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IMPROVEMENT OF STUDENTS' CRITICAL THINKING SKILLS AS AN IMPACT OF THE APPLICATION OF THINK TALK WRITE ON EARTH AND SOLAR SYSTEM

Fitrotin Nufus [1], Try Hartiningsih[2], Mochammad Ahied[3], Eva Ari Wahyuni[4] , Dwi Bagus Rendy Astid Putera[5]
[1,2,3,4,5] Natural Science Education Dapartment, Faculty of Education, Trunojoyo University of Madura, Bangkalan, 69162, Indonesia

Email : 200641100073@student.trunojoyo.ac.id, try.hartiningsih@trunojoyo.ac.id, evaariw@trunojoyo.ac.id, dwi.bagus@trunojoyo.ac.id

Abstract

This research aimed to determine whether the Think Talk Write model increased students' critical thinking skills regarding the earth and solar system. A quasi-experimental research design was used, specifically Nonequivalent Control Group Design. The study was conducted at Al-Kholiliyah Bangkalan Middle School during the 2023/2024 academic year, involving all class VII students. The VII-A cohort served as the experimental class, where the Think Talk Write model was implemented, while the VII-B cohort served as the control class, where direct instructional method was used. Purposive sampling was employed to select the sample groups. The N-Gain Score test was utilised to analyze the improvement in critical thinking skills. The results show a significant increase in critical thinking skills among students in the experimental class, with 100% achieving an improvement categorized as medium. In contrast, the control class showed only 7.14% improvement in medium category, with 85.71% of students falling into the low improvement category.

Keywords: Earth and Solar System, Critical Thinking Skills, Think Talk Write

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INTRODUCTION

Natural Sciences (IPA) is learning based on principles and processes to foster a scientific attitude through research (Ilmi et al., 2023). Science is taught to pass on knowledge to students about nature and its surroundings (Fauzi et al., 2023). The Earth and the Solar System is one of the materials in class VII that discusses the Sun and all objects that interact through the gravitational force with each other to form the Solar System (Mutemainna et al., 2023). The material used in this study is the earth and solar system material which discusses planets and extraterrestrial bodies (Sudana et al., 2021). The terms earth and solar system refer to planets, asteroids, and satellites that refer to the Earth, the solar system itself is part of the universe and located in the Milky Way, one of the galaxies of the universe (Mutemainna et al., 2023).

Putra & Negara (2021) said that the material on the Solar System is abstract and generally teachers still explain using books, so students tend to be passive and do not actively participate in learning. Students only listen, so learning becomes not student centered, while if students are active in learning, they can learn through their own experiences. Students learn independently, will create meaningful learning, because they not only learn about material concepts but are also involved in learning that can be used as experiences (Darmayoga, 2023). Not only that, but if students are directly and actively involved in learning, then they can find out their problems and find answers to the questions that exist at that time so that they can understand the concept of the material carefully. Lack of mastery of science concepts can result in low grades obtained by students (Efendi & Putri, 2022). Thus, teachers need to vary and innovate learning models, strategies, and methods as well as create fun classrooms so that students can receive maximum learning (Fitra, 2022).

One of the benefits of innovative and fun learning is the development of student's critical thinking skills. Critical thinking skills are the ability to think deeply (Pratama et al., 2022). The development of critical thinking skills in students is very important, because it can help them face various challenges in the future, as well as be wise in making decisions. The criterion for people who can think critically is to be able to understand the obstacles that exist, but not to rush to make decisions because the decisions are well thought out (Latifah et al., 2020). The aspects that have an impact on students' thinking are the aspect of themselves, the role of the school, the role of educators, and the supporting facilities and infrastructure (Winangun et al., 2022).

One of the strategies that can be used to support the development of students' critical thinking skills is Think Talk Write (TTW). TTW is one of the cooperative learning that provides opportunities for students to develop their ideas before being discussed and concluded through writing (Ichtiari et al., 2022). The flow of this TTW learning is that students think, followed by discussion, and finally write (Wattimena et al., 2022).

Through cooperative activities, students share, and help each other, so that later students are expected to be able to understand the material taught (Prasetryawati, 2021).

Research that has been carried out by Nasrulloh & Umardiyah (2020) found that TTW learning is effective for critical thinking. Another study conducted by Herlena et al. (2021) concluded that has been an increase in critical thinking known from perfect scores. If previous studies focused on other materials, so they did not focus on science materials, then this study focuses on studying more deeply to find out the improvement of students' critical thinking skills through the Think Talk Write model of Earth and Solar System materials. The results of this research are expected to add insight and can be one of the alternative teachers in teaching by using one of the models that can be applied in science learning to maximize and be able to improve student's' critical thinking skills through this model.

RESEARCH METHODS

The research carried out is a quasi-experiment. The research was conducted in the even semester, the 2023/2024 school year. The study was conducted at Al-Kholiliyah Bangkalan Middle School. The population in this study is all grade VII students of Al-Kholiliyah Junior High School Bangkalan. The sample used is class VII A an experimental class that applies the TTW model and class VII B is control class that applies the direct learning model. The sample selection technique is Purposive Sampling. The selection of the sample was based on the ability of the same students based on interviews with teachers before the study, so it is hoped that the data obtained related to the improvement of students' critical thinking skills between the experimental class and the control class will be valid. The null hypothesis in this study is that there is no difference in students' critical thinking skills through the think talk write model. The alternative hypothesis is that there is a difference in students' critical thinking skills through the exam model.

The research instruments in this study consist of (1) learning implementation instruments, namely teaching modules and Student Worksheets (LKPD), and (2) data collection instruments consisting of critical thinking ability test questions. The data collection instruments in this study were tested using validity tests and reliability tests. The validity test is calculated using the Gregory equation, which is as follows.

$$V = \frac{\mathrm{D}}{(\mathrm{A+B+C+D})}$$

(Mirnawati et al., 2022)

Information:
V = Content validity
A = Cell disagreement between the two validators
B = Cell of differing views between validators
C = Cell of differing views between validators
D = Valid consent cell between the two validators

The category of determining the validity of the instrument can be determined by the following Table 1.

Table 1. Instrument Validity Category

Index	Category
0,80 - 1,00	Very high
0,60 - 0,79	High
0,40 - 0,59	Medium
0,20 - 0,39	Low
0,00 – 0, 19	Very low

(Wirayasa et al., 2021)

The reliability test uses the reliability method between validators, namely using the following formula.

$$R = [1- \frac{(A-B)}{(A+B)}] \text{ x } 100\%$$

(Uzani et al., 2023)

Information :
R = Reliabilitas
A = Highest validator score
B = Lowest validator value

The category of determining the reliability of the instrument can be determined by the following Table 2.

Table 2. Categories Instrument Reliability

Index	Category
80%<R≤100%	Very high
60%<R≤80%	High
40%<R≤60%	Medium
20%<R≤40%	Low
R≤20%	Very low

Information : R = Reliability

Modification (Kurnia et al., 2022)

The data collection techniques in this study are tests and documentation. The results of the critical thinking ability test were analyzed using the following equation.

$$\text{Percentage} = \frac{\text{Total student score}}{\text{Maximum Scorel}} \text{ x } 100\%$$

(Az Zahra & Hakim, 2022)

The percentage value is obtained through calculation using categories in Table 3 as follows.

Table 3. Percentage of Critical Thinking Ability

Perscentage	Category
80%<*BK*≤100%	Very high
60%<*BK*≤80%	High
40%<*BK*≤60%	Medium
20%<*BK*≤40%	Low
BK≤20%	Very low

Information : BK = Critical Thinking

Modification (Zakhia et al., 2022)

Meanwhile, in improving critical thinking skills, it can be known that the n-gain score test is obtained with the following formula.

$$\textit{N-Gain (g)} = \frac{\text{Posttest Scores} - \text{Pretest Scores}}{\text{Maximum score} - \text{pretest score}}$$

(Rismayanti et al., 2022)

The percentage value is obtained through calculation using categories in Table 4 as follows.

Table 4. Percentage of n-gain score test

Percentage	Category
0,7<*g*	High
0,3<*g*≤0,7	Medium
g≤0,3	Low

Information : g = *n-gain*

Modification (Rismayanti et al., 2022)

RESEARCH RESULTS AND DISCUSSION

The test was carried out to test the hypothesis using the n-gain score test. This test was carried out to determine the improvement of the critical thinking skills of students in the experimental class and control class. The data used were pretest and posttest of the experimental class and the control class. This test was carried out with the help of the SPSS application. The calculation results are in Table 5.

Table 5. Percentage of N-Gain Scores of Experimental and Control Classes

Criterion	Experimental Classes		Control Classes	
	F	%	F	%
High	0	0	0	0
Medium	28	100	2	7,14
Low	0	0	24	85,71
Number of Students	**28**		**28**	

Information : F = Frequency

Based on Table 3, the experimental class experienced an increase in critical thinking skills with a high category of 0%, in the medium category by 100%, and in the low category by 0%. Meanwhile, in the control class, the increase in the high category was 0%, in the medium category was 7.14 percent, and in the low category was 85.71%. Thus, it can be seen that the application of think talk write can improve critical thinking skills in experimental classes with medium categories. The n-gain score test was also carried out on each critical thinking indicator. It aims to determine the improvement of the critical thinking ability of the experimental class and control each indicator. The recapitulation of the results of the calculation of the n-gain score value of each indicator can be seen in Table 6.

Table 6. Test the n-gain score for each indicator of the experimental class

No	Indicators	*Posttest-Pretest*	Max Score *-Pretest*	*N-Gain*	Category
1	Giving a simple explanation	2,85	6,39	0,45	Medium
2	Building basic skills	4,22	6,68	0,63	Medium
3	Making inferences	3,82	5,75	0,66	Medium
4	Give further explanation	2,68	7,11	0,37	Medium
5	Set strategies and tactics	3,64	7,82	0,47	Medium

Table 6 shows that the improvement in critical thinking skills of each indicator of the experimental class is moderate, which means that there is a fairly good improvement in each indicator. The maximum value obtained is 0.66 on the making inferences indicator. The lowest value of 0.37 on the indicator give further explanation. The recapitulation of the improvement of critical thinking skills for each indicator of the control class is shown in Table 7.

Table 7. Test the n-gain score of each indicator of the control class

No	Indicators	*Posttest-Pretest*	Max Score - *Pretest*	*N-Gain*	Category
1	Giving a simple explanation	0,32	6	0,05	Low
2	Building basic skills	1,07	6,75	0,16	Low
3	Making inferences	1,15	7,36	0,16	Low
4	Give further explanation	0,19	6,82	0,03	Low
5	Set strategies and tactics	1,43	8,14	0,18	Low

Table 7 shows that the improvement of critical thinking skills of each control class indicator is included in the low category. The maximum value obtained is 0.18 on the indicator of set strategies and tactics. The lowest value of 0.03 on the indicator give further explanation. Based on the results of the n-gain score test carried out, it can be seen that learning in the experimental and control classes has increased, but there is a difference, namely an increase in the experimental class with a medium category, while the control class with a low category.

Improving students' critical thinking skills in the experimental class by applying think talk write is better than the control class that uses a direct learning model. This is because, with this model, students can be active. After all, it requires them to interact with their friends (Agus et al., 2023). With this model, students are also allowed to think independently first in finding answers in LKPD through existing books, if in independent thinking there are still unknown answers, then they can be discussed again with their group friends. That way

students can easily understand the material at the time of learning. The steps of the think talk write learning model according to Shoimin (2020) consist of seven steps in learning, which are in Figure 1 as follows.

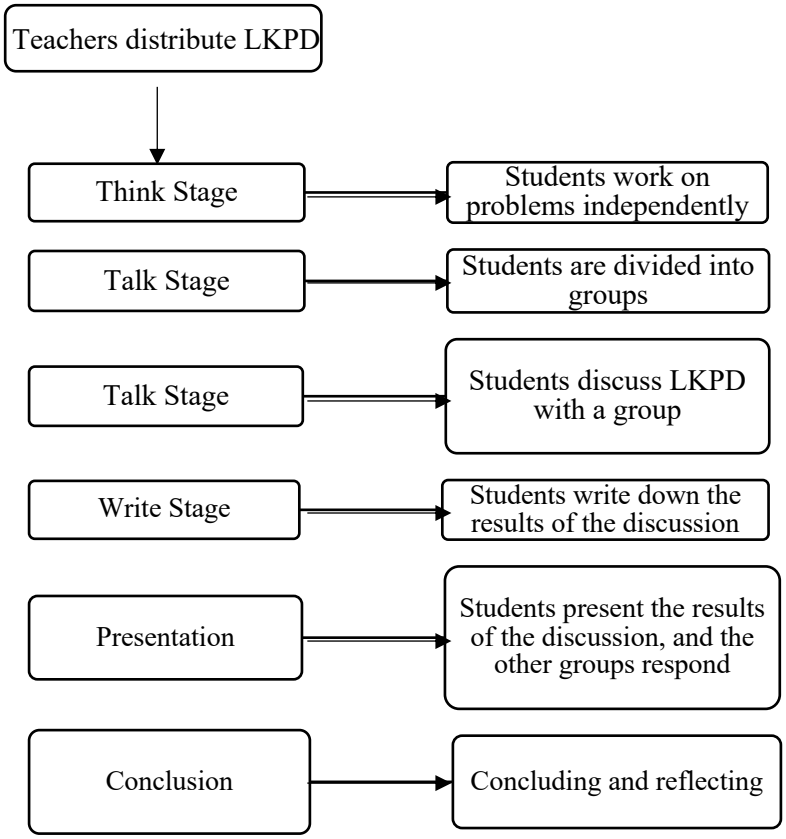

Figure 1. Steps to Learn Think Talk Write

Meanwhile, Ennis (2011) stated five indicators of critical thinking, namely (1) give a simple explanation, (2) building basic skills, (3) maing inferences, (4) giving further explanations, and (5) set strategies and tactics. The application of think talk write starts with the teacher giving the LKPD of Earth and Solar System material to students, students are required to work on the problems in the LKPD, namely the think stage, which contains questions that train critical thinking skills. Through this, students will think independently in analyzing problems and then try to answer existing problems related to the matter of the Earth and the Solar System so that at this stage students can provide a simple explanation of what they understand from the material formed through the problem. This stage can encourage students' curiosity regarding the learning material studied so that they can train students thinking in dealing with a problem through the handouts presented. Based on the results of the N-Gain Score test on the critical thinking indicator giving a simple explanation in the experimental class, a score of 0.45 was obtained with a medium category. Meanwhile, in the control class, the critical thinking indicator gave a simple explanation, a score of 0.05 was obtained with a low category. This shows that at the thinking stage in the experimental class, students' critical thinking skills on critical thinking indicators “give a simple explanations” better than using the direct learning model.

Students' critical thinking skills are better in the experimental class, the indicators provide a simple explanation because at the thinking stage, students are trained to think critically by doing LKPD independently. Critical thinking skills are not enough just to give simple explanations, there is a second indicator of critical thinking skills, namely, building basic skills. Indicators of building basic skills in the experimental class can be practiced in the step of finding answers to existing problems, namely teachers provide opportunities for students to identify problems by searching for information in books or in handouts that have been provided.

The information that students have obtained from books or handouts is used to answer questions presented in the LKPD about the Earth and the Solar System. Students identify the knowledge they have gained to answer questions, so students can discover material concepts through questions. This step can train students in building basic skills by observing and considering the results of information obtained through independent search for answers.

Based on the results of the N-Gain Score test on the indicator of critical thinking to “building basic skills”, in the experimental class a score of 0.63 was obtained in the medium category, while in the control class a

score of 0.16 was obtained in the low category. This shows that at the think stage, the experimental class can improve the critical thinking ability of the teacher on the critical thinking indicator of "building basic skills" which is better than using the direct learning model. As according to Rahmi et al., (2023), LKPD is a teaching material that must be done by students because it is able to make it easier for students to understand the learning content.

The next indicator of critical thinking is to “give further explanations”. This ability can be trained in the step of learning to talk or discuss. At this stage, students are divided into groups and gather according to their groups. Then, students will discuss the answers that have been found from the think stage and discuss them with the group to find the right answer. In the talk stage, students will discuss each answer that has been found, or if they have not gotten the answer to the question, they can discuss together to find answers to the questions in the LKPD. The questions in the LKPD contain questions that can train critical thinking skills about the matter of the Earth and the Solar System. Thus, from these activities, students can improve their thinking skills by providing further explanations related to what has been found before.

Based on the results of the N Gain Score test on the critical thinking indicator “give further explanations”, the experimental class obtained a score of 0.37 with the medium category, while in the control class a score of 0.03 was obtained with a low category. This shows that at the talk stage in the experimental class, it can improve critical thinking skills on indicators that give better “further explanations” than using direct learning. In this regard, Marzuki (2023) stated that discussing can cause interaction between students so that students can express their opinions and exchange ideas logically, so that students can find an agreement on each other's answers through discussion.

The next indicator of critical thinking is to “set strategies and tactics”. This critical thinking indicator can also be trained at the talk stage. At this stage, students discuss with each other and develop strategies to solve the problems in the LKPD. Because this is a group activity, each student can exchange ideas and help each other if there are difficulties, most of them are afraid to ask the teacher directly if there is something they do not understand. Therefore, with this think talk write model, they can discuss with their friends at the talk stage so that they can be expected to solve problems by thinking critically.

Based on the results of the N-Gain Score test on the indicator of critical thinking to “set strategies and tactics” in the experimental class, a score of 0.47 was obtained in the medium category, while in the control class, a score of 0.18 was obtained in the low category. This shows that at the talk stage in the experimental class, it can improve critical thinking skills on indicators of managing strategies and tactics better than using a direct defense model. According to Marzuki (2023), discussing can make students active in learning because students are directly involved, so they can express their opinions and decide to get the best answer according to the results of the discussion.

“Making inferences” is one of the indicators of Ennis's (2011) critical thinking ability, so that they think talk write model can be trained at the write stage. At this stage, students make conclusions by thinking critically through the LKPD that has been discussed previously in the talk stage, in this activity after discussion, students will find answers to the questions in the LKPD related to Earth and Solar System materials. They also presented each of the answers obtained and other groups who did not present would give a response. At this stage, students can complement each other's answers if anything is lacking between each group so that they will understand the material better and practice students' critical thinking skills as well.

Based on the results of the N-Gain Score test on the critical thinking indicator, making inferences in the experimental class was obtained with a score of 0.66 in the medium category, while in the critical thinking indicator making inferences in the control class obtained a score of 0.16 with the low category. This shows that the write stage in the experimental class can improve critical thinking skills on critical thinking indicators, concluding better than using a direct learning model. According to Mulyanti (2023), presentations, it can open multi-directional communication between students and also students and teachers, as well as involve students to play an active role in learning. So that from this activity students can complement each other's answers.

Based on the results of the N-Gain Score of each indicator in the critical thinking test of the experimental class, it shows that in the “making inferences” indicators, critical thinking skills have experienced the most significant improvement. Because, during the learning process, students are trained to conclude from the results of the discussion in the previous stage. Students also present the results of group work to each other so that the groups complement each other. Thus, they understood the learning material at that time. Meanwhile, the less significant indicator of improving critical thinking skills is in “give further explanation”. This is because during the learning process, students are less than optimal in discussing. The cause of students' lack of optimality at this stage is that there are students who are passive and inactive in discussion activities which can hinder students from providing further explanations.

Based on the results of the average N-Gain Score, show that the improvement of students' critical thinking skills in the experimental class is better than that of the control class. This is by the theory that the application of think talk write in learning makes students' critical thinking skills experience a better improvement. The application of TTW invites students to participate in learning, they take part in a role that finally makes it easy to understand the material taught which is influential in improving their critical thinking skills (Miftahurrahman et al., 2020).

The think talk write learning model in this study is applied in groups. However, each student still works on their own at the think stage. This is by Vygotsky's constructivist learning theory which emphasizes more on the social aspect of learning. Lev Vygotsky's learning theory emphasizes the social aspect of learning. According to Lev Vygotsky, knowledge is built by cooperation between friends, so that each individual can build the knowledge he has by exchanging ideas with each other (Muhibin & Hidayatullah, 2020).

The results of the N-gain score showed that the experimental class experienced a better improvement compared to the control class. Thus, the application of think talk write on Earth and Solar System material at Al-Kholiliyah Bangkalan Junior High School grade VII is appropriate because, it can improve students' critical thinking skills. This is supported by the data and theories that have been outlined showing that the application of think talk write to the earth and solar system can improve students' critical thinking skills.

CONCLUSIONS AND RECOMMENDATIONS

A. Conclusions

The critical thinking skills of experimental class students increased after the implementation of think talk write with a high category percentage of 100% in the experimental class. Meanwhile, the increase in the control class with the percentage of the medium category was 7.14%, and the percentage of the low category was 85.71%. With the improvement of critical thinking skills, each indicator of the experimental class was moderate. The maximum score obtained was 0.63 on the indicator of building basic skills. The lowest value of 0.37 on the indicator give further explanation. Meanwhile, the improvement in the critical thinking ability of each indicator of the control class was low. Namely the maximum value obtained, which is 0.18 on the indicator of set strategies and tactics and the lowest value of 0.03 on the indicator give further explanations. Thus, it can be concluded that the think talk write model can improve the critical thinking skills of students in grade VII of Al-Kholiliyah Bangkalan Junior High School.

B. Recommendations

The application of the TTW learning model requires careful preparation, so it is hoped that further research will better prepare the necessary needs, such as the readiness of the material, and also the LCD to display the powerpoint so that the estimated time needed is sufficient. The limitation of this study is that it only focuses on improving students' critical thinking skills on the earth and solar system by applying the think talk write model.

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