

Implementation of TPSW (Think Pair Share Write) Learning Model in High School Science Learning to Increase Students' Critical Thinking Ability on Earth and Solar System Matter

Fradita Nindi Astarti¹, Suwito Singgih², Ahmad Muhlisin³

^{1,2,3}*Universitas Tidar, Jln. Kapten Suparman, No. 39 Kota Magelang, Jawa Tengah*

Abstract

Critical thinking skills are included in the category of high-level thinking that needs to be improved in problem solving efforts as one of the life skills. Critical thinking skills can be improved through science learning by using a student center learning model. One of the student center learning models is the TPSW model. The model is designed to increase the role of students in learning with learning syntax consisting of think, pair, share, and write. This study aims to determine the ability of the TPSW model to improve students' critical thinking skills on Earth and Solar System material. The population in this study included all seventh grade students of SMP 3 Magelang with samples consisting of class VII-E (experimental class) and class VII-D (control class). The method used in this research is quasy experiment method with non equivalent control group design. The results of hypothesis testing using pre-test and post-test data with independent sample t-test test obtained a significance value of <0.001 , meaning that there is a significant difference in students' critical thinking skills between experimental and control classes. The experimental class got an N-Gain value of 0.73 including the high category, while the control class got an N-Gain value of 0.44 including the medium category. Based on these results it can be concluded that the TPSW learning model is able to improve students' critical thinking skills on Earth and Solar System material.

Keywords : TPSW Learning Model, Critical Thinking Ability, Earth and Solar System.

Implementasi Model Pembelajaran TPSW (*Think Pair Share Write*) Dalam Pembelajaran IPA SMP Untuk Meningkatkan Kemampuan Berpikir Kritis Siswa Pada Materi Bumi dan Tata Surya

Abstrak

Kemampuan berpikir kritis termasuk dalam kategori berpikir tingkat tinggi yang perlu ditingkatkan dalam upaya pemecahan masalah sebagai salah satu kecakapan hidup (*life skill*). Kemampuan berpikir kritis dapat ditingkatkan melalui pembelajaran IPA dengan menggunakan model pembelajaran yang bersifat *student center*. Salah satu model pembelajaran yang bersifat student center adalah model TPSW. Model tersebut dirancang untuk meningkatkan peran siswa dalam pembelajaran dengan sintaks pembelajaran yang terdiri atas think (berpikir), pair (diskusi), share (berbagi), dan write (menulis).

Penelitian ini bertujuan untuk mengetahui kemampuan model TPSW untuk meningkatkan kemampuan berpikir kritis siswa pada materi Bumi dan Tata Surya. Populasi dalam penelitian ini mencakup seluruh siswa kelas VII SMP 3 Magelang dengan sample terdiri dari kelas VII-E (kelas eksperimen) dan kelas VII-D (kelas kontrol). Metode yang digunakan dalam penelitian ini adalah metode *quasy experimen* dengan desain *non equivalent control group design*. Hasil uji hipotesis menggunakan data *pre-test* dan *post-test* dengan *uji independent sample t-test* mendapatkan nilai signifikansi sebesar $<0,001$, artinya terdapat perbedaan signifikan kemampuan berpikir kritis siswa antara kelas eksperimen dan kelas kontrol. Pada kelas eksperimen mendapatkan nilai *N-Gain* sebesar 0,73 termasuk kategori tinggi, sedangkan pada kelas kontrol mendapatkan nilai *N-Gain* sebesar 0,44 termasuk kategori sedang. Berdasarkan hasil tersebut dapat disimpulkan bahwa model pembelajaran TPSW mampu meningkatkan kemampuan berpikir kritis siswa pada materi Bumi dan Tata Surya.

Kata kunci: Model Pembelajaran TPSW, Kemampuan Berpikir Kritis, Bumi dan Tata Surya.

INTRODUCTION

The ability to think needs to be developed through the educational process as a life skill . Critical thinking is included in the category of higher order thinking along with reasoning, analytical skills, problem solving, and creative thinking. In the 21st century, these skills are known as 4C skills, namely critical thinking, communication, creative thinking, and collaboration (Arnyana, 2019). Critical thinking is the ability to think complexly which is used to understand the relationship between ideas and facts in a rational and orderly manner through the process of analysis and evaluation of something received and in solving a problem.

People who think critically can be characterized by their ability to always look for and explain the relationship between the problem being discussed and other problems or experiences that are relevant in the organized process (Saputra, 2020). A critical thinker is able to analyze and evaluate information, raise vital questions and problems, organize these questions and problems clearly, collect and assess relevant information using abstract ideas, be open-minded, and communicate it effectively (Duron, 2006) . The ability to think critically provides more precise direction in thinking, working, and helps more accurately determine the relationship between things and others in solving problems or finding solutions.

Critical thinking skills are included in the form of high-level thinking skills that can make someone think reflectively in analyzing, identifying and evaluating arguments to make decisions whether they can be trusted or not (Levina Jessica., 2022). Equipped with Facione's statement that critical thinking skills are the ability to be able to organize oneself in deciding something with an attitude of interpreting, analyzing, evaluating, and concluding and conveying results using real evidence, criteria, methodology, factual concepts or in accordance with the conditions underlying the decision. conclusion or a statement (Facione, 2011).

There are five indicators of critical thinking proposed by Ennis (Ennis, 1996) , namely:

1. Providing a simple explanation (elementary clarification), consisting of focusing on the problem, examining an excuse, and asking and answering affirmative questions or difficult questions.
2. Building basic skills (basic support), consisting of reviewing the truth of a source, researching and considering research results.
3. making inferences , consisting of producing conclusions and considering the results of the conclusions or producing sentence descriptions and considering the results, as well as producing decisions and considering the results.
4. providing further explanation (advanced clarification), consisting of defining the concept expression and considering it, as well as identifying the premises.
5. organizing strategy and tactics (strategy and tactics), consisting of interpreting an action, as well as expressing arguments verbally or in text.

The problem encountered by researchers when conducting observations is the low critical thinking ability of students which can be assessed based on facts, namely the majority of students have difficulty in collecting facts from observed scientific phenomena, students have difficulty in concluding the results of collecting facts about observed phenomena, students Difficulty in estimating the factors that cause a natural phenomenon, students have difficulty conveying ideas about the form of problem solving in writing, pictures/graphics, or verbally, students have difficulty identifying and determining criteria that might be a solution to the problem being observed. .

This can be based on the learning model used by the teacher during learning.

Based on the results of observations and interviews between researchers and science teachers, the implementation of science learning still uses conventional learning models, namely the expository model. By using the expository learning model, students do not need to search for and discover the concepts, principles and facts of a subject matter themselves because it has been explained in its entirety by the teacher and in learning students follow the pattern set by the teacher carefully (Sunartombs, 2009). That way, students only listen to the teacher's explanation without knowing what they are doing in the learning process.

One learning model that can be applied to overcome this problem as a solution is the TPSW (Think Pair Share Write) learning model, namely a learning model that combines the Think Pair Share (TPS) model. and Think Talk Write (TTW) (Siregar, 2017). The TPSW (Think Pair Share Write) Learning Model is designed to increase the role of students in learning by first posing problems in the form of a series of questions or instructions that target key concepts related to the subject matter by the teacher. The learning syntax for the Think-Pair-Share-Write model consists of think (observing, asking, and collecting data), pair (associating answers), share (sharing discussion results), and write (rewriting learning results). With these learning steps, students are actively involved in learning and have a student-centered character .

Previous relevant research conducted by Dyah Ayu Puspitorini, et al (2020) with the research title "Improving Cognitive Learning Outcomes Through TPSW Learning Based on Hybrid-Learning Circulation System Material" found that the TPSW learning model could be used as an alternative to limited face-to-face time in class and to increase learning outcomes with the results of the N-Gain t test analysis showed that there was a significant difference in the N-gain values in the two classes ($p < 0.05$). Apart from that, research conducted by Alya Sabita Sasabila (2022) with the research title "The Influence of the Think Pair Share Write (TPSW) Cooperative Learning Model on Students' Metacognitive Skills in Animalia Material" shows the results that the Think-Pair-Share-Write learning model has an effect significant to students' metacognitive abilities with an N-Gain value of 0.5148, which means it has medium criteria. Research using the TPSW (Think Pair Share Write) learning model has not been carried out much, especially to measure the increase in students' critical thinking skills. Researchers

have not found any references related to this research. So in this research, a novelty carried out by researchers was to use the TPSW (Think Pair Share Write) learning model, which is a modified learning model to measure students' critical thinking abilities on Earth and Solar System material.

Based on the descriptions, This study aims to determine the ability of the TPSW model to improve students' critical thinking skills on Earth and Solar System material. The hypothesis expected by the researcher is that there is a difference in students' critical thinking abilities in classes that implement the TPSW learning model and classes that implement the conventional learning model.

METHODS

There are several research stages, including compiling learning tools (RPP, LKPD, and teaching materials), compiling pretest and posttest research instruments, carrying out validity and reliability tests, conducting a pretest before treatment, providing treatment to the experimental class and control class, conducting a posttest after treatment. , and analyze the results of research data.

This research is a quasi-experiment research with a non-equivalent control group design. The groups used consisted of an experimental group (experimental class) and a control group (control class), each group was given a pretest and posttest of critical thinking skills. The experimental group will be given treatment by applying the TPSW (Think Pair Share Write) learning model. Meanwhile, the control class group will be given the conventional learning model. The design of research can be shown in 1.1.

Table 1 .1 Quasi experimental design with non-equivalent control group design

Group	Pretest	Treatment	Posttest
A	O ₁	X ₁	O ₂
B	O ₃	X ₂	O ₄

(Arikunto, 2013)

Information:

A = experimental class

O₃ = pretest (control)

B = control class

O₄ = posttest (control)

O₁ = pretest (experiment)

X₁ = TPSW model

O₂ = Posttest (experiment)

X₂ = Conventional model

The location of the research was at SMP Negeri 3 Magelang on Jalan Kalimas No. 23, Kedungsari, Central Magelang, Magelang City with a research period of one month (8 May to 4 June 2023). The research subjects consisted of class VII-E as the experimental class consisting of 31 students and class VII-D as the control class consisting of 29 students. Determination of research subjects was based on the results of considerations using cluster random sampling techniques with one stage cluster sampling. This technique is used because there is uniformity between groups in the population but they are still internally different or are called homogeneous groups and only require one stage in determining research subjects. The cluster random sampling technique with one stage cluster sampling can be shown in figure 1.1:

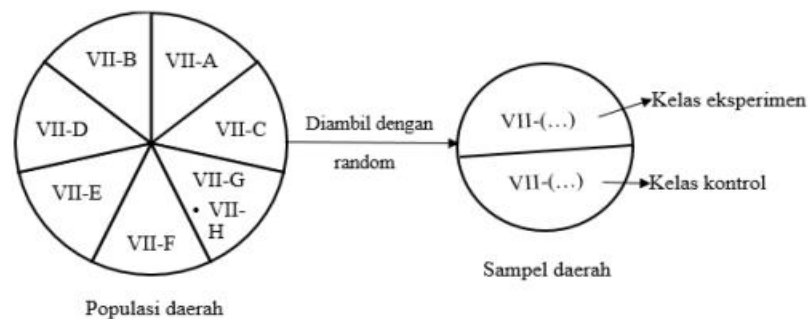


Figure 1.1 . Cluster Random Sampling Technique with One Stage Cluster Sampling

The material studied is Earth and Solar System material for class VII semester 2 in the independent curriculum which consists of three sub-chapters, including the Solar System, Earth and its Satellites, and Getting to Know the Sun Closer.

pretest-posttest test technique in the form of descriptions for students' critical thinking abilities. The instrument used is 10 descriptive questions which have been adapted to indicators of critical thinking abilities and in their assessment adhere to the rubric for assessing critical thinking abilities. The test instrument first goes through several testing stages, namely testing the validity, reliability of the questions, differentiation and level of difficulty of the questions. Because it can be said to be a good test question if the validity and reliability of the instrument meet the requirements (Purwanto, 2011).

The validity test was carried out to test the validity of the content which was carried out by 4 validators and analyzed using the V Aiken formula (Aiken, 1985).

$$V = \frac{\sum (r_i - l_0)}{[n(c - 1)]}$$

Then, to test the construct validity, reliability test, level of difficulty test and differentiability of questions, they were tested on 28 class VIII students of SMP Negeri 3 Magelang. Results of the analysis construct validity test using the product moment correlation formula (Sumarna, 2009):

$$r_{xy} = \frac{N \sum xy - (\sum x)(\sum y)}{\sqrt{(N \sum x^2 - (\sum x)^2)(N \sum y^2 - (\sum y)^2)}}$$

Reliability tests in the form of essay questions can be analyzed using the Cronbach Alpha formula (Zein, 2012):

$$r_{11} = \left(\frac{k}{k-1} \right) \left(1 - \frac{\sum S_i^2}{S_t^2} \right)$$

The different power test questions can be analyzed using the formula (Arikunto, 2013):

$$DB = \frac{\bar{X}_A - \bar{X}_B}{X_{maks}}$$

The test results for the level of difficulty of the questions can be analyzed using the formula (Arikunto, 2013):

$$TK = \frac{\bar{X}}{X_{maks}}$$

Based on the results of instrument testing, 6 questions were obtained that will be used for research. Table can be seen in Table 1.1.

Table 1.1 Question based on critical thinking indicators

Critical Thinking Indicators	Question Number
Provide a simple explanation (elementary clarification)	6
Building basic skills (basic support)	8
Doing inference (inference)	9
Provide further explanation (advance clarification)	7
Set strategy and tactics (strategy and tactics)	3.10

Statistical testing to prove that the TPSW learning model is able to improve critical thinking skills through working on pretest-posttest questions can be carried out by fulfilling the average value test, prerequisite tests (normality test and homogeneity test), T test, and N-Gain test .

RESULTS AND DISCUSSION

1. Average Value Test

Pretest and posttest scores is carried out after the scores from the data obtained are calculated using the formula:

$$\bar{X} = \frac{\text{Total score of all students}}{\text{amount of students}}$$

The results obtained are shown in the table 1.2.

Tabel 1.2 Result of mean based on pretest and posttest

Class	Pretest Mean	Posttest Mean
Experiment	44.55	85.03
Control	51.41	72.83

2. Prerequisite Test

a. Normality test

The normality test uses the Kolmogorov-Smirnov test using SPSS can be seen in Table 1.3.

Table 1.3 Normality test of pretest and posttest

Class	Test Results	Significance	Information
Experiment	Pretest	0.200	Normal
	Posttest	0.200	Normal
Control	Pretest	0.180	Normal
	Posttest	0.068	Normal

These results can be concluded that the pretest-posttest results are normally distributed and significance testing can be continued using parametric tests because they are > 0.05 .

b. Homogeneity Test

In testing homogeneity, this research used the Levene test with the help of SPSS software . The result of homogeneity test was shown in table 1.4

Table 1.4 Homogeneity test of pretest - posttest

Variable	Based on Mean	Significance Level	Information
Students' Critical Thinking Ability	0.290	0.005	Homogeneous

The significance value obtained is greater than the 0.05 significance level, namely 0.290. It can be concluded that the data from the pretest-posttest questions are homogeneous.

3. Independent Sample T-Test

The Independent Sample T-Test was carried out using SPSS software . The result was shown in table 1.5.

Table 1.5 Result of independent sample T-test analysis

Results	value . (2-tailed)	Information
Equal variances assumed	<0.001	There is a significant difference in students' critical thinking abilities between the experimental class and the control class.

The significance value is smaller than 0.05, namely <0.001, meaning there is a significant difference in students' critical thinking abilities between the experimental class and the control class.

4. N-Gain Test

N-Gain Score testing was carried out using SPSS software . The formula for calculating the N-Gain Score is (Hake, 2002):

$$N - Gain = \frac{\text{Score of Posttest} - \text{Score of Pretest}}{\text{Ideal Score} - \text{Pretest Score}}$$

The following calculation results was shown in table 1.5.

Table 1.5 Result of independent sample T-test analysis

Class	Average Pretest	Average Posttest	ΔScore	N-Gain	Information
Experiment	44.55	85.03	40.48	0.73	High
Control	51.41	72.83	21.42	0.44	Medium

N-Gain calculation in the experimental class is 0.73, which is classified as high. The result of the N-Gain calculation in the control class is 0.44, which is included in the medium category. These results prove that there is a difference in increasing critical thinking skills between the experimental class and the control class.

RESULT AND DISCUSSION

Data from research on students' critical thinking abilities proves that there are differences between the experimental class and the control class and can improve students' critical thinking abilities. The increase in critical thinking skills in the experimental class was 0.7318 with a high improvement category and in the control class it was 0.4427 with a moderate improvement category. The increase in critical thinking skills in the experimental class was greater than in the control class.

Based on the results of research analysis, the increase in critical thinking skills in the experimental class was higher than in the control class. This finding is based on the stages of the TPSW (Think Pair Share Write) learning model which can support students' critical thinking abilities. Using the Think Pair Share (TPS) learning model can provide students with space to think critically, reason, think broadly, and be able to find their own answers to problems given to students, so students will actively learn, thereby enabling students to develop critical thinking skills.

The increase in thinking ability is also based on the N-Gain value , an indicator of critical thinking ability which is measured in both the experimental and control classes. The critical thinking skills proposed by Ennis are grouped into 5 indicators, namely providing simple explanations (elementary clarification), building basic skills (basic support), making inferences , providing further explanations (advanced clarification), and organizing strategies and tactics (strategy). and tactics) (Ennis, 1996). The increase in each indicator in the experimental class and control class has a different N-Gain .

The first indicator is to provide a simple explanation. In the experimental class, the N-Gain value was 0.518, which is in the medium category. In the control class, the N-Gain value was 0.283, which is in the low category. Indicators providing a simple explanation in the two research classes experienced an increase, but the experimental class got a greater N-Gain value compared to the control class. The greater improvement in the experimental class was based on the implementation of the TPSW

learning model, where in the TPSW learning model there is a Think stage which trains students to be able to give simple explanations individually with the teacher giving students time to think.

At the Think stage in TPSW learning, the teacher first provides a video presentation related to the lesson material and all students observe and understand the content of the video presentation. Then, through this video, students are asked to ask a question about a concept that they do not yet understand within the time specified by the teacher. Giving time by the teacher to students can provide a stimulus for students to think about the content of the video delivery by focusing on what problems are related to the material, as well as thinking about concepts that they do not yet understand from the video presentation, so that questions that arise from students will become material for group discussion. later. Before the group discussion is held, several students' questions will be asked and give other students the opportunity to answer simply according to the basic understanding they have or the reading sources in the book. This activity will stimulate students' curiosity about the lesson material and motivate other students to answer questions and participate in the lesson.

In line with research conducted by Setiawan, the stage of answering pre-learning questions trains students to build the character of initiative or independence to find answers based on the sources of information they read (Setiawan D. H., 2020). Students who have high curiosity tend to have a high level of critical thinking (Laelasari, 2018). With various answers from students, students can connect various concepts to answer the question and make it a conclusion in the form of a simple explanation (elementary clarification). Visualization of phenomena that occur in the universe through videos or reading allows students to connect various concepts they have to provide temporary answers to previous questions and provide simple explanations for these questions (Puspitorini, 2020).

In the control class which applies the conventional learning model, students are not given time to think, but instead students are guided to continue thinking for themselves when the teacher explains the material using the lecture method. The conventional learning model is teacher-centered , students are not directly involved in the learning process, which makes students unmotivated, easily feel bored and sleepy, sometimes makes students chat with their classmates without paying attention to the

teacher's explanations and makes the class atmosphere noisy (Fitriani, 2018). Therefore, the increase in students' ability in the indicator of providing simple explanations in the control class is included in the low category.

The second indicator is building basic skills. In the experimental class, the N-Gain value was 0.701, which is in the high category. In the control class, the N-Gain value was 0.184, which is in the low category. Both research classes experienced an increase, but the experimental class got a greater N-Gain value compared to the control class. The high increase in indicators for building basic skills in the experimental class is based on the implementation of the TPSW learning model with the Pair stage . The Pair stage is carried out by means of student discussion through group formation.

Pair Stage in the TPSW learning model, students will be grouped with 4 members per group to work on and discuss LKPD (Students' Worksheets). At this stage students exchange opinions to solve questions with the right answers. Students and their groups look for answers to these questions through various reading sources, including student handbooks or internet access. Through this activity, students can consider the credibility of an answer source and observe various literature studies as a data collection process. This discussion activity can improve students' social skills. Students with different abilities will help each other so that the learning process is more independent. Students who have an open mind will be willing to hear and accept other people's opinions as a form of humility and can see solutions to problems from various perspectives.

This is in line with research conducted by Rahmawati that discussions with a group of friends can provide the stimulus needed for students to be more aware of their cognitive processes and have an impact on their cognitive learning outcomes (Rahmawati, 2015). Apart from that, the discussion method causes students to be very enthusiastic about learning activities, they become more creative, group learning activities can bring students to be active and act quickly, students can rely on their ability to solve problems, students' motivation to learn about the subject matter was initially only partially possessed. students, almost all students have it so they can improve their critical thinking skills (Widiastuti, 2021).

In the control class, the indicator for building basic skills is the indicator with the lowest increase because conventional learning models cannot train basic critical thinking skills, namely high curiosity, skepticism and humility. With this learning

model, students only accept the explanation of the material presented by the teacher and trust it completely. The implementation of the conventional model only makes students the recipients of information which requires students to memorize the material provided by the teacher and does not relate the material to real situations (Syafnidawaty, 2020). Even though there is a question and answer stage in learning, it is not optimally able to build basic critical thinking skills.

Apart from being able to improve critical thinking skills on indicators of building basic skills, the Pair stage is also able to improve the results of critical thinking skills on indicators of making inferences in the experimental class. As based on the results of research data analysis, the experimental class obtained an N-Gain value of 0.792, which is included in the high category. In the control class, the N-Gain value was 0.455, which is in the medium category. The indicator for inference in the experimental class gets a greater N-Gain value compared to the control class.

pair stage in the TPSW learning model helps students to be able to choose or combine various perspectives on answers from the results of literature review observations previously carried out by each group member so that they decide on an answer that is mutually agreed upon. The agreed answer can be in the form of a deduction or induction sentence based on the results of considerations with the aim of answering the question referred to in the question and deciding on the answer that is most correct, can be accounted for and can relate to events in everyday life. Deciding on an answer requires critical thinking, so the more precise students are in making an answer decision together with the group, the higher their critical thinking skills will be.

This is in line with the results of research conducted by Susilawati, by thinking critically students will be able to think according to the experience gained, answer problems well and be able to make decisions according to what students find (Susilawati, 2020). Apart from that, research conducted by Azizah, et al showed that students were able to analyze or make decisions related to solving problems in these questions which were connected to the lesson material (Azizah, 2018).

the N-Gain value for the inference indicator is in the medium category. This increase is considered quite good compared to the students' previous abilities. Improvements in this indicator can be based on the question and answer stage with students by the teacher. After the teacher explains the material, the teacher will check

students' understanding by asking questions and answers regarding the material which is connected to daily events, in this way the teacher will measure the students' abilities whether the students can provide an answer that is an induction or deduction or a decision or not. If students pay close attention to the teacher, the students' answers will reflect their abilities. However, if two or three students cannot answer questions then a lot of time will be wasted. Because basically with the conventional learning model students are passive and only act as recipients of the material.

Next, the fourth indicator is to provide further explanation. In the experimental class, the N-Gain value was 0.731, which is in the high category. In the control class, the N-Gain value was 0.456, which is included in the medium category. Both classes experienced an increase, but the experimental class got a greater N-Gain value compared to the control class. The greater improvement in the experimental class was based on the implementation of the TPSW learning model with the share stage . The Share stage trains students to be able to provide further explanation of the results of discussions with the group through presentation activities.

At this stage, students will present the results of the discussion together with their groups, but only a few groups are represented who make presentations, other groups can respond or add an answer as material for further discussion. Presentation activities can train students to have the courage to appear in public, train their speaking skills in conveying explanations of answers from group discussion results, so that the results presented can be understood by other students and provide stimulation for other students to be actively involved in class discussions. At this stage the discussion takes place more widely with other groups of students in the class. Students can share opinions, justifications and corrections to the results of small group discussions. So that students can understand concepts more deeply and completely with wider discussions.

In line with the results of research conducted by Puspitorini, the various answers and differences in discussion results submitted by each student will form a complete new understanding (Puspitorini, 2020) . Students will also find out what material they understand and what they don't as a process for evaluating further learning. This self-evaluation process makes a person can be said to have critical thinking. In line with Reza Rachmadtullah's research that critical thinking is the ability to hold opinions in an organized manner, the ability to systematically evaluate the weight of personal opinions

from the opinions of other people (Rachmadtullah, 2015).

In the control class, the indicator providing further explanation is an increase in the ability of the critical thinking indicator which gets the highest N-Gain value even though it is still lower than the N-Gain value for the experimental class. This improvement is based on a conventional learning model focused on teacher explanations through stages of presenting lesson material information, so that students receive full explanations from the teacher and memorize what has been conveyed according to the material being taught. Students with high memorization abilities will increase their ability to provide answers in the form of further explanations. The activities of noting, copying, imitating, remembering and following directions either from the teacher or from friends who are considered smarter are LOTS (Lower Order Thinking Skills) techniques used by students, because students will actively listen to the teacher's explanation (Yusuf, 2022).

The final indicator in measuring critical thinking skills is managing strategies and tactics. In the experimental class, the N-Gain value was 0.804, which is in the high category and is the highest N-Gain obtained in the experimental class. In the control class, the N-Gain value was 0.379, which is included in the medium category. Both research classes experienced an increase in this indicator, however the experimental class got a greater N-Gain value compared to the control class. The highest increase in indicators for managing strategies and tactics in the experimental class is based on the implementation of the TPSW learning model. Students are required to find their own answers to the questions presented so they need to think critically by organizing strategies and tactics to find these answers through high curiosity and skepticism (not easily believe in something), and have humility when evaluating that it turns out that his ideas or opinions are not correct. The three basic skills such as humility, skepticism and curiosity are the benchmarks for someone who can be said to be a critical thinker (Ananda, 2022).

The ability to organize strategies and tactics in TPSW learning can be trained at the Write stage . The Write stage in the TPSW learning model is realized by writing a learning journal. In learning journals, students can write down the results of concept formulation according to each student's self-understanding after learning and become a form of conveying arguments in writing. The application of learning journals in

studying the earth and solar system aims to familiarize ourselves with reflection and self-evaluation activities at the end of each learning process to make them more meaningful. Students will write down their learning experiences as a form of gathering information.

The information contains the concepts that students have studied, the extent to which they understand the concepts and which concepts they have not yet understood from the entire material studied during the learning process in class as a form of student self-reflection. In line with research conducted by Setiawan, self-reflection during learning will cause students to think and respond deeply to events, activities or newly received knowledge so that it can help students to understand the material further (Setiawan D. H., 2015) . With learning journals written by students, teachers can monitor each student's understanding after learning is complete. In line with Susanti's opinion that learning in schools should train students to explore abilities and skills in searching, managing and assessing various information critically (Susanti, 2019).

In the control class, the ability to organize strategies and tactics can only be trained through assignments given by the teacher to students. Students organize strategies and tactics to be able to answer these questions, either through reading textbooks or other sources of information in order to get good grades. Assessment of students using the conventional learning model is only obtained from the results of assignments or exams given by the teacher. Conventional learning only focuses on assessment based on results, not the learning process, where students cannot express their thoughts freely regarding the questions given (Hatmanto, 2011). Apart from that, research conducted by Ibrahim also explains that the conventional learning model is teacher-centered learning, students are placed as objects and not subjects of learning so that it is difficult for students to express their opinions, the methods that are often used are lectures, division of tasks and exercises as a form of repetition and deepening of teaching materials so that learning prioritizes results, not processes (Ibrahim, 2017).

Based on the discussion that has been explained, it can be concluded that critical thinking skills in the experimental class by implementing the TPSW learning model and the control class by implementing the conventional learning model both experienced an increase in each indicator. However, the experimental class that implemented the TPSW learning model had a greater improvement compared to the control class that

implemented the conventional learning model.

When implementing learning using the TPSW model, the teacher first ensures that the physical condition of the students is optimal, so that they are not sleepy so that they can participate in learning well, where students will be required to solve a problem that requires concentration and critical thinking. The strong willingness of students to ask questions and do something can also improve critical thinking skills, and in the discussion process students can be resilient in facing difficulties together and also maintain and evaluate the answers that have been given.

A learning process that is relaxed but still focused can reduce feelings of anxiety and tension within students, students are given the freedom to ask questions about what they have observed through the lighters that the teacher provides and students are also given the freedom to explore the answers to the questions that have been presented so that can improve students' critical thinking skills. The habit of writing a student's journal at the end of each lesson can also improve critical thinking skills, the student's journal contains the lesson material that has been obtained according to the student's self-understanding, so that with this journal, students can evaluate themselves whether they have completely understood the lesson material or not. . Based on the student's journal, the teacher can assess the student's intellectual development. With the student's intellectual development increasing in responding to and solving problems, connecting or uniting one thing with another, and being able to respond well to stimuli, the student's critical thinking ability will also increase.

In the control class, learning leads to mastery of memorization and theory that has been conveyed by the teacher and is illustrative. Earth and solar system materials require real understanding and visualization of processes. Conventional learning using the lecture method causes students to only receive information without any meaningful learning process. This does not arouse students' enthusiasm for learning, learning motivation, curiosity and skepticism. Passion for learning, motivation to learn, curiosity and skepticism influence students' critical thinking abilities. So the lower the four basic attitudes that students must have in learning, the lower the students' critical thinking abilities will be.

CONCLUSION

Based on the results of the research and discussion, it can be concluded that there is a difference in increasing critical thinking skills between classes that implement the TPSW (Think Pair Share Write) learning model compared to conventional learning models. Increasing critical thinking skills in the experimental class that applied the TPSW model obtained an N-Gain value of 0.73 in the high improvement category. Increasing critical thinking skills in the control class which implemented the conventional learning model received an N-Gain value of 0.44 in the moderate improvement category. The suggestion from the researcher is that this research further needs to determine guidelines for creating questions in TPSW learning that integrates critical thinking skills and requires a learning design that applies software to implement technology in learning.

REFERENCES

- Aiken, L. R. (1985). Three Coefficients for Analyzing the Reliability and Validity of Ratings. *Educational and Psychological Measurement* , Vol 45 (1), 131-142.
- Ananda. (2022). *Critical Thinking: Definition, Benefits, How to Sharpen it & Book Recommendations* . Retrieved from gramedia.com: <https://www.gramedia.com/best-seller/berikir-kritis/>
- Arikunto, S. (2013). *Research Procedures A Practical Approach*. Jakarta: Rineka Cipta.
- Arnyana, I. (2019). Learning to Improve 4C Competencies (Communication, Collaboration, Critical Thinking and Creative Thinking) to Welcome the Era of the 21st Century. *Proceedings: National Conference on Mathematics and Science, PGRI Banyuwangi University* , vol. 1 No. 1.
- Azizah, MS (2018). Analysis of Primary School Students' Critical Thinking Skills in Mathematics Learning in the 2013 Curriculum. *A & A Educational Research Journal (Semarang)* , Vol. 35(1), 61-70.
- Duron, R.L. (2006). Critical Thinking Framework for Any Discipline. *International Journal of Teaching and Learning in Higher Education* , vol 17(2), 160-166.
- Ennis, R. (1996). *Critical Thinking*. Upper Saddle River, NJ: Prentice-Hall.
- Facione, P. A. (2011). *Critical Thinking: What It Is and Why It Counts*. Millbrae: Measured Reasons and The California Academic Press.
- Hake, R. (2002, January). *Relationship of Individual Student Normalized Learning Gains in Mechanics with Gender, High-School Physics, and Pretest Scores on Mathematics and Spatial Visualization*. Retrieved from physics.indiana.edu: <http://www.physics.indiana.edu/-hake>
- Hatmanto, E. (2011, January 26). *Conventional Teaching Methods Cause Students to Think Less Critically* . Retrieved from umy.ac.id: <https://www.umy.ac.id/method-pengajaran-konvensional-sebabkan-siswa-kurang-berikir-kritis>
- Ibrahim. (2017). Combination of Conventional Active Learning Models (Lecture) with Cooperation (Make-A Match) to Improve Citizenship Education Learning

- Outcomes. *Journal of Social Education, Science and Humanities*, Vol. 3(2), 199-211.
- Laelasari, IY (2018). Exploring Students' Critical Thinking Abilities and Curiosity Through Simple Inquiry Laboratory Activities. *THAIBIEA Journal*, Vol. 1(1): 14-19.
- Levina Jessica., YG (2022). The Influence of the Problem-Based and Cooperative Learning Model of the Think Pair Share Type in terms of Learning Style on the Critical Thinking Ability of Class II ABC Elementary School Students. *POLYGLOT: Scientific Journal Vol 18 No 1* , 97-113.
- Purwanto. (2011). *Evaluation of Learning Outcomes*. Yogyakarta: Student Library.
- Puspitorini, DI (2020). Improving Cognitive Learning Outcomes Through TPSW Learning Based on Hybrid-Learning Circulatory System Material. *Biomes* , Vol. 9(1): 41-53.
- Rachmadtullah, R. (2015). Critical Thinking Ability and Self-Concept with Citizenship Education Learning Outcomes for Class V Elementary School Students. *Journal of Elementary Education* , Vol. 6(2), 287-298.
- Rahmawati, YS (2015). Application of the Project Based Learning Model to Improve Metacognitive Skills. *Journal of Chemical Education Innovation* , Vol. 9(2), 1596-1606.
- Saputra, H. (2020). Mathematical Critical Thinking Ability. *IAI Agus Salim Library*, 1-7.
- Setiawan, DH (2015). Improving the Metacognitive Skills of Biology Study Program Students through the Application of Learning Journals with Jigsaw Strategy Combined with PBL Based on Lesson Study in General Biology Courses. *Proceedings of the 2015 National Seminar on Biology Education. The Role of Biology and Biology Education in Preparing a Superior and Globally Competitive Generation*. Malang: Biology Education Study Program, FKIP University of Muhammadiyah Malang.
- Setiawan, DH (2020). Effectiveness of Critical Multiliteration Model With Radec Model on the Ability of Writing Explanatory Text. *EduHumaniora: Journal of Elementary Education* , 12(1), 1-14.
- Sumarna, S. (2009). *Analysis of Validity, Reliability, and Interpretation of Test Results*. Bandung: Rosdakarya Youth.
- Sunartombs. (2009, March 9). *Understanding the Expository Method* . Retrieved from wordpress.com: <https://sunartombs.wordpress.com/2009/03/09/pengertian-method-ekspositori/>
- Susanti, E. (2019). Critical Thinking Ability of Students at SDN Margorejo VI Surabaya Through the Jigsaw Model. *Bioeduciana* , Vol. 4(2), 55-64.
- Susilawati, EA (2020). Analysis of the Level of Critical Thinking Skills of High School Students. *Journal of Physics and Technology Education* , Vol. 6(1).
- Syafnidawaty. (2020, November 17). *Conventional Learning Model* . Retrieved from raharja.ac.id: <https://raharja.ac.id/2020/11/17/model-pembelajaran-konvensional/>
- Widiastuti, WK (2021). Application of Discussion Methods to Improve Critical Thinking and Problem Solving Skills. *Indonesian Journal of Economic Education* , Vol. 3(1), 259-264.
- Yusuf, A. (2022, January 7). *What are LOTS and HOTS? Advantages and Differences* . Retrieved from deepublishstore.com: <https://deepublishstore.com/pengertian-hots-dan-lots/>

Zein, MD (2012). *Evaluation of Mathematics Learning*. Pekanbaru: Sovereign of Riau.