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The Effect Of The Kahoot-Assisted Discovery Learning Model On The Mathematical Critical Thinking Ability

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Abstract: The purpose of this study is to ascertain how the Discovery Learning learning paradigm, with Kahoot's assistance, affects the mathematical critical thinking abilities of SMAN 1 Utan class X pupils throughout the 2024/2025 academic year. This type of research is a quasi-experimental with a Post-test Only Control Group Design, involving two classes, namely the experimental class (X-6) and the control class (X-5). While the control class employs a traditional learning model, the experimental class uses the Discovery Learning learning paradigm with Kahoot's help. Post-test questions on critical thinking abilities and observation sheets for learning implementation serve as the research tools. According to the findings, the experimental class's average post-test score was 78.27, which was higher than the control class's average score of 64.89. A statistically significant difference between the two classes was revealed by the Mann-Whitney U test. With an effectiveness of 78.93%, the effect size (Cohen's d) of 0.80407 suggests a moderate effect. The experimental class is primarily in the very high category on the interpretation and evaluation indicators, while the control class is primarily in the high category on the analysis indicator and low on the inference indicator, according to the distribution of critical thinking ability categories by indicator. These results indicate that the use of Kahoot-assisted Discovery Learning can influence students' critical thinking abilities overall.

Keywords: Discovery Learning; Critical Thingking Skills; Mathematics Learning; Quasi Experiment.

Introduction

The Independent Curriculum implemented through Permendikbudristek No. 12 of 2024 emphasizes the development of character and competencies in the 21st century, one of which is critical thinking. The critical thinking skills in this independent curriculum include more than just analytical skills, but also the ability to make assessments, consider various perspectives, and solve problems rationally and responsibly. stating that critical thinking skills can be trained through mathematics learning. Amalia, Scholar, et al. (2022)

This proves that critical thinking skills are crucial in mathematics learning because they allow students to understand problems, design solution strategies, evaluate processes and work results,

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and draw logical conclusions. Thus, strengthening mathematical critical thinking skills must be a top priority in mathematics learning activities in schools.

According to stating that critical thinking involves the process of understanding the problem, carefully collecting and analyzing information, and concluding results appropriately and responsibly. adding that a critical thinker is one who can explain his reasons for his choice, accept differences of opinion and conduct an objective analysis of other people's arguments. In line with that, it states that critically thinking students can collect the necessary data effectively as well as creatively, as well as ask and answer questions correctly. Rega Yuniar et al. (2022) Turmuzi et al. (2021) Rizqiani, Sridana, Junaidi, & Kurniati (2023)

(Facione, 2011) Identify critical thinking indicators, namely interpretation, analysis, inference, explanation, evaluation, and self-regulation. In this study, only 4 indicators from Facione were used, namely interpretation, analysis, evaluation, and inference. Interpretation is the ability to understand and explain the meaning of things such as data or opinions. Analysis is the ability to understand the relationship between ideas. Evaluation is the ability to assess existing information, consider options and make decisions. Whereas, inference is the ability to draw conclusions from existing information and make decisions. The selection of these four indicators is based on the view that "explanatory skills" and "self-regulation" are related to the ability to explain what one thinks and the process used to reach conclusions when making inferences. The selection of the critical thinking indicator from Facione is based on its suitability with the definition used in the research, namely the ability to solve problem-solving problems. Karim & Normaya (2015)

However, although the importance of critical thinking skills has been emphasized a lot, facts show that students' mathematical critical thinking skills are relatively low. Referring to the initial observation that took place at SMAN 1 Utan, it is known that class X students have not shown optimal critical thinking skills. This can be seen from the initial tests analyzed using the Facione indicator. For example, in questions related to bacterial growth, some students can indeed understand basic information (interpretation) but make many mistakes in analyzing growth patterns (analysis), do not re-examine the calculation steps (evaluation), and the conclusions drawn are not based on the right arguments (inference).

This was reinforced by the acquisition of an interview with a mathematics teacher on February 3, 2025. The teacher said that students still had difficulty understanding reasoning problems and evaluating their own answers. The teacher mentioned that the commonly used learning methods are lectures, discussions, and peer tutors with learning media in the form of LKPD which is considered less innovative and a factor in students' low critical thinking skills. Thus, an innovative learning model such as discovery learning is needed that emphasizes the exploration and discovery of concepts by students actively with the guidance of teachers. states that in this model students are challenged to find patterns, compile generizations, and draw conclusions from their learning experiences. This learning model is considered to be able to improve extra thinking skills, especially critical thinking skills. Hosnan (2014)

In the discovery learning paradigm, students find the concepts or material they are learning independently without the teacher providing an in-depth explanation. Whereas according to encouraging students to discover and research topics independently, the discovery learning model aims to improve their active learning strategies. As a result, the information studied by students can linger long in their memory and be difficult not to remember. Therefore, in conclusion, discovery leanring encourages active thinking processes and independent inquiry to discover concepts. The Ministry of Education and Culture (2013) mentions six steps of (Fadilah Wulan Dari & Syafri

Ahmad, 2020) Endang Titik Lestari (2020) *discovery learning*: providing stimulation, problem identification, data collection, data processing, verification, and drawing conclusions.

To support the success of the discovery learning model, a learning medium that is able to increase student involvement is needed. The use of learning media has been proven to help students absorb learning faster and make learning activities more effective. Based on the results of observations, SMAN 1 Utan students are allowed to use cellphones in learning and prefer interactive and fun learning. One of the relevant media that supports the application of the discovery learning model is Kahoot, which is a game-based learning platform that allows students to answer quizzes directly through cellphone devices in a fun, competitive, and interactive atmosphere. According to this, it can strengthen the conditions of education, learning and make the classroom environment conducive and comfortable. In line with that, interactive learning media can strengthen students' critical thinking skills. (Hariyanti, Arjudin, & Baidowi, 2021) Yulis Tyaningsih, Biography, Scholar, & Prayitno (2022) Noviyanti et al. (2024)

This hail is in line with research that has been conducted showing that with a Delta Cliff value of +0.591, students who were taught using the TGT model with the help of Kahoot showed a significant difference in their average critical thinking skills compared to students who were taught using the conventional model. Therefore, the purpose of the study is to determine the impact of the discovery learning model assisted by Kahoot on the mathematical critical thinking skills of class X students at SMAN 1 Utan. Yushak Willian Siahaan (2024)

Method

To show the impact of a therapy on outcomes, this study used an experimental research design. . This type of study uses a control group design with post-treatment tests and is quantitative in nature. The purpose of this study is to determine the impact of the Kahoot-assisted discovery learning model on the mathematical critical thinking skills of grade X students. (Farhan Arib et al., 2024)

This study took place at SMAN 1 Utan in the research population of all classes X which was composed of 8 classes and selected a research sample of 2 classes. Where X-6 is the experimental class and X-5 is the control class. Clustered random sampling is used to select samples. Trials and observation sheets are among the methods used to collect data. The test consisted of 4 questions describing the material of the row and series to find out the ability after being given treatment. Meanwhile, the observation sheet of educator activities and the observation sheet of student activities form observation sheets, which are used to evaluate how learning is carried out in accordance with the module. Descriptive quantitative data analysis and inferential statistical analysis are used as data analysis methods. The researchers applied the following assessment guidelines to evaluate test results: assessment criteria for the evaluation of mathematical critical thinking skills.

Table 1 : Guidelines for Scoring the Mathematical Critical Thinking Ability Test

Indicator	Student Responses to Questions	Score
Interpretasi	Not writing question information or not answering	1
	Writing information about some of the truth, part or all of it.	2
	Write complete information about the question	3
Analysis	Not writing down any information at all	1
	Describing some information correctly, or describing but incorrect	2
	Describe the information of the question and relate the information logically and accurately.	3
Evaluation	Does not assess the accuracy of the method	1

	Assessing the accuracy of some aspects, but there are deficiencies in assessing the method, or assessing the accuracy of aspects but all wrong	2
	Assess the accuracy of the method or answer appropriately and critically.	3
Inference	Not making any conclusions at all.	1
	Partially inferred with limited support or inferred but incorrectly	2
	Conclude logically and according to information.	3

Result and Discussion

Results

Data on the activities of educators and students during the learning stage were obtained by observation sheet instruments, the results of which are shown in Table 2 and Table 3 below.

Table 2 : Results of Teacher Activity Observation Sheet

Indicator	Experimental Classes					Control Class				
	Shoes									
	P. I	P. II	P. III	P. IV	Skor Mak.	P. I	P. II	P. III	P. IV	Skor Mak.
Introductory activities	5	5	5	5	5	4	4	4	4	4
Core activities	5	5	5	7	7	6	4	5	5	6
Closing activities	3	2	3	3	3	3	3	0	3	3
Total score	13	12	13	15	15	13	11	9	12	13
Presentation	86,6%	80%	86,6%	100%		100%	84,6%	69,2%	92,3%	
Category	SB	SB	SB	SB		SB	SB	B	SB	

Table 3 : Results of Student Activity Sheets

Indicator	Experimental Classes					Control Class				
	Shoes									
	P. I	P. II	P. III	P. IV	Skor Mak.	P. I	P. II	P. III	P. IV	Skor Mak.
Introductory activities	4	4	4	4	4	4	4	4	4	4
Core activities	4	4	3	5	5	6	4	5	5	6
Closing activities	2	2	2	2	2	2	2	0	2	2
Total score	10	10	9	11	11	12	10	9	11	12
Presentation	90,9%	90,9%	81,8%	100%		100%	83,3%	75%	91,6%	
Category	SB	SB	SB	SB		SB	SB	B	SB	

Description :
P : Meeting
SB : Very Good
B : Good

The implementation of experimental classroom learning from the first to the fourth meeting is included in the Very Good category, according to Tables 2 and 3. This shows that the implementation of the Kahoot-assisted discovery learning model is carried out optimally and consistently during the learning process. Meanwhile, the implementation of learning in the control class was also in the very good category, except in the third meeting which showed a percentage of 69.23% which was included in the Good category. This decline is caused by delays in starting learning and less than optimal time management and classroom management by teachers which causes the learning flow

to be less structured. This has an impact on a less conducive classroom atmosphere where some students become noisy, pay less attention to the teacher's explanations and even disturb the concentration of other students. This disorder further hinders the learning process, especially when the closing stage cannot be carried out properly. This condition shows that although the students' activities in the control class are relatively good, their involvement is not as optimal as the students in the experimental class.

The results of the post-test of mathematical critical thinking ability can be observed in the following table;

Table 4 : Post-test Results of Mathematical Critical Thinking Ability

Classes	Number of Students	Average Score	Highest Score	Lowest Score
X-5 (Control)	**33**	**65,899**	**100**	**41,67**
X-6 (Experiment)	**28**	**78,274**	**100**	**56,25**

Table 5 : Distribution by Critical Thinking Ability Category

Value Interval	Kateogri	*f*	
		Experimental class	Control Class
81.25 < x ≤ 100	Very High	12	6
71.5 < x ≤ 81.25	Height	6	4
62.5 < x ≤ 71.5	Medium	2	1
43.75 < x ≤ 62.5	Low	8	18
0 ≤ x ≤ 43,75	Very Low	0	4
Total		28	33

Description : (Source: Danaryanti & Lestari, 2017)

X : the value of the student's post-test results

The difference in distribution between categories indicates the impact of the discovery learning model on students' critical thinking skills. These findings support the finding that learning models involving exploration and interactive media tend to encourage the enhancement of higher-level thinking skills. These findings are in line with a study conducted by , which indicates that students' critical thinking skills in mathematics can be significantly improved by using interactive learning resources such as Kahoot, as they encourage active engagement and higher learning motivation. Yushak Willian Siahaan (2024)

Then the results of the post-test will be tested for normality, homogeneity test, hypothesis test, and effect size test. The following are the test results.

Table 6 : Normality Test Results Post-test Results

Classes	Number of students	x^2_{hitung}	x^2_{tabel}	Tarsf sig.	Conclusion
Control	33	37,22157	9,488	5%	Data is not normally distributed
Eksperimen	28	13,68004	5,991		

The calculation obtained shown in table 5 indicates that $x^2_{hitung} \geq x^2_{tabel}$ at a significant level of 0.05 then the conclusion is that the data is not normally distributed.

Table 7: Homogeneity Test Results Post-test Results

F_{hitung}	F_{tabel}	Grade sig.	Conclusion
1,284844	1,872451	5%	Variansi homogen

Based on the calculation obtained seen in table 6 indicates that $\boldsymbol{F_{hitung} \leq F_{tabel}}$ at a significant level of 0.05 so that it can be concluded that the data varies homogeneously. The Mann-Whitney U test, a non-parametric test, is applied to test hypotheses because the data are not distributed normally. The calculation of the Mann-Whitney U test was carried out with the help of SPSS. Based on the calculation obtained in figure 1, it can be observed that the score of sig. namely 0.004 which is smaller than the significant level of 0.05 so that it is rejected and accepted. $H_0 H_a$With its acceptance, it can be concluded that the average critical thinking skills of the experimental class that apply the discovery learning model through the help of Kahoot are different from the average critical thinking skills of the control class that uses conventional methods. Apparently, the average value of the experimental class was greater than that of the control class. This indicates that in the 2024–2025 school year, grade X students at SMAN 1 Utan have better critical thinking skills thanks to discovery learning supported by Kahoot.H_a

Table 8 : Effect Size Test Results Post-test Results

Classes	Number of Students (n)	Post-Test Average (M)	Baku Junction (SD)	SDpolled	Cohen's D
Eksperimen	28	78,27381	15,48085	16,63375	0,804077
Controls	33	64,89899	17,54769		

Based on table 7, the effect size test with a Cohen's D score of 0.804 shows where this score is in the medium group according to the Cohen's value interpretation criteria. If converted into percentage, the effect size score of 0.804 is equivalent to an effectiveness of 80.40%. The following indicates that when compared to conventional learning, the discovery learning method supported by Kahoot significantly improves students' mathematical critical thinking skills.

Discussion

Based on the acquisition of observation sheets on the implementation of learning in experimental classes that applied the Kahoot-assisted discovery learning model, it was recorded to be in the very good category in all meetings, showing that this model can be applied optimally in the context of class X of SMAN 1 Utan. On the other hand, at the third meeting, the implementation rate dropped to 69% for the control group using conventional teaching techniques. This indicates that there are challenges in maintaining the consistency of student involvement in conventional learning models.

This difference in implementation reinforces that the discovery learning model assisted by Kahoot can create an active, exploratory, and meaningful classroom atmosphere compared to conventional learning. Students' active involvement in the thinking process, group discussions, and interactive evaluations is key to learning success in encouraging mathematical critical thinking skills. This result is consistent with Trianto's (2011) statement that the constructivist learning approach will be successful if students play an active role directly in the process of building their understanding. However, the successful implementation of the discovery learning model assisted by Kahoot is also inseparable from challenges, such as unstable internet connections, suboptimal time management, and inequality of participation in group discussions. These constraints are important considerations in the development and planning of innovative learning in the future.

Based on the post-test analysis, students in the experimental class who received learning using the Kahoot-powered discovery learning approach scored higher on average (78.27) than students in the control group (65.89). The results of the Mann-Whitney U test indicated that there was a significant difference between the two classes, with a significance score of less than 0.05. This improvement shows how effective the student-focused discovery learning approach supported by Kahoot is in increasing motivation, engagement, and critical thinking skill development. According to the opinion, the gamification element in Kahoot is able to increase student participation through

competitions and direct feedback. Thus, one of the tactical options for developing mathematical critical thinking skills is discovery learning, which is powered by Kahoot. Zichermann & Cunningham (2011)

Data analysis based on critical thinking ability criteria provides a clear picture of the impact of the learning model on different levels of student ability. 5 categories make up the criteria used in this study: Very High, High, Medium, Low, and Very Low. Based on the research findings, there were more students in the Very High, High, and Medium categories in the experimental class than in the control group. In contrast, the experimental class had fewer students in the Low and Very Low categories than the control group. This shows that the discovery learning approach can help students develop high-level thinking skills, which are very important for critical thinking. By providing students with the opportunity to explore, process data, analyze, and draw their own conclusions, they are better trained in interpreting information, evaluating solutions, and inferring logically, all of which are key indicators in critical thinking according to . Meanwhile, students in control classes who applied conventional approaches tended to understand only the material on the surface and received less stimulus to think deeper. This makes their achievements stagnant in the "Low" category. This difference in the distribution of categories provides additional evidence that Ennis (2011) *the Kahoot-assisted* Discovery Learning *model* not only provides average scores, but plays a role in shaping students' thinking skills more comprehensively. Given the importance of critical thinking as a key soft skill in the 21st century, its development needs to begin as early as possible.

The implementation of the discovery learning model supported by Kahoot has a significant correlation with the improvement of critical thinking skills in students' mathematics learning, of course in the indicators of interpretation, analysis, evaluation, and inference. Each stage in this model contributes to the critical thinking aspect. At the stimulation and problem statement stage, students are faced with contextual and triggering problems through Kahoot which encourages interpretation skills, namely understanding the meaning of mathematical information and organizing it into appropriate representations (Facione, 2011). The data collection and data processing stage requires students to process information independently, related to analysis indicators. However, the results show that the analytical ability of students in the experimental class has not been maximized, so it is necessary to strengthen scaffolding (Syafitri et al., 2023). At the verification stage, Kahoot acts as a reflective tool to help students evaluate the accuracy of the solution and the settlement strategy used. This supports evaluation indicators (Facione, 2011) and improves students' metacognitive awareness (Pangestuti et al., 2019). The generalization stage develops the ability to inference, which is to draw logical conclusions from patterns or data. The use of pattern-based questions in Kahoot shows that many students of the experimental class are able to draw conclusions appropriately, in line with the findings of Mugi Arto et al. (2025).

Overall, the use of the Discovery Learning model with the help of Kahoot showed a positive impact on developing students' mathematical critical thinking skills, especially on indicators of interpretation, evaluation, and inference. This integration between models and media encourages more active, in-depth, and problem-solving-based learning

Conclusion

The results of the analysis and discussion indicated that the Kahoot-assisted discovery learning model significantly affected the mathematical critical thinking skills of grade X students at SMAN 1 Utan with an average score of 78.27 for the experimental class and 65.89 for the control class. The statistical test on the Mann-Whitney U test obtained a significance score of $0.004 < 0.05$. Overall, the use of the Discovery Learning model with the help of Kahoot showed a positive influence on the development of students' critical thinking skills in mathematics, especially in the areas of

interpretation, assessment, and reasoning. This integration between models and media encourages more active, in-depth, and problem-solving-based learning

Based on the results of the research implementation, there are several things that need to be considered so that the application of *the Kahoot-assisted* Discovery Learning learning model can run more optimally, including (1) Teachers can set class agreements related to the use of cellphones and appoint students as group supervisors so that device abuse does not occur, (2) Teachers can download questions first, utilizing *Challenge* modeor *Team Mode* on *Kahoot*, as well as preparing a printed version of the questions as a backup and coordinating with the school to get network support if the internet connection is unstable, (3) Teachers are advised to develop a more structured time plan and set time limits so that less time management can be overcome, (4) Teachers can assign or share assignments to each student to address student participation in discussions groups that are still not all active, (5) Teachers can implement firm but positive classroom management, give rewards for orderly students, and take a personal approach to students who tend to be disruptive in order to create a conducive and fun learning atmosphere for all students.

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