JPBIO (Jurnal Pendidikan Biologi)
Vol. 11, No. 1, April 2026, 198 – 205 //e-ISSN 2540-802X
http://jurnal.stkippersada.ac.id/jurnal/index.php/JBIO/index

Think pair share learning model based on 3d media in developing students' critical thinking skills

Mutmainnah*, Mohammad Djamil M. Nur, Siti Rabiatul Adawiyah

Datokarama State Islamic University Palu, Indonesia

* Corresponding author: muthmutmainnahmut@gmail.com

Article Info

Article History:
Received 26 February 2026
Revised 11 March 2026
Accepted 07 April 2026
Published 30 April 2026

Keywords:
Think-Pair-Share,
Three-dimensional (3D) media
Critical thinking skills.

ABSTRACT

Critical thinking skills is one of the essential competencies that must be developed in science learning, especially in the 21st century, as it enables students to analyze, evaluate, and solve problems effectively. Therefore, this study aims to determine the effect of the Think-Pair-Share (TPS) learning model based on three-dimensional (3D) media on the critical thinking skill of seventh-grade students at SMP Negeri 10 Palu on the topic of marine ecosystems. This study employed a quantitative approach with a quasi-experimental method using a non-equivalent control group design. The sample consisted of two classes, namely the experimental and control classes, selected through purposive sampling. The research instrument was an essay test consisting of 10 questions developed based on indicators of critical thinking, including interpretation, analysis, inference, explanation, and self-regulation. Data were analyzed using the Shapiro–Wilk normality test, Levene homogeneity test, and independent sample t-test at a significance level of 0.05. The results showed that the data were normally distributed and homogeneous. The hypothesis testing result obtained a significance value of 0.000 (<0.05), indicating that there was a significant difference in students' critical thinking skills between the experimental and control classes after the treatment. These findings suggest that the implementation of the Think-Pair-Share learning model based on 3D media has a significant positive effect on improving students' critical thinking skills.

Citation: Mutmainnah, Nur, M.D.M., & Adawiyah, S.R. (2026). Think pair share learning model based on 3d media in developing students' critical thinking skills. *JPBIO (Jurnal Pendidikan Biologi), 11*(1), 198-205. DOI: https://doi.org/10.31932/jpbio.v11i1.6234

INTRODUCTION

Education is a consciously designed process aimed at creating meaningful learning experiences that enable students to develop their potential optimally. It is not merely a process of

transferring knowledge, but also a process of developing thinking skills that serve as a foundation for facing the challenges of 21st-century life (Bhutoria & Aljabri, 2022). In this context, the education system is expected to produce individuals who are adaptive, independent, and capable of higher-order thinking.

One of the essential competencies that must be developed in the 21st century is critical thinking skills. Critical thinking involves the skills to interpret, analyze, evaluate, and draw conclusions logically and reflectively (Seventika et al., 2018). This skill plays an important role in enabling students to filter information, solve problems, and make appropriate decisions (Aspastur & Drivoka Sulistyaningrum, 2021). Previous studies have shown that critical thinking skills significantly influences students' learning outcomes and problem-solving skills (Roath et al., 2025). However, both national and international findings indicate that students' critical thinking skills, particularly in Indonesia, is still relatively low. This condition is often caused by learning practices that are still oriented toward memorization and have not fully facilitated in-depth analytical thinking processes (Roath et al., 2025).

Natural Science (IPA) is one of the subjects that has strong potential to develop critical thinking skills, as it emphasizes scientific processes such as observation, experimentation, data analysis, and conclusion drawing ("The Impact of Bybee and Synectics Models on Creativity, Creative Problem-Solving, and Students' (Bhutoria & Aljabri, 2022)Performance in Geometry," 2020). Ideally, science learning should be student-centered and inquiry-based, allowing students to actively construct their own understanding. However, in practice, science learning is still often dominated by lecture methods, resulting in limited interaction and suboptimal development of critical thinking skills (Li, 2020).

This problem becomes more complex when students learn abstract topics such as marine ecosystems, which involve understanding interactions between biotic and abiotic components, food chains, food webs, and environmental balance. Students often experience misconceptions when learning is only delivered through verbal explanations or textbooks (Sejati et al., 2025). Therefore, learning strategies that can help students visualize concepts more concretely are needed.

One alternative that can be used is the use of three-dimensional (3D) learning media, which provides more realistic and concrete visual representations. The use of 3D media helps students understand abstract concepts and supports deeper conceptual understanding (Tlili et al., 2024). In addition, previous studies indicate that interactive visual media can improve students' understanding and critical thinking skills compared to conventional learning methods (Hodaifah et al., 2025).

However, the effectiveness of learning media will be more optimal when combined with an appropriate learning model. One model that can support active learning is the Think-Pair-Share (TPS) learning model, which consists of three stages: thinking individually (think), discussing in pairs (pair), and sharing ideas with the class (share) (Franco Landa, 2025). Through these stages, students are trained to process information independently, evaluate ideas through discussion, and communicate their reasoning. Previous research shows that TPS can improve students' participation, communication skills, and critical thinking skills (Rusmini et al., 2021).

Despite the effectiveness of TPS and 3D media reported in previous studies, research that integrates both approaches in science learning, particularly on marine ecosystem material at the junior high school level, is still limited. This indicates a research gap that needs to be addressed.

Based on preliminary observations conducted at SMP Negeri 10 Palu, it was found that students' critical thinking skills in science learning is still relatively low. The learning process tends to be teacher-centered, with limited use of innovative media. In addition, 3D media that can support the visualization of marine ecosystem concepts has not been optimally utilized. This

condition shows a gap between the demands of 21st-century learning and the actual implementation in the classroom.

Therefore, this study offers a novelty by integrating the Think-Pair-Share learning model with three-dimensional (3D) media in science learning on marine ecosystem material. The purpose of this study is to determine the effect of the Think-Pair-Share learning model based on 3D media on students' critical thinking skills in grade VII of SMP Negeri 10 Palu.

RESEARCH METHODS

Research Design

The research is a quantitative research utilising the non-equivalent control group design. Quantitative method is used as a knowledge discovery process that involves gathering and processing data in numeric form, and therefore enabling the researcher to quantitatively and objectively measure research variables and derive findings that can be generalized and form the basis on which valid and reliable inferences can be made (Creswell J. and Creswell D., 2023) The quasi-experimental form of research seeks to establish the impact of a treatment by making comparisons between two groups, i.e., the experimental group that receives the treatment and the control group that does not, thus, where the choice of the subjects is done in a non-random fashion. In its implementation, both groups are first given a pretest using the same instrument to determine the students' initial skills, and the pretest results are considered good if there is no significant difference between the two groups. Subsequently, the experimental sample receives a treatment as the application of a problem-based learning model, and the control group is exposed to a direct learning model (Sugiyono, 2022) When the treatment is conducted, the posttest is done to determine the differences in the skills of the students of both groups, and the results of the pretest and posttest are compared to determine the effect of the treatment administered.

Table 1. Non-Equivalent Control Group Design

Group	Pretest	Treatment	Posttest
Experimental Group	O_1	X	O_2
Control Group	O_3	–	O_4

Note:

O_1, O_3 = Pretest (initial students' critical thinking skills)
O_2, O_4 = Posttest (final students' critical thinking skills)
X = Treatment using Think-Pair-Share (TPS) model based on 3D media
– = No treatment (conventional learning)

Population and Samples

This study will have a population of all students in level VII of SMP Negeri 10 Palu. The sample population is two classes, and they are the Tembang and Pimpilido classes, whereby the Tembang class is the experimental group with 20 students, and the Pimpilido class is the control group with 20 students. The sampling method applied is the purposive sampling, or the choice of the samples based on some consideration. Both classes were selected because they have relatively equivalent characteristics, both in terms of the learning process and academic skills, making them suitable to be used as comparison groups in the implementation of the research.(Fraenkel et al., 2022) The research population and sample cover the total population, sample, and sampling technique. It is important to ensure the rationale for the use of the sampling technique applied.

Instruments

The instruments used in this study were test instruments and documentation, which were designed in accordance with the research objectives. The main instrument in this study was a test in

the form of essay questions, administered as a pretest and posttest to measure students' critical thinking skills before and after the implementation of the learning treatment. The test consisted of 10 essay questions developed based on indicators of critical thinking, including interpretation, analysis, inference, explanation, and self-regulation (Facione, 2015). These indicators were used to ensure that the instrument accurately measured the components of students' critical thinking skills.

Before being used in the research, the test instrument was first validated to ensure its validity and suitskills in measuring the intended variables. The results of the test were then analyzed using statistical tests, including normality, homogeneity, and hypothesis testing, to determine the effect of the Think-Pair-Share learning model based on three-dimensional (3D) media on students' critical thinking skills. The results of the test are presented in the results section to show students' critical thinking skills before and after the treatment. In addition, documentation was used as a supporting instrument to record the implementation of the learning process and to collect relevant data, such as photographs and students' work, to strengthen the research findings.

Procedures

The research procedure in this study was carried out through several stages conducted systematically, starting from the preparation stage through to the final stage of the research. In the initial stage, the researcher conducted preliminary observations at SMP Negeri 10 Palu, developed learning materials, prepared three-dimensional (3D) media, compiled and tested research instruments in the form of essay tests, observation sheets, and documentation, and arranged research permits. After that, during the implementation phase, the researcher identified the Tembang class as the experimental group and the Pimpilido class as the control group and conducted a pretest for both groups to establish the initial skills of the students in critical thinking. Subsequently, the process of learning was implemented by implementing the Think-Pair-Share model that relies on three-dimensional (3D) media in the experimental group, whereas the traditional learning was applied in the control group, and the learning processes were observed, and the appropriate documentation was made. At the last phase, a posttest was administered to both classes to assess the difference in the critical thinking prowess of the students after the treatment.

Data Analysis

The method of data analysis in this study entails the data processing and testing process as it addresses the research question, which deals with the impact of the Think-Pair-Share learning model using three-dimensional (3D) media on the critical thinking capacity of students. The data of the pretest and posttest results were described with the purpose of identifying the mean, minimum, maximum, and data distribution in the control condition and in the experimental condition. This was followed by prerequisite analysis tests where a test of normality was done using the Shapiro-Wilk and homogeneity test using the Levene test with the help of the IBM SPSS application, with a significance test of 0.05. After the data were confirmed to be normally distributed and homogeneous, the hypothesis. The use of the independent sample t-test aims to compare the means of two groups that are not paired or are independent of each other, making it suitable for a quasi-experimental design with a control group and an experimental group. (Liang et al., 2019).

RESULTS

The prerequisite analysis test involved the use of a normality test where the Shapiro-Wilk was used to establish the data distribution of each group. According to Table 1, this indicates that all the pretest data and posttest data in both the control group and experimental group have significance value (p-value) which is above 0.05. The significance of the pretest and posttest of the control group are 0.736 and 0.437, respectively, whereas those of the experiment group are 0.239

and 0.349. These results show that the data of the research are normally distributed, and hence the assumption to proceed with parametric statistical analysis in the following stage is met.

Table 1. Normality Test Results (Shapiro–Wilk)

Data	Statistik Shapiro-Wilk	df	Sig. (p-value)	Description
Control Class Pretest	0,969	20	0,736	Normal
Control Class Posttest	0,954	20	0,437	Normal
Experimental Class Pretest	0,940	20	0,239	Normal
Experimental Class Posttest	0,949	20	0,349	Normal

Table 1 shows the results of the normality test using the Shapiro–Wilk test. All pretest and posttest data in both the control and experimental classes have significance values greater than 0.05. This indicates that the data are normally distributed and meet the assumptions for further parametric statistical analysis.

Table 2. Homogeneity Test Results (Levene Test)

Basis	Levene Statistic	df1	df2	Sig. (p-value)	Description
Based on Mean	1,966	3	76	0,126	Homogen
Based on Median	1,719	3	76	0,170	Homogen
Based on Median (adj. df)	1,719	3	70,114	0,171	Homogen
Based on Trimmed Mean	1,981	3	76	0,124	Homogen

Table 2 presents the results of the homogeneity test using the Levene test. All significance values are greater than 0.05, indicating that the data are homogeneous. Therefore, the assumption of homogeneity of variance is fulfilled.

Table 3. Independent Sample t-Test Results

Variable	t	df	Sig. (2-tailed)
Value	-8,200	38	0,000

Table 3 shows the results of the independent sample t-test used to test the research hypothesis. The significance value (0.000) is less than 0.05, indicating that there is a significant difference in students' critical thinking skills between the experimental class and the control class after the learning treatment.

DISCUSSION

The results of this study indicate that there is a significant difference in students' critical thinking skills between the experimental class and the control class after the implementation of the Think-Pair-Share learning model based on three-dimensional (3D) media. This is supported by the results of the independent sample t-test, which show a significance value of 0.000 (<0.05). These findings indicate that the learning treatment applied in the experimental class was effective in improving students' critical thinking skills compared to conventional learning.

From the results of the prerequisite tests, it was found that the data were normally distributed and homogeneous. This indicates that the data met the assumptions for parametric statistical testing, so the results of the hypothesis test can be considered valid and reliable in explaining the differences between the two groups.

The improvement in students' critical thinking skills can be explained through the characteristics of the Think-Pair-Share (TPS) learning model. In the think stage, students are given

the opportunity to think independently and analyze the problems presented. This stage supports the development of interpretation and analysis skills. In the pair stage, students discuss their ideas with their partners, allowing them to exchange opinions, evaluate arguments, and refine their understanding. Meanwhile, in the share stage, students present the results of their discussions to the class, which encourages them to explain their reasoning and respond to feedback. These processes involve higher-order thinking activities such as analysis, evaluation, and explanation, which are key components of critical thinking skills (Seventika et al., 2018).

In addition to the learning model, the use of three-dimensional (3D) media also contributes significantly to the improvement of students' critical thinking skills. The use of 3D media provides more concrete and realistic visualization, enabling students to better understand abstract concepts, particularly in marine ecosystem material. Students are able to observe the relationships between biotic and abiotic components, food chains, and food webs more clearly. This supports their skills to analyze information and draw logical conclusions. According to Tlili et al. (2024), visual learning media can enhance students' understanding by providing interactive and meaningful learning experiences.

The findings of this study are in line with several previous studies. Astuti et al. (2020) found that the use of 3D visualization media significantly improved students' critical thinking skills and scientific attitudes. Similarly, Nurilma et al. (2023) reported that the use of STEM-based 3D multimedia improved students' critical thinking skills by 56.1%. These studies support the findings of this research, indicating that the use of 3D media can facilitate deeper understanding and improve students' skills to think critically.

Furthermore, the results of this study are also consistent with research on cooperative learning models. Rusmini et al. (2021) stated that the Think-Pair-Share learning model can increase student participation and encourage active involvement in the learning process. Through discussion and collaboration, students can evaluate ideas, compare perspectives, and construct knowledge together. This process plays an important role in developing critical thinking skills.

Overall, the findings of this study strengthen previous research indicating that the integration of cooperative learning models and interactive learning media can create a more effective learning environment. The combination of the Think-Pair-Share learning model and three-dimensional media not only increases student engagement but also supports the development of critical thinking skills through active discussion, visualization of concepts, and collaborative knowledge construction. Therefore, this learning approach can be used as an effective strategy to improve students' critical thinking skills, especially in science learning that involves abstract concepts such as marine ecosystems.

CONCLUSION

As per the research result and discussion, it can be inferred that the use of the Think-Pair-Share learning model using three-dimensional (3D) media has a profound impact on enhancing critical thinking skills among grade VII students in SMP Negeri 10 Palu. Such results of the statistical analysis show that the abilities of the students of the experimental and the control groups in critical thinking are significantly different after the learning treatment was conducted using the independent sample t -test with the significance value of 0.000 (<0.05). This observation shows that the incorporation of the Think-Pair-Share cooperative learning model in collaboration with 3D visual media can enable students to become more actively involved, engage in a critical and judgmental thinking process, and make students learn the concepts in a more concrete and in-depth manner. In addition, interactive media in 3D facilitates the discussion and collaboration process at every stage of TPS, which makes the learning process meaningful. As such, the 3D media-based

Think-Pair-Share learning model can be employed as a viable alternative to the innovative learning strategies in the development of critical thinking skills among students.

REFERENCES

Aspastur, K. P., & Drivoka Sulistyaningrum, S. (2021). The Integration Of Problem-Solving Skills In English In Academic Discourse Syllabus At English Language Education Study Program. *Let: Linguistics, Literature and English Teaching Journal*, *11*(2). https://doi.org/10.18592/let.v11i2.5198

Astuti, T. N., Sugiyarto, K. H., & Ikhsan, J. (2020). Effect of 3D visualization on students' critical thinking skills and scientific attitude in chemistry. *International Journal of Instruction*, *13*(1), 151–164. https://doi.org/10.29333/iji.2020.13110a

Bhutoria, A., & Aljabri, N. (2022). Managerial practices and school efficiency: a data envelopment analysis across OECD and MENA countries using TIMSS 2019 data. *Large-Scale Assessments in Education*, *10*(1). https://doi.org/10.1186/s40536-022-00147-3

Creswell, J., & Creswell, Jd. (2018). Research Design: Qualitative, Quantitative adn Mixed Methods Approaches. In *Journal of Chemical Information and Modeling* (Vol. 53, Number 9).

Creswell John and Creswell David. (2023). Research Design, Qualitative, Quantitative and Mixed Methods Approaches. In *SAGE Publications,Inc.: Sixth Edit* (Number 1).

Fraenkel, J., Wallen, N., & Hyun, H. (2022). How to Design and Evaluate Research in Education. In *Journal of American Optometric Association* (Vol. 60).

Franco Landa, E. (2025). Recuperando la lengua de herencia: un ciclo de atrición y revitalización del euskera en la diáspora vasca de Boise. *Lengua y Migración*, *2*(17). https://doi.org/10.37536/lym.2.17.2025.2521

Hodaifah, H., Widodo, W., & Prahani, B. K. (2025). Implementation of Interactive Multimedia to Improve Science Literacy of Elementary School Students. *Journal of Innovation and Research in Primary Education*, *4*(3), 653–663. https://doi.org/10.56916/jirpe.v4i3.1416

Li, Q. (2020). Overseeing Memory Circuits by NFIA: New Face In Astrocytes. In *Neuron* (Vol. 106, Number 6). https://doi.org/10.1016/j.neuron.2020.05.027

Liang, G., Fu, W., & Wang, K. (2019). Analysis of t-test misuses and SPSS operations in medical research papers. In *Burns and Trauma* (Vol. 7). Oxford University Press. https://doi.org/10.1186/s41038-019-0170-3

Nurilma, F. R., Supriana, E., & Diantoro, M. (2023). Using STEM-Based 3D-Multimedia to Improve Students' Critical Thinking Skills in Uniform Circular Motion. *Jurnal Pendidikan Fisika*, *11*(2), 193–201. https://doi.org/10.26618/jpf.v11i2.10785

Peter A. Facione. (2015). *Critical Thinking: What It Is and Why It Counts*. Insight Assessment / California Academic Press.

Roath, C., Alkaki, Z. R. A., & James, J. S. (2025). Critical Thinking as a Key to Solving Mathematical Problems: Findings from the TIMSS Framework in Middle Schools. *Interval: Indonesian Journal of Mathematical Education*, *3*(1), 95–101. https://doi.org/10.37251/ijome.v3i1.1626

Rusmini, H., Ulfa, A. M., Fitriani, D., & Rifatunnissa, L. (2021). Studi Literatur Pengaruh Pemberian Ekstrak Daun Bayam Merah (Amaranthus tricolor L.) Terhadap Kadar Sgot Dan Sgpt Pada Tikus Putih (Rattus Norvegicus) Jantan Galur Wistar Yang Diberi Diet Tinggi Lemak. *Prepotif : Jurnal Kesehatan Masyarakat*, *5*(2). https://doi.org/10.31004/prepotif.v5i2.1865

Sejati, A., Wahyuni, L. D., & Fajar Rakhman, G. G. (2025). From Global to Local: Comparative Validation of Quiet Quitting Scales in the Indonesian Workforce. *Dinasti International*

Journal of Education Management And Social Science, *6*(6). https://doi.org/10.38035/dijemss.v6i6.4932

Seventika, S. Y., Sukestiyarno, Y. L., & Mariani, S. (2018). Critical thinking analysis based on Facione (2015) - Angelo (1995) logical mathematics material of vocational high school (VHS). *Journal of Physics: Conference Series*, *983*(1). https://doi.org/10.1088/1742-6596/983/1/012067

Sugiyono. (2022). Metode penelitian kuantitatif kualitatif dan R&D. In *Penerbit Alfabeta*. https://doi.org/WWW.cvalfabeta.com

The Impact of Bybee and Synectics Models on Creativity, Creative Problem-solving, and Students' Performance in Geometry 27 08 2019. (2020). *Journal For Educators, Teachers And Trainers*, *11*(01). https://doi.org/10.47750/jett.2020.11.01.007

Tlili, A., Adarkwah, M. A., Lo, C. K., Bozkurt, A., Burgos, D., Bonk, C. J., Costello, E., Mishra, S., Stracke, C. M., & Huang, R. (2024). Taming the Monster: How can Open Education Promote the Effective and Safe use of Generative AI in Education? *Journal of Learning for Development*, *11*(3). https://doi.org/10.56059/jl4d.v11i3.1657