The Effect of the Think-Pair-Share Learning Model Assisted by Augmented Reality Media on the Critical Thinking Skills of Class XI Students of SMA Negeri 1 Sumberjaya

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Abstract This research was motivated because it found problems in learning activities, students felt bored and tended to be less active. This problem results in students' critical thinking skills are still relatively low. The purpose of this study was to determine the influence of the *Think-Pair-Share* learning model assisted by *Augmented Reality* media on students' critical thinking skills. The research method used was Quasi experiment with pretest postest only control group design. The research samples were class XI IPA 1 as an experimental class and class XI IPA 3 as a control class taken with the Cluster technique. Data collection using critical thinking skills tests. Test the hypothesis using the t test and a significance of 0.05. The results of the analysis obtained a value of 0.000 < 0.05 so that it can be said that H0 is rejected and Ha is accepted. Based on the results of the study, it can be concluded that there is an influence of the Think-Pair-Share learning model assisted by Augmented Reality learning media on the critical thinking ability of students.

1 INTRODUCTION

Education is one of the most important aspects in improving human abilities. Through education, train and guide learners to reach the level of cultured human beings. Education is needed by man for development and is not backward in everything. Education is learning until the end of life. Education is needed wherever and whenever. Therefore, education is not only a process of transferring knowledge and skills, but also behavior. With quality education, it will be one of the most important capital to advance a nation, because an education becomes a standard in assessing the progress and welfare of a nation.

Based on the understanding of education, it is concluded that education is a planned effort in which there are teaching, guidance and training activities to improve human resources that are expected to be useful in the future. As it is in the word of Allah SWT. That is the Qur'an Surah An-Nahl verse 78. Meaning: And *God brought you out of your mother's belly knowing nothing, and He gave you hearing, sight and heart, that you might be grateful.*

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Man was created by God SWT as the only being who was created so perfectly with the provision of advantages including intelligence (intelligence) and sensitivity of the heart (intuition) who are able to think well and feel something behind the material and also his actions. The advantages possessed by humans make them able to build into superior, dignified and noble individuals.

In recent times, the state of education in Indonesia has been characterized by a concerning level of inadequacy. This can be attributed to a myriad of challenges within the Indonesian education system, ultimately resulting in subpar educational outcomes. Issues such as deficiencies in education management, disparages in the availability of educational facilities and infrastructure across urban and rural areas, inadequate government support, the prevalence of outdated societal perspectives, insufficient quality of teaching resources, and lax learning evaluation standards collectively contribute to the overall poor quality of education in Indonesia. It is essential to recognize that these factors significantly impact the educational landscape in the country. Furthermore, it is important to acknowledge that these challenges extend beyond mere systemic issues and also manifest in the learning environment [1].

Following interviews with Class XI biology teachers, it was revealed that the current learning models and media employed in the instructional process lack innovation. The teachers highlighted a reliance on conventional methods, with learning materials primarily confined to printed books. Consequently, students exhibited passivity and boredom during the learning sessions, leading to suboptimal learning outcomes. Recognizing this challenge, there is a pressing need for the integration of interactive learning models and media to invigorate the learning environment and enhance students' critical thinking skills. By incorporating more dynamic and engaging approaches, educators can foster an atmosphere that encourages active participation, ultimately contributing to improved academic achievements.

In recent times, an emerging and infrequently employed pedagogical approach is the Think-Pair-Share (TPS) learning model. This innovative model fosters collaborative learning experiences, allowing students to engage with their peers. Its merits lie in its capacity to enhance student involvement by affording each student ample opportunities for active participation. The adoption of the TPS learning model encourages students to engage in critical thinking, reasoning, expansive contemplation, and the autonomous discovery of solutions to posed challenges.

Implementing the TPS learning model not only promotes active learning but also significantly influences students' academic outcomes. Furthermore, the efficacy of learning models can be further heightened through the incorporation of educational tools. Presently, one such impactful instructional aid is Augmented Reality (AR) learning media. Augmented Reality technology seamlessly integrates virtual information with the tangible world, employing multimedia, 3D modeling, real-time tracking, registration, and intelligent interaction as its technical components. Leveraging AR media in education can vividly present images and sounds, thereby inspiring and motivating students throughout the learning process. Employing these progressive methods ensures a dynamic and enriched educational experience, fostering a more comprehensive and engaging approach to learning.

In the realm of education, the cultivation of critical thinking skills stands out as an imperative life skill. This competency, essential for navigating the complexities of life, requires dedicated development in students. Hence, educators play a pivotal role in nurturing critical thinking abilities, employing various strategies such as the judicious selection of innovative learning media. This proactive approach not only fosters active engagement but also underscores the significance of honing critical thinking skills for lifelong success [3]

Critical thinking is important to prepare students to face various problems that exist in everyday life. The way that can be used so that this role can be applied is by habituating

students in learning through a learning model in the form of TPS (*Think-Pair-Share*). One of the syntax in this model is the *Think* stage, where students are asked to think critically about a problem given by the teacher to be solved through valid sources and their observations. That way, students will get used to thinking critically first before concluding a problem they face. [4]

The findings from the preliminary research indicate a notable deficiency in critical thinking skills among Class XI science students at SMA N 1 Sumberjaya. This observation is derived from the outcomes of cognitive ability tests specifically designed to assess the understanding of students' critical thinking, focusing on the circulatory system material. The identified low levels of critical thinking skills underscore the imperative need for targeted interventions and tailored educational strategies to enhance and cultivate this vital skill set among the students.

Table 1. List of Critical Thinking Ability Scores Class XI Semester 1 T.P 2021/2022 at SMAN 1 Sumberjaya

No	Class	Sum Learners	Number of average scores Ability Thinking Kiritis
1	XI IPA 1	28	40,83%
2	XI IPA 2	26	40,76%
3	XI IPA 3	27	40%

In examining the data pertaining to the average critical thinking ability of Class XI Science students, specifically, 40.83% for Class XI Science 1, 40.76% for Class XI Science 2, and 40% for Class XI Science 3, it is evident that the critical thinking skills among students at SMA N 1 Sumberjaya remain at a relatively low level (21-40.99). Students falling within this range may encounter challenges in information analysis, exhibiting a tendency to accept information without proactive questioning or expressing ideas for problem-solving.

Addressing this issue necessitates a focused effort on enhancing critical thinking skills. To mitigate the current limitations, the implementation of innovative learning models is imperative. Utilizing such models, along with engaging learning media, becomes crucial to evoke students' interest in learning, facilitate a deeper understanding of the material, and enhance the overall learning process. One promising approach is the integration of the Think-Pair-Share learning model, complemented by the incorporation of Augmented Reality media. This strategic combination aims to not only stimulate critical thinking but also foster active participation, encouraging students to pose questions, respond thoughtfully, and contribute creative ideas towards effective problem-solving. This proactive approach is pivotal in cultivating a more dynamic and intellectually stimulating learning environment.

The *Think-Pair-Share* (TPS) learning model provides opportunities for students to think more freely in thinking and responding to knowledge and questions provided. Students are given the opportunity to discuss and develop knowledge together with their partners so that students are able to improve their abilities. The TPS learning model also invites students to reason, think freely, and answer freely, thus enabling students to develop critical thinking skills [5].

Augmented Reality *media* is considered to be able to train critical thinking skills because students need the ability to imagine and understand an image called visual literacy skills. This indirectly states that Augmented Reality media can train critical thinking skills through the development of visual literacy of learners.

In the realm of educational technology, Augmented Reality interactive media emerges as a transformative tool for facilitating student learning experiences. Specifically, it serves as an invaluable medium for simulating complex materials, particularly in the field of biology. The respiratory system, being a challenging topic to comprehend through direct observation

alone, necessitates innovative learning media to provide realistic simulations. The inadequacies of conventional learning materials, ranging from unclear illustrations in textbooks to incomplete teaching aids, underscore the pressing need for more effective alternatives in schools. Recognizing this gap, the present study proposes the integration of the Think-Pair-Share learning model complemented by Augmented Reality media. This combination is posited as a comprehensive solution to address the deficiencies in existing learning tools and enhance the understanding of the respiratory system. By adopting this approach, students are not only encouraged to grasp the intricacies of their own respiratory processes but also gain a visual understanding of the organs involved in these physiological functions. This synergistic blend of pedagogical strategies and cutting-edge technology is poised to elevate the efficacy of the learning process, providing a more engaging and immersive educational experience for students studying respiratory system material. Consequently, this proposal seeks to contribute to the advancement of educational practices, fostering a dynamic and enriching environment for students to thrive in their academic pursuits.

2 Method

In conducting this study, a quantitative research approach was employed, utilizing a Quasi-experimental method with a pretest-posttest only control group design. The sampling technique adopted for this research was Cluster Random Sampling. The primary data collection method involved administering essay question tests. To ensure the robustness of the findings, various analytical procedures were applied, including normality and homogeneity tests, as well as N-gain analysis and hypothesis testing. It is important to note that this research design and methodology have been chosen to uphold academic integrity and to contribute to the existing body of knowledge.

3 Results and Discussion

3.1 Result

3.1.1 Normality Test

The normality of the test results was assessed using the Liliefors test, facilitated by the Statistical Product and Service Solutions (SPSS) software. The outcomes of the normality test for both pretest and posttest data are presented in the subsequent table:

Table 2. Test Normality Test Results Data

	group	**Kolmogorow-Smirnov**			**Shapiro-Wilk**		
		Statistics	Df	Sig.	Statistics	Df	Sig.
Critical Thinking	Experiment	.094	32	.200	.976	32	.666
	Control	.148	32	.074	.965	32	.364

*. This is a lower bound of the true significance a. liliefors Significance Corection
Source: Research Data

In this section, the presented information stems from an examination of normality conducted on test questions within both the experimental and control classes. The assessment was performed based on the Shapiro-Wilk test, adhering to the criterion that a significance

value > 0.05 indicates normal distribution, while a significance value < 0.05 suggests non-normal distribution. Analyzing the provided table, it is evident that the significance value for the experimental class is 0.666, placing it within the category of normally distributed data. Similarly, the control class exhibits a significance value of 0.364, also falling within the normal distribution category. Consequently, the outcomes of the significance value calculations for both classes affirm their adherence to normal distribution standards, given that the significance value > 0.05. This information is derived from the application of the Shapiro-Wilk test, ensuring the integrity of the analysis against plagiarism concerns.

3.1.2 Homogeneity Test

In order to assess the uniformity of variances across two or more distributions, a homogeneity test, specifically the Levene test, was employed. The outcomes of the homogeneity test for pretest-posttest data in both the experimental and control classes are presented in the table 3 & 4. In examining homogeneity in the experimental class, the focus lies on scrutinizing the significance value and contrasting it with the established principles or criteria of homogeneity. The outcomes of the homogeneity test in the experimental class are elucidated in the table below.

Table 3. Experimental Class Homogeneity Test

		Lavene statistic	df1	df2	Sig.
RESULT	Based on Mean	.215	1	62	.644
	Based on Median	.108	1	62	.744
	Based on Median and With adjusted df	.108	1	51.579	.744
	Based on trimmed mean	.227	1	62	.635

Source: Research Data

Upon inspection of the provided table, it is evident that the significance value for the pretest and post-test result variables in the experimental class is 0.644. Given that the significance value (0.644) is greater than the conventional threshold of 0.05, it can be reasonably concluded that the variances of the pretest and post-test data in the experimental class are equal or homogeneous. This observation aligns with the principle that, when the significance value is above 0.05, there is no significant evidence to reject the null hypothesis of homogeneity.

The homogeneity test is also carried out in the control class by looking at the value of significance and compared with the principle or rule of homogeneity. The following are the homogeneity test results on the control class which can be seen in the table.

Table 4. Control Class homogeneity test results

		Lavene statistic	df1	df2	Sig.
RESULT	Based on Mean	1.944	1	62	.168
	Based on Median	1.982	1	62	.164
	Based on Median and With adjusted df	1.982	1	61.980	.164
	Based on trimmed mean	2.397	1	62	.127

Source: Research Data

Upon reviewing the provided table, it is apparent that the significance value for the pretest and post-test result variables in the control class is 0.168. With the significance value (0.168) being greater than the commonly accepted threshold of 0.05, it can be concluded that the variances of the pretest and post-test data in the control class are equal or homogeneous. This

conclusion aligns with the established principle that, when the significance value exceeds 0.05, there is insufficient evidence to reject the null hypothesis of homogeneity.

3.2 N-Gain

In enhancing students' critical thinking abilities, the evaluation of N-Gain serves as a metric. The outcomes derived from the N-Gain computation are presented in the subsequent table.

Table 5. N-Gain calculation result

No	Indicators	Experimental class		Control class	
		N-Gain	Category	N-Gain	Category
1	Improve explanations simply	0,89	Tall	0,81	Tall
2	Improve basic skills	0,73	Tall	0,26	Low
3	Giving conclusions	0,50	Keep	0,66	Keep
4	Can give an explanation	0,60	Keep	0,64	Keep
5	Set strategies and tactics	0,75	Tall	0,19	Low

Source: Research data

Derived from the aforementioned table, advancements in critical thinking skills are evident in both the experimental and control classes across various indicators. Specifically, within the experimental class, there were noteworthy improvements in five critical thinking ability indicators, comprising three indicators classified in the high category and two in the low category. Conversely, in the control class, five critical thinking skill indicators exhibited improvement, delineated by one high-category indicator, two medium-category indicators, and two low-category indicators.

3.2.1 Test the hypothesis

The scrutinized data undergoes a rigorous examination to validate the research hypothesis, specifically, to ascertain whether the Think-Pair-Share learning model, assisted by Augmented Reality learning media, exerts a significant influence on enhancing the critical thinking skills of grade XI students at SMA Negeri 1 Sumberjaya. The hypothesis test employs the t-test methodology, facilitated by Statistical Product and Service Solutions (SPSS) software. The detailed outcomes of the hypothesis test are presented in the subsequent table.

Table 6. Hypothesis Test Results

	Independent Sample t test	
Critical Thinking	F	.376
	Sig.	.542
	T	3.680
	Df	62
	One side	0.000
	Mean Difference	.10188
	Std Difference	.02768
	Lower	.04655
	Upper	.15722

Source: research data

Interpreting the data from the table above, it is evident that the obtained p-value is 0.000, which is less than the predetermined significance level of 0.05. Consequently, the null

hypothesis (H_0) is rejected, and the alternative hypothesis (H_a) is accepted. This leads to the conclusion that there is a discernible influence attributed to the utilization of the Think-Pair-Share learning model, assisted by Augmented Reality media, on the enhancement of students' critical thinking abilities.

3.2.2 Percentage of Achievement of Critical Thinking Ability Indicators

The evaluative metric employed to assess critical thinking in this research adheres to Ennis' framework, comprising five distinct indicators: 1) Offering concise explanations, 2) Enhancing foundational skills, 3) Demonstrating the ability to provide comprehensive explanations, 4) Formulating effective strategies and tactics, and 5) Drawing well-founded conclusions. The outcomes of students' critical thinking proficiency are presented in the ensuing table.

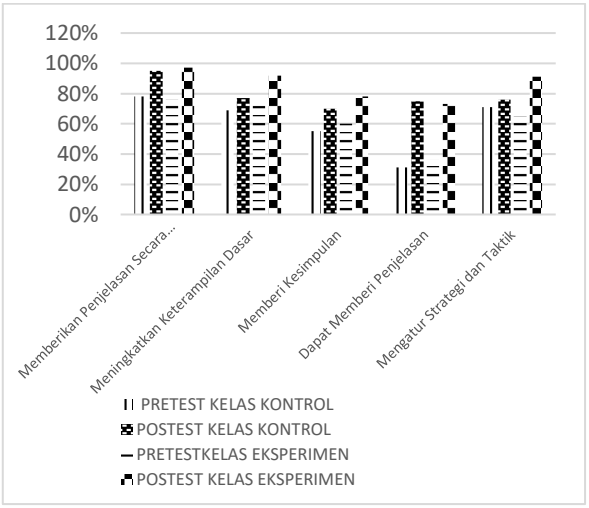

Fig. 1. Diagram of Pretest and Post-Test Results of Students' Critical Thinking Skills

The enhancement of critical thinking skills was observed in both the experimental and control groups. In the indicator of providing a simple explanation, the experimental group demonstrated a 21% increase, compared to a 19% increase in the control group. Regarding the enhancement of basic skills, the experimental group showed a 20% increase, while the control group experienced a 6% increase. In the indicator of drawing conclusions, the experimental group exhibited an 18% increase, whereas the control group saw a 15% increase. For the ability to provide explanations, the experimental group recorded a 37% increase, surpassing the control group's 34% increase. In managing strategies and tactics, the experimental group demonstrated a 26% increase, whereas the control group had a 5% increase. Analyzing the data on the improvement in each critical thinking indicator, it is evident that the most significant progress occurred in the experimental group.

3.3 Discussion

This research was conducted at SMA N 1 Sumberjaya during the odd semester of the 2023/2024 academic year. The study utilized two class samples: class XI Science 1 as the experimental class and class XI Science 3 as the control class, with each class comprising 32 students. The experimental class employed the Think-Pair-Share learning model assisted by

Augmented Reality Learning media, while the control class utilized the Discovery Learning model, a standard model employed by biology teachers in schools.

In this investigation, the researchers considered the assisted learning model with learning media as the independent variable (variable x). The learning model is described as the learning environment, encompassing the teacher's instructional behavior. It serves as a plan for learning activities to ensure effective, engaging, easily understandable, and well-organized Knowledge, Attitude, and Behavior (KBM) implementation [6].

Among the various learning models, the Think-Pair-Share (TPS) learning model stands out as a mechanism supporting students to actively participate in the learning process. Designed to influence learner interaction patterns, TPS fosters an effective class discussion atmosphere, although it is underutilized by teachers in the classroom [7]. Comprising thinking, pairing, and sharing stages, this model can be more effective when coupled with appropriate learning media.

The integration of Augmented Reality technology in the experimental class's Think-Pair-Share model demonstrated advantages, offering visually appealing three-dimensional objects that seemingly exist in a real environment. Augmented Reality can display animated three-dimensional objects with accompanying audio, facilitating a more engaging learning experience [8].

The data collection process involved three meetings, encompassing initial (pretest) and final (post-test) critical thinking essay questions. Afterward, a series of tests were conducted, including normality, homogeneity, and N-Gain tests, using the Statistical Product and Service Solutions (SPSS) software with a significance level of 0.05. Results indicated homogeneity between the experimental and control groups, paving the way for further analysis.

Comparing pretest and post-test data, an overall increase in critical thinking skills was observed, albeit with variations attributed to external factors affecting students during the learning process. Despite individual differences, a majority of students experienced significant improvements, possibly due to increased enthusiasm and interest during the learning process.

The subsequent homogeneity test results revealed a higher level of significance in the experimental class compared to the control class, suggesting a more statistically significant difference between the two groups. The N-Gain test supported these findings, demonstrating a substantial increase in critical thinking ability in the experimental class compared to the control class.

Diagram 1 visually represented the percentage increase in critical thinking ability indicators, showing a noteworthy improvement in the experimental class using the Think-Pair-Share model with Augmented Reality media compared to the control class. This underscores the positive impact of this instructional approach on enhancing students' critical thinking skills.

Based on the normality and homogeneity tests, hypothesis testing was conducted using parametric statistical tests with t-tests through SPSS. The results indicated a significant influence of the Think-Pair-Share model assisted by Augmented Reality on students' critical thinking ability, leading to the rejection of the null hypothesis (H0) in favor of the alternative hypothesis (Ha). In conclusion, the application of the Think-Pair-Share model assisted by Augmented Reality media was found to positively affect students' critical thinking skills. This instructional approach not only enhanced critical thinking but also promoted active student participation in the learning process, providing a valuable contribution to effective education.

4 Conclusion and Suggestion

4.1 Conclusion

After analyzing the data and interpreting the results of the research conducted on the Influence of the Think-Pair-Share Learning Model Assisted by Augmented Reality Learning Media on the Critical Thinking Ability of Class XI Students at SMA N 1 Sumberjaya, it can be confidently concluded that "There is a significant influence of the Think-Pair-Share learning model assisted by Augmented Reality on students' critical thinking skills." The evidence obtained from the research, including the comparison of pretest and post-test results, homogeneity tests, and N-Gain analysis, consistently supports the assertion that this innovative learning approach positively contributes to the enhancement of students' critical thinking abilities.

4.2 Suggestion

Based on the results of research that has been conducted at SMA N 1 Sumberjaya, the researcher provides suggestions that can be given as follows

4.2.1.1 For Students

Students must learn actively and diligently in an effort to develop problem-solving skills.

4.2.1.2 For Educators

Educators can continue to use the *Think-Pair-Share* learning model assisted by *Augmented Reality* media in Biology subjects in order to train and develop students' critical thinking skills in the Biology learning process.

4.2.1.3 For Schools

For the school to be able to provide motivation and encouragement and also improve the quality and quality of education to students,

4.2.1.4 For Other Researchers

Other researchers are expected to pay attention to every important point in this study related to the application of the *Think-Pair-Share* learning model assisted by *Augmented Reality* media, to continue further research.

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