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THE EFFECT OF GAMIFICATION STRATEGIES ON MATHEMATICS LEARNING OUTCOMES IS REVIEWED BASED ON SELF-EFFICACY

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Abstract

This study aims to explain the interaction between gamification strategies and the level of self-efficacy on students' mathematics learning outcomes. This study uses a quantitative approach and a pseudo-experimental method with a two-track variance analysis design (two-path anava). The population used in this study is all grade VIII at MTs Al-Ittihadiyah and the research sample consists of students in grades VIII-1 and VIII-2 who were selected by the Cluster Random Sampling technique.The results show that the gamification strategy assisted by Kahoot is more effective in improving student learning outcomes (average 96.67) compared to PowerPoint (76.33). Students with high self-efficacy achieved the highest results with the Kahoot strategy (110.56), while students with low self-efficacy obtained the lowest results in both strategies (Kahoot: 64.00; PowerPoint: 61.82). Two-way ANOVA analysis confirmed a significant effect of learning strategies, self-efficacy, and their interaction on learning outcomes ($R^2 = 0.940$), with the model explaining 94% of the variability in student learning outcomes. The conclusion of the study indicates that the Kahoot-assisted gamification strategy is more effective in improving student learning outcomes, especially for students with high and medium self-efficacy. However, for students with low self-efficacy, the PowerPoint-assisted gamification strategy yields better learning outcomes. Self-efficacy has a significant effect on learning outcomes, and there is an interaction between the learning strategy and self-efficacy level that influences the effectiveness of learning.

Keywords: *self-efficacy, mathematics learning outcomes, kahoot, powerpoint , gamification strategy*

Abstract

Penelitian ini bertujuan untuk menjelaskan interaksi antara strategi gamifikasi dengan tingkat efikasi diri terhadap hasil belajar matematika siswa. Penelitian ini menggunakan pendekatan kuantitatif dan metode eksperimen semu dengan rancangan analisis varians dua jalur (anava dua jalur). Populasi yang digunakan dalam penelitian ini adalah seluruh kelas VIII di MTs Al-Ittihadiyah dan sampel penelitian terdiri dari siswa kelas VIII-1 dan kelas VIII-2 yang dipilih dengan teknik Cluster Random Sampling. Hasil penelitian menunjukkan bahwa strategi gamifikasi berbantuan Kahoot lebih efektif meningkatkan hasil belajar siswa (rata-rata 96,67) dibandingkan PowerPoint (76,33). Siswa dengan efikasi diri tinggi mencapai hasil tertinggi pada strategi Kahoot (110,56), sementara siswa dengan efikasi diri rendah memperoleh hasil terendah pada kedua strategi (Kahoot: 64,00; PowerPoint: 61,82). Analisis varians dua jalur mengonfirmasi pengaruh signifikan strategi pembelajaran, efikasi diri, dan interaksi keduanya terhadap hasil belajar (R^2 = 0,940), dengan model mampu menjelaskan 94% variabilitas hasil belajar siswa. Simpulan dari hasil penelitian menunjukkan bahwa strategi gamifikasi berbantuan Kahoot lebih efektif dalam meningkatkan hasil belajar siswa, terutama bagi siswa dengan efikasi diri tinggi dan sedang. Namun, bagi siswa dengan efikasi diri rendah, strategi gamifikasi berbantuan PowerPoint memberikan hasil belajar yang lebih baik. Efikasi diri memiliki pengaruh signifikan terhadap hasil belajar, dan terdapat interaksi antara strategi pembelajaran dan tingkat efikasi diri, yang mempengaruhi efektivitas pembelajaran.

Kata kunci : efikasi diri, hasil belajar matematika, kahoot, powerpoint, strategi gamifikasi.

INTRODUCTION

Mathematics education in Indonesia, especially at the secondary school level, faces various challenges such as low quality of learning. This challenge arises due to the limited knowledge of teachers and low student confidence. Low learning outcomes indicate students'

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lack of understanding of the material and their inability to solve mathematical problems (Maria Ulfah, et al., 2024). Bandura (1994), low self-efficacy requires an effective approach to increase students' confidence, so that learning outcomes can be improved.

Mathematics learning outcomes are measured by students' ability to understand, apply, and solve mathematical problems. However, many students have difficulty achieving optimal results in learning in Sutrisno's class (2020). Self-efficacy, which is the student's confidence in his or her abilities, plays an important role in this. Students with high self-efficacy are usually more motivated, able to overcome challenges, and have better performance (Suryadi, 2021) found that high self-efficacy is closely related to better math achievement. Bandura (1997) stated that students are more confident and persistent, dare to face risks, and are more able to solve complex problems, so that they have a better chance of achieving high academic achievement.

Mathematics learning outcomes are the main indicator to assess students' ability to understand and apply mathematical concepts. Materials, teaching methods, and internal factors, such as students' confidence in mathematics learning ability, affect good achievement. Effective learning strategies play an important role in improving student understanding and learning outcomes (Yusuf, et al., 2022). Approaches such as game-based learning offer a fun and interactive way to deepen your understanding of mathematics. By utilizing technology and elements of play, this approach increases student engagement and motivation to actively learn. (Prasetyo & Sari, 2021).

Students' self-efficacy plays a big role in influencing their mathematics learning outcomes, in addition to learning strategies. Self-efficacy describes students' confidence in their ability to complete difficult academic tasks. Confident students are more motivated to tackle math challenges more effectively. They tend to be more active in independent learning, find solutions to the problems they face, and keep trying despite facing difficulties in the learning process (Baduri & Nurrahmah, 2024)

Previous research has shown that the combination of the right learning strategies and the development of students' self-efficacy can significantly improve mathematics learning outcomes. Researchers need to conduct further research to understand how the interaction between learning strategies and students' self-efficacy affects math learning outcomes at the

high school level, although these two factors have been shown to have a positive influence on academic achievement.

In the modern era, the development of technology and communication affects various aspects, including education. Game-based learning often uses computer media and the internet because of the convenience offered. However, the use of computers can make tasks more individual, which can reduce student social interaction (Sutrisno and Wijaya, 2022). Technology also provides opportunities to improve learning effectiveness. Games, for example, are used to hone skills and improve mathematics learning outcomes through active interaction and game elements (Rahmawati, et al., 2022). With digital technology, learning has become more engaging and interactive. Innovations in learning methods, such as gamification, are important to improve student motivation and learning outcomes. One of the tools used in gamification is Kahoot and PowerPoint (Rini, et al, 2023).

Johan Brand, Jamie Brooker, and Morten Versvik developed Kahoot as an educational platform in collaboration with the Norwegian University of Technology and Science in March 2013 (Sholichah et al., 2022). The platform allows teachers to create interactive quizzes online based on games. This quiz allows students to learn while having fun. The use of Kahoot makes learning more interesting, helps students understand math material, and increases their confidence in facing challenges (Yuliana, et al, 2023). Kahoot simplifies communication between teachers and students in distance learning without additional applications and provides an innovative approach while paying attention to student social interaction (Lestari, et al, 2023)

Powerpoint is a presentation tool that has long been used in the world of education to visualize concepts and convey information clearly and interestingly. With features such as animations, graphics, and multimedia, PowerPoint allows for more interactive learning experiences. The use of gamification strategies with powerpoint helps teachers create more dynamic learning activities and supports active learning (Mayer, 2009).

The literature that has been described presents the formulation of the problem in this study as follows: "Is there a difference in the learning outcomes of mathematics taught with kahoot-assisted gamification strategies and powerpoint-assisted gamification? Is there a difference in the math results of students who have high self-efficacy and low self-efficacy? Is

there an interaction between gamification strategies and self-efficacy on mathematics learning skills?

The purpose of this study is to identify the differences in mathematics learning outcomes between students who are taught using Kahoot-assisted gamification strategies and powerpoint. The study was to find out whether there was a difference in mathematics learning outcomes between students who had high levels of self-efficacy and low self-efficacy. This study also aims to find out whether there is an interaction between gamification strategies and the level of self-efficacy on students' mathematics learning outcomes.

This study identifies the uniqueness that distinguishes it from other studies in the same field, especially in the context of gamification-based mathematics learning. One of the distinguishing aspects is the gamification strategy combination approach, which compares the effectiveness of kahoot and powerpoint head-to-head. Previous research has focused on only one strategy, without comparing the two in depth. This study introduces the psychological dimension by exploring the influence of students' self-efficacy, namely high self-efficacy and low self-efficacy on mathematics learning outcomes. This main focus is rarely encountered in other studies in the same field.

METHOD

This research was carried out at MTs Al-Ittihadiyah on November 18-26 which is located at Bromo Street, Medan Area District. The population used in this study is all grade VIII students at MTs Al-Ittihadiyah which are spread across 3 classes, namely classes VIII-1, VIII-2 and VIII-3. Sample withdrawal uses the Cluster Random Sampling Technique. The sample of this study is classes VIII-1 and VIII-2.

This study uses a quantitative approach and a pseudo-experimental method with a two-track variance analysis design (two-path anava) which allows researchers to assess the influence of a quantitative approach of two independent variables at once and the interaction between the two on dependent variables.

The instruments used in this study are the Learning Implementation Plan (RPP) as a treatment instrument and a test in the form of multiple-choice questions that measure mathematical learning outcomes on the topic of number patterns and questionnaire instruments to measure students' self-efficacy. The instrument is tested for validity and

reliability before use. The content validation was carried out by three expert validators, namely two lecturers of the UINSU mathematics education study program and a mathematics teacher. Empirical validation was carried out by trial on 26 students of grade IX Mts Al Ittihadiyah. The reliability of the test uses Cronbach's Alpha test.

The procedure in this study has 5 stages, namely: the preparation stage, the implementation stage, the data collection stage, the data analysis stage, and the research reporting stage. The researcher used interviews and tests as instruments, which consisted of pretest and posttest in the form of multiple-choice questions.

The data analysis in this study uses inference statistics with SPSS version 28. The data normality test uses the Kolmogorov-Smirnov test and the Levene test to test the homogeneity of variance. The hypothesis test in the study used the Independent Samples t-test at a significance level of $\alpha = 5\%$. In addition, the two-path anava test was used to analyze the influence of two independent factors, namely learning strategies and self-efficacy, on students' mathematics learning outcomes, as well as to identify the interaction between the two factors.

RESULTS AND DISCUSSION

Result

The pretest data for the experimental class (gamification strategy assisted by Kahoot) and the control class (gamification strategy assisted by PowerPoint) show a significant difference between the two classes. The average pretest score for the experimental class is 14.79, with a variance of 1.91 and a standard deviation (SD) of 1.38, indicating that the pretest scores in the experimental class are more concentrated and have a smaller spread. Meanwhile, the control class has a higher average pretest score of 22.58, with a variance of 24.69 and a standard deviation of 4.96, which indicates that the pretest scores in the control class are more spread out and have a larger variation. The range of pretest scores in the experimental class is between 12.00 and 18.00, while in the control class, it ranges from 15.00 to 28.00. Overall, although the average pretest score in the control class is higher, the spread of scores in the control class is wider compared to the experimental class.

Table 1. Description of Pretest Data in Experimental Classes and Control Classes

		Statistics
Experimental Class Pretest Scores	Mean	14,79
	Median	14,50

	Variance	1,91
	SD	1,38
	Minimum	12,00
	Maximum	18,00
Control Class Pretest Scores	Mean	22,58
	Median	25,00
	Variance	24,69
	SD	4,96
	Minimum	15,00
	Maximum	28,00

The pretest data in Table 2 show that for the Kahoot-assisted gamification strategy, the majority of students fall within the 0-67.5 interval, with a frequency of 15 or 62.5%, which is categorized as low. Meanwhile, the scores in the moderate category (interval 67.5-82.5) have a frequency of 7 or 29.17%. There are no scores in the high category (interval 82.5-120), with a frequency of 0 or 0%. Therefore, it can be concluded that most of the scores are classified as low, with only a small number in the moderate category, and no scores in the high category.

Table 2. Pretest Data for Mathematics Learning Outcomes for Experimental Classes

Value Interval	Frequency	Percentage	Criterion
0 - 67,5	15	62,5%	Low
67,5 - 82,5	7	29,17%	Keep
82,5 - 120	0	0	Tall

The pretest data in Table 3 show that the distribution of pretest scores for participants indicates that the majority fall into the low category, with a frequency of 18, or 66.67% of the total data. The moderate category records a frequency of 9, which is equivalent to 33.33% of the total data. Meanwhile, there are no data in the high category. Therefore, it can be concluded that most of the scores are classified as low, a small number fall into the moderate category, and none reach the high category.

Table 3. Pretest of Mathematics Learning Outcomes of Control Class Students

Value Interval	Frequency	Percentage	Criterion
0 - 67,5	18	66,67%	Low
67,5 - 82,5	9	33,33%	Keep
82,5 - 120	0	0	Tall

The posttest data for the experimental class (gamification strategy assisted by Kahoot) and the control class (gamification strategy assisted by PowerPoint) show differences in the distribution and average scores between the two classes. The average posttest score for the

experimental class is 14.55, with a variance of 2.17 and a standard deviation (SD) of 1.47, indicating that the posttest scores in the experimental class are more concentrated and have a smaller variation. On the other hand, the control class has a higher average posttest score of 17.78, with a variance of 10.00 and a standard deviation of 3.162, which indicates that the posttest scores in the control class are more spread out and have a larger variation. The range of posttest scores in the experimental class is between 12.00 and 17.00, while in the control class, it ranges from 13.00 to 23.00. Overall, although the control class has a higher average, the spread of scores in the control class is greater compared to the experimental class..

Table 4. Description of Postes Data in Experimental Classes and Control Classes

		Statistic
Experimental Class Postes Scores	Mean	14,55
	Median	14,00
	Variance	2,17
	SD	1,47
	Minimum	12,00
	Maximum	17,00
Control Class Postes Grades	Mean	17,78
	Median	18,00
	Variance	10,00
	SD	3,162
	Minimum	13,00
	Maximum	23,00

The data results in table 5 have a value in the high category with a presentation of 62.5% (15 people). A small number of others were in the low category with 25% (6 people) of presentations, and the rest were in the medium category with 12.5% (3 people) of presentations. Thus, the value distribution tends to be dominated by the high category.

Table 5. Postes of Mathematics Learning Outcomes of Experimental Class Students

Value Interval	Frequency	Percentage	Criterion
0 - 67,5	6	25%	Low
67,5 - 82,5	3	12,5%	Keep
82,5 - 120	15	62,5%	Tall

The data results in table 6 have a value in the high category with a percentage of 62.5% (15 people), while a small part is in the low category of 25% (6 people), and the remaining 12.5% (3 people) are in the medium category. This shows that the value distribution tends to be dominated by high categories.

Tabel 6. Postes Hasil Belajar Matematika Siswa Kelas Kontrol

Value Interval	Frequency	Percentage	Criterion

0 - 67,5	12	44,44%	Low
67,5 - 82,5	7	25,93%	Keep
82,5 - 120	58	29,63%	Tall

Hypothesis testing in this study was conducted inferentially using two-way analysis of variance (two-way ANOVA), which is useful for analyzing the interaction between two independent variables (gamification strategy and self-efficacy) and their effect on the dependent variable (mathematics learning outcomes). Before conducting the two-way analysis of variance (two-way anova), several prerequisites must be met, including testing the normality of pretest and posttest data from both classes using the One-Sample Kolmogorov-Smirnov technique, and conducting a homogeneity of variance test using Levene's Test to ensure that the variances between groups are homogeneous (uniform).

Next, the criteria for testing the normality of the data accept the null hypothesis (H_o) that the data come from a normally distributed population. Based on the normality test in Table 7 using the One-Sample Kolmogorov-Smirnov Test, the test statistic value was 0.100, and the significance value (p-value) was 0.200. Since the p-value is greater than the significance level (α=0.05), the null hypothesis (H_o), which states that the residuals are normally distributed, is accepted. Therefore, the residuals in this model meet the normality assumption. This indicates that the model used is appropriate for the statistical analysis prerequisites, allowing for a more valid and accurate interpretation of the results.

Table 7. Results of Pretest and Posttest Data Normality Testing of Experimental Classes

One-Sample Kolmogorov-Smirnov Test		
		Unstandardized Residual
N		24
Normal Parameters[a,b]	Mean	,00
	Std. Deviation	1.1873
Most Extreme Differences	Absolute	,100
	Positive	,100
	Negative	-,075
Test Statistic		,100
Asymp. Sig. (2-tailed)[c]		,200[d]

a. Test distribution is Normal.
b. Calculated from data.
c. Lilliefors Significance Correction.
d. This is a lower bound of the true significance.

The normality test results in Table 8 using the One-Sample Kolmogorov-Smirnov Test show a test statistic value of 0.146 and a significance value (p-value) of 0.143. Since the p-value is greater than the established significance level (α = 0.05), the null hypothesis (H_o), which states that the residual data are normally distributed, cannot be rejected. Therefore, it can be concluded that the residuals in this model are normally distributed and meet the normality assumption. Meeting this normality assumption is crucial to ensure the validity of the statistical analysis results, especially when applying models that require a normal distribution as a prerequisite for the analysis.

Table 8.Results of Pretest and Posttest Data Normality Test of Control Class

One-Sample Kolmogorov-Smirnov Test		
		Unstandardized Residual
N		27
Normal Parameters[a,b]	Mean	,000
	Std. Deviation	,9802
Most Extreme Differences	Absolute	,146
	Positive	,146
	Negative	-,114
Test Statistic		,146
Asymp. Sig. (2-tailed)[c]		,143

a. Test distribution is Normal.
b. Calculated from data.
c. Lilliefors Significance Correction.

The results of the variance homogeneity test (Levene's Test) in Table 9 show that the Levene statistic for learning outcomes based on the mean is 0.303 with a significance value (p-value) of 0.585, the p-value based on the median is 0.704, and the p-value based on the trimmed mean is 0.584. All p-values are greater than the established significance level (α = 0.05), which indicates that there is no reason to reject the null hypothesis (H_o) that states the variances between groups are homogeneous. Therefore, it can be concluded that the variances in learning outcomes between groups in this pretest are homogeneous, meaning the homogeneity of variance assumption is met, and further analysis can be conducted validly.

Table 9. Results of Variance Homogeneity Test of Pretest Data for Experimental and Control Classes

Tests of Homogeneity of Variances					
		Levene Statistic	df1	df2	Sig.
Hasil Belajar	Based on Mean	,303	1	49	,585
	Based on Median	,146	1	49	,704
	Based on Median and with adjusted df	,146	1	47,724	,704
	Based on trimmed mean	,304	1	49	,584

The results of the variance homogeneity test (Levene's Test) in Table 9 show that the Levene statistic for learning outcomes presents varying significance values (p-values). In the test based on the mean, the p-value is 0.003, and in the test based on the trimmed mean, the p-value is 0.005. Both values are smaller than the established significance level (α = 0.05), indicating that the variances between groups are not homogeneous. Meanwhile, in the tests based on the median and the median adjusted for degrees of freedom (df), the p-values are 0.107 and 0.110, respectively, both of which are greater than 0.05, indicating that the variances between groups can be considered homogeneous based on these two tests.

Table 10. Results of Variance Homogeneity Test of Postes Data for Experimental and Control Classes

Tests of Homogeneity of Variances

		Levene Statistic	df1	df2	Sig.
Hasil Belajar	Based on Mean	9,539	1	49	,003
	Based on Median	2,699	1	49	,107
	Based on Median and with adjusted df	2,699	1	31,835	,110
	Based on trimmed mean	8,817	1	49	,005

The results of this study show that there are differences in learning outcomes based on learning strategies and students' self-efficacy levels. The kahoot-assisted gamification strategy resulted in a higher average learning outcome, which was 96.67, compared to the powerpoint-assisted gamification strategy, which only reached an average of 76.33. This indicates that the kahoot-assisted gamification strategy strategy is more effective in improving overall student learning outcomes. Based on the level of self-efficacy, students with high self-efficacy showed the highest average learning outcomes in both learning strategies (Kahoot: 110.56; PowerPoint: 90.55). In contrast, students with low self-efficacy had the lowest average learning outcomes (Kahoot: 64.00; PowerPoint: 61,82). Meanwhile, students with moderate self-efficacy showed the same average learning outcomes in both strategies, which was 77.00. The interaction between learning strategies and self-efficacy showed that the combination of kahoot-assisted gamification strategies with high self-efficacy resulted in the highest learning outcomes (110.56), while the combination of powerpoint-assisted gamification strategies with low self-efficacy resulted in the lowest learning outcomes (61.82).

Table 11. Results of Two-Path Variance Analysis Test (Two-Way Anava)

Descriptive Statistics

Dependent Variable: Learning Outcomes

Strategy	Self-Efficacy	Mean	Std. Deviation	N
Kahoot	Tall	110,5625	7,88221	16
	Keep	77,0000	,00000	3
	Low	64,0000	,00000	5
	Total	96,6667	21,38400	24
Powerpoint	Tall	90,5455	4,88597	11
	Keep	77,0000	,00000	5
	Low	61,8182	2,75021	11
	Total	76,3333	13,66635	27
Total	Tall	102,4074	12,06157	27
	Keep	77,0000	,00000	8
	Low	62,5000	2,47656	16
	Total	85,9020	20,31084	51

The results of the analysis of Tests of Between-Subjects Effects show that the model used as a whole has a very significant influence on students' mathematics learning outcomes ($F(5, 45) = 139,952$, $p < 0.001$). This indicates that the combination of factor A, factor B, and the interaction of the two plays an important role in explaining the difference in learning outcomes obtained by students. In detail, factor A has a significant influence on learning outcomes with an F value of 18,200 and a p-value < 0.001. These findings suggest that changes in factor A can affect student learning outcomes. Factor B also had a significant influence on students' mathematics learning outcomes, with an F value of 243,020 and a p-value < 0.001, which showed that variations in factor B had a great impact on the difference in learning outcomes. In addition, the interaction between factor A and factor B also had a significant influence on learning outcomes ($F = 18,396$, $p < 0.001$), indicating that the influence of one factor on learning outcomes could depend on the level of other factors. The model tested in this study showed an excellent match with the data, with an R Squared value of 0.940, which means that this model can account for about 94% of the variability of student learning outcomes. Thus, it can be concluded that factor A, factor B, and the interaction between the two factors have a significant influence on student learning outcomes, and the model used in this study is able to provide an excellent explanation of the analyzed data.

Table 12. Tests of Between-Subjects Effects

Tests of Between-Subjects Effects

Dependent Variable: Learning Outcomes

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	19380,209a	5	3876,042	139,952	<,001 reviews
Intercept	236577,088	1	236577,088	8542,052	<,001 reviews
A	504,054	1	504,054	18,200	<,001 reviews

B	13461,185	2	6730,592	243,020 <,001 reviews
A*B	1018,982	2	509,491	18,396 <,001 reviews
Error	1246,301	45	27,696	
Total	396963,000	51		
Corrected Total	20626510	50		

a. R Squared = .940 (Adjusted R Squared = .933)

The results of the follow-up test of two-path variance analysis (two-path anava) showed that the model used had a significant influence on learning outcomes. The test results show that the model used as a whole has a very significant influence, with a p value < 0.001. In addition, the PH variable also showed a significant influence on learning outcomes, with a p value of < 0.001, which indicates that the PH factor plays an important role in influencing student learning outcomes.

The results of this analysis also show that the model used can explain about 94% of the variation in learning outcomes, as reflected in the R Squared value of 0.940 (Adjusted R Squared = 0.933). This shows that the model applied is quite strong in predicting student learning outcomes. Overall, the further test of this two-track variance analysis provides clear evidence that the factors tested, especially PH, have a significant influence on learning outcomes and this model has high predictive power on the variation of students' learning outcomes.

Table 13. Two-Path Variance Analysis Advanced Test (Two-Path Anava)

Tests of Between-Subjects Effects

Dependent Variable: Learning Outcomes

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	19380,209a	5	3876,042	139,952	<,001 reviews
Intercept	236577,088	1	236577,088	8542,052	<,001 reviews
PH	19380,209	5	3876,042	139,952	<,001 reviews
Error	1246,301	45	27,696		
Total	396963,000	51			
Corrected Total	20626510	50			

a. R Squared = .940 (Adjusted R Squared = .933)

The results of the study showed that there was a significant difference in learning outcomes based on learning strategies and students' self-efficacy. The kahoot-assisted gamification (C_1) strategy resulted in a higher average learning outcome (96.67) compared to the powerpoint-assisted (C_2) strategy (76.33), indicating that kahoot was more effective in improving overall learning outcomes. When viewed from the level of self-efficacy, students

with high self-efficacy (R_1) who were taught using the kahoot-assisted gamification strategy (R_1C_1) achieved the highest learning outcomes (110.56), while the powerpoint strategy in the same group (R_1C_2) produced an average of 90.55. In contrast, students with low self-efficacy (R_2) showed lower learning outcomes on both strategies, with an average outcome of 64.00 for kahoot (R_2C_1) and 61.82 for powerpoint (R_2C_2). Interestingly, students with moderate self-efficacy showed stable learning outcomes on both strategies, with the same average of 77.00.

In addition, the results of the study also showed an interaction between learning strategies and self-efficacy levels. The combination of kahoot-assisted gamification strategies with high self-efficacy (R_1C_1) is the most effective combination, resulting in the highest learning outcomes. In contrast, the combination of powerpoint strategies with low self-efficacy (R_2C_2) resulted in the lowest learning outcomes. This indicates that the effectiveness of learning strategies is highly dependent on the level of self-efficacy of students. Overall, the results of this study confirm that the kahoot-assisted gamification strategy is superior to powerpoint in improving learning outcomes, especially in students with high self-efficacy. However, students with low self-efficacy needed additional approaches to support their learning outcomes, given that the effectiveness of both strategies in this group was still limited.

Table 14. Students' Mathematics Learning Outcomes Based on Gamification and Self-Efficacy Strategies

R	C	Gamification Strategy	
		Kahoot Assisted (C_1)	Power Point Assisted (C_2)
Self-Efficacy	Tall (R_1)	110,56	90,55
	Keep (R_2)	77,00	77,00
h	Low (R_3)	64,00	61,82

Information:

R_1C_1: The learning outcomes of students with high self-efficacy who were taught using Kahoot-assisted gamification strategies (average 110.56).

R_1C_2: Learning outcomes of students with high self-efficacy who were taught using PowerPoint-assisted gamification strategies (average 90.55).

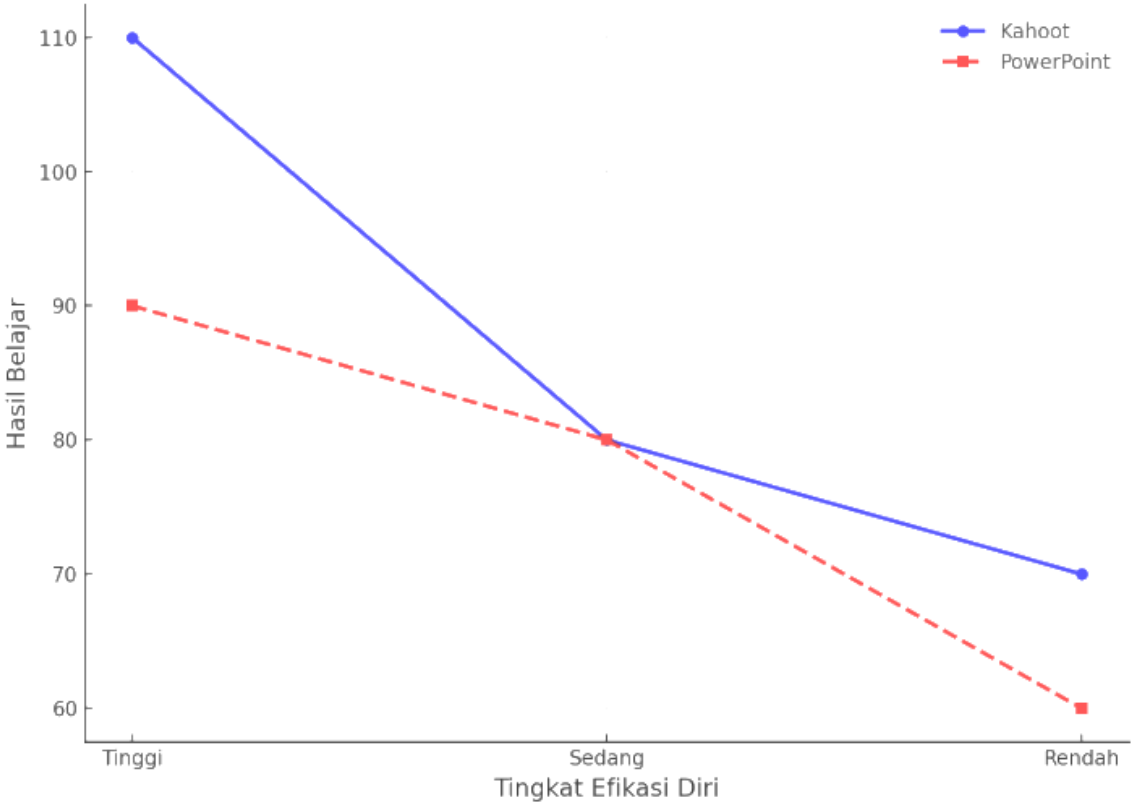
RsC_1: The learning outcomes of students with moderate self-efficacy taught using Kahoot-assisted gamification strategies (average 77.00).

RsC_2: Learning outcomes of students with moderate self-efficacy who were taught using PowerPoint-assisted gamification strategies (average 77.00).

R_2C_1: Learning outcomes of students with low self-efficacy taught using Kahoot-assisted gamification strategies (average 64.00).

R_2C_2: Learning outcomes of students with low self-efficacy who were taught using PowerPoint-assisted gamification strategies (average 61.82).

Figure 1. Interaction Graph of Gamification and Self-Efficacy Strategies



The results of the graph analysis showed that there was a significant interaction between the kahoot-assisted gamification strategy and the powerpoint-assisted gamification strategy) with the level of students' self-efficacy towards learning outcomes. The results of the analysis showed that students with high self-efficacy achieved much better learning outcomes when using the kahoot-assisted gamification strategy compared to the powerpoint-assisted gamification strategy, thus demonstrating the effectiveness of the kahoot strategy for this group. Meanwhile, students with self-efficacy were showing relatively stable learning outcomes in both strategies, with no noticeable differences. On the other hand, students with

low self-efficacy tended to have low learning outcomes in both strategies, although the kahoot-assisted gamification strategy was slightly more effective than PowerPoint. Overall, there was a clear interaction between the gamification strategy and the level of self-efficacy of students on learning outcomes. Kahoot-assisted gamification strategies have been proven to be more effective in improving student learning outcomes, especially in students with high self-efficacy, while students with moderate or low self-efficacy require additional approaches to support optimal learning outcomes.

Discussion

Differences in Mathematics Learning Outcomes Taught with Kahoot-Assisted Gamification and Powerpoint-Assisted Gamification Strategies

The results of the analysis showed that there was a significant difference in the mathematics learning outcomes of students who were taught with the kahoot-assisted gamification strategy and the powerpoint-assisted gamification strategy The kahoot-assisted gamification strategy produced a higher average learning outcome, which was 96.67, compared to the powerpoint-assisted gamification strategy which only reached an average of 76.33. The results of the two-path variance analysis showed that the learning strategy factor had a significant influence on student learning outcomes, with an F value of 18.200 and a $p <$ of 0.001. These findings show that the kahoot-assisted gamification strategy is more effective in improving students' math learning outcomes compared to powerpoint. This is likely due to the advantages of the kahoot-assisted gamification strategy in creating a more interactive, competitive, and engaging learning atmosphere, so as to motivate students to learn more optimally.

Differences in Mathematics Learning Outcomes of Students Who Have High Self-Efficacy and Low Self-Efficacy

There is a significant difference in mathematics learning outcomes between students who have high self-efficacy and low self-efficacy. Students with high self-efficacy showed a much higher average learning outcome than students with low self-efficacy. In the kahoot-assisted gamification strategy, students with high self-efficacy achieved an average learning outcome of 110.56, while students with low self-efficacy only reached 64.00. A similar pattern was also seen in the powerpoint-assisted gamification strategy, where students with high self-

efficacy had an average learning outcome of 90.55, much higher than students with low self-efficacy who only reached 61.82. Two-path anava analysis showed that the self-efficacy factor had a significant influence on student learning outcomes, with an F value of 243.020 and a p < of 0.001. These findings confirm that students' level of self-efficacy significantly affects learning outcomes. Therefore, additional strategies are needed to increase the self-efficacy of students with low levels of confidence so that they can achieve more optimal learning outcomes.

The Interaction Between the Influence of Gamification Strategies on Mathematics Learning Outcomes is Reviewed Based on Self-Efficacy

The results of the study showed that there was a significant interaction between the influence of gamification strategies on mathematics learning outcomes reviewed based on self-efficacy. Kahoot-assisted gamification strategies are more effective than PowerPoint, especially in students with high self-efficacy. The combination of Kahoot strategies with high self-efficacy resulted in the highest average learning outcome of 110.56, while the combination of PowerPoint strategies with low self-efficacy resulted in the lowest average learning outcome of 61.82. Meanwhile, students with moderate self-efficacy showed stable learning outcomes in both strategies, with an average of 77.00. The results of statistical analysis showed that there was a significant interaction between learning strategies and self-efficacy, with an F value of 18.396 and a p < of 0.001, which indicated that the effectiveness of learning strategies was influenced by the level of self-efficacy of students. These findings confirm that the success of learning strategies depends not only on the methods used, but also on the level of self-efficacy of students. Therefore, a more adaptive and supportive approach is needed to help students with low self-efficacy to achieve optimal learning outcomes.

CONCLUSION

The conclusions of the research results show that learning strategies and students' self-efficacy levels have a significant influence on mathematics learning outcomes, both individually and in their interactions. Kahoot-assisted gamification strategies proved to be more effective than PowerPoint, with a higher average student learning outcome, which was 96.67 compared to 76.33. Kahoot's excellence in creating an interactive and engaging learning atmosphere is believed to be the main factor in its effectiveness.

In addition, the level of student self-efficacy also significantly affects learning outcomes. Students with high self-efficacy achieved significantly higher learning outcomes than students with low self-efficacy, both in Kahoot-assisted gamification strategies and PowerPoint. The combination of Kahoot strategies with high self-efficacy resulted in the highest average learning outcome of 110.56, while the combination of PowerPoint with low self-efficacy resulted in the lowest average of 61.82. These results show that there is a significant interaction between learning strategies and students' self-efficacy, where the effectiveness of learning strategies is greatly influenced by the level of self-efficacy. Therefore, a more adaptive approach is needed to support students with low self-efficacy in order to achieve optimal learning outcomes.

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REFERENCE

Baduri, J., & Nurrahmah, A. (2024). The effect of self-efficacy on the mathematics learning outcomes of grade X high school students in West Jakarta. *Derivative: Journal of Mathematics and Mathematics Education, 11*(2), 147–156. https://doi.org/10.31316/jderivat.v10i2.6496

Bandura, A. (1997). Self-efficacy: The exercise of control. W.H. Freeman.

Bloom, B. S. (1956). *Taxonomy of Educational Objectives, Handbook I: The Cognitive Domain*. New York: David McKay Co. Inc.

Dina, F. N., 2020. The application of *Game Based Learning*using the Kahoot! As an interactive learning medium on acid-base material. Thesis. Semarang: Semarang State University. https://lib.unnes.ac.id/38975/1/4301415036.pdf

Hakim Lukman, et al. (2024). Analysis of Mathematics Learning Difficulties of Junior High School Students in Mathematics Learning. Journal of Learning and Scientific Studies, 8(1), 66-76. https://jurnal.untan.ac.id/index.php/jurnalkpk/article/view/78212

Indirwan, et al. (2021). The Importance of Self Efficacy on Mathematics Learning Achievement. Journal of Sublimation, 2(1), 61-70. https://ojs.uho.ac.id/index.php/sublimapsi/article/view/13055

K. R. Winatha and I. M. D. Setiawan, "The Effect of Game-Based Learning on Learning Motivation and Achievement," *Sch. J. Educator. and Kebud.*, 2020.

Lestari, D., & Utami, N. (2023). The use of Kahoot to improve communication and social interaction in distance learning. Journal of Digital Education, 20(1), 33-40. https://ejournal.undiksha.ac.id/index.php/jpd/article/view/48212

Prasetyo, D., & Sari, R. (2021). Game-based learning as an innovative approach to mathematics learning. Journal of Educational Innovation, 10(1), 45-60. https://ejournal.upi.edu/index.php/jip/article/view/32729

Rahmawati, A., & Nugroho, S. (2022). The use of technology in increasing the effectiveness of mathematics learning through games. Journal of Education and Technology, 19(1), 22-30. https://journal.uny.ac.id/index.php/jpt/article/view/45678

Rini, S., & Pratama, I. (2023). The use of technology to increase the effectiveness of mathematics learning through gamification. Journal of Education and Technology, 17(2), 105-112. https://journal.uny.ac.id/index.php/jpt/article/view/45678

Schunk, D. H., & Pajares, F. (2002). The development of academic self-efficac y. In A. Wigfield & J. S. Eccles (Eds.), *Development of achievement motivation*, 16-31

Sholichah, I., Arif, M., & Hadi, S. (2022). The use of the Kahoot platform to increase student engagement in math learning. Journal of Educational Technology, 14(1), 1-10. https://journal.uny.ac.id/index.php/jtp/article/view/45678

Suryadi, D. (2021). The Relationship of Self-Efficacy to Increasing Learning Motivation and Mathematics Learning Outcomes of Students in School. Andragogi. https://jurnalptiq.com/index.php/andragogi/article/view/220

Sutrisno, A., & Wijaya, H. (2022). The influence of technological developments on game-based learning. Journal of Educational Technology, 18(3), 45-53. https://repository.lppm.unila.ac.id/51768/1/6433-24730-1-PB.pdf

Sutrisno, S. (2020). The Effect of Active Learning on Mathematics Learning Outcomes of Junior High School Students. Journal of Mathematics Education, 5(3), 45-56. https://journal.uny.ac.id/index.php/jpm/article/view/45678

Wang, A. I., & Tahir, R. (2020). The effect of using Kahoot! for learning – A literature review. *Computers & Education, 149*, 103818.

Yuliana, R., & Haris, A. (2022). The use of Kahoot in mathematics learning to increase student motivation and understanding. Journal of Educational Technology, 18(3), 78-85. https://journal.uny.ac.id/index.php/jtp/article/view/45678

Yusuf, M., & Ahmad, F. (2022). The influence of teaching methods on students' mathematics learning outcomes in junior high school. Journal of Mathematics Education, 8(2), 112-125. https://www.researchgate.net/publication/348299190