fairly effective category. From all of these results, it is also supported by the implementation of learning which reached 92.30% which is included in the very good category. The implications of these findings indicate that the Think Pair Share type Cooperative learning model with a scientific literacy approach can be a strategy that can improve students' scientific argumentation skills in science learning actively and meaningfully. However, the limitations of this study lie in the scope which is limited to one school. Therefore, recommendations for further research

are to expand the scope of the study to different levels of education and different school contexts, and to further explore the long-term effects of implementing this model on the development of students' argumentative skills.

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