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Gamified Arabic Vocabulary Learning: Integrating Puzzle-Based Discovery Learning to Foster Learner Autonomy

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Abstract

Existing studies rarely integrate puzzle-based educational games with the discovery learning model while simultaneously examining students' learning independence as an affective outcome in Arabic vocabulary learning at the Junior Islamic School level. This study aims to examine, implement, and determine the effectiveness of Arabic vocabulary learning based on games that combine the use of puzzles with discovery learning in improving the learning independence of Junior Islamic School students in Kaliwungu, Kendal, Central Java. The method employed in this study was a quantitative approach with a pre-experimental design. The sample used was from class 8C Junior Islamic School NU 05 Sunan Katong, which consisted of 26 students. Data collection was conducted using observation techniques to measure student learning independence, interviews to gather supporting data, and tests to assess students' vocabulary comprehension. This study shows that integrating puzzle-based discovery learning in vocabulary learning is quite effective in improving student learning independence. The results of the analysis using SPSS showed a significance value of 0.000, which means that the value is <0.05, indicating that there is an effect of vocabulary learning through puzzle media and discovery learning on students' learning independence. The results of the N-Gain test showed a percentage value of 57.6066, which means that vocabulary learning through puzzle media and discovery learning is quite effective. Based on the results of observations, the measurement of student learning independence shows that most students fall into the category of being fairly independent. This means that game-based vocabulary learning through puzzles and discovery learning can encourage student independence in learning. These findings indicate that integrating puzzle-based discovery learning in vocabulary learning is needed for Arabic vocabulary learning in order to improve student learning independence.

Keywords: Educational Game; Independent Learning; Vocabulary Learning

Introduction

Learning Arabic vocabulary is one of the difficulties faced by students, because Arabic is a language with a wide vocabulary and a diverse word structure (Afzal, 2019; Bakker, 2020; Elmahdi & Hezam, 2020; Nuuriyah et al., 2025). The difficulties faced by students have an impact on their weak Arabic writing (Inayah et al., 2024), reading (Inayah et al., 2023), and speaking skills (Al-sobhi & Preece, 2018). Vocabulary is the foundation of meaning comprehension that determines fluency in language (Aminah et al., 2025; Hidayah et al., 2025). However, vocabulary learning in Islamic schools is still conventional, relying on lecture and memorization methods. According to Nadhilah Abdul Pisal et al, vocabulary learning requires active student involvement and is less effective when using teacher-centered teaching models (Pisal et al., 2025).

Game-based learning has appeared as an innovative approach that can increase student engagement in learning. According to Muhammad Andi Wasgito, the use of educational media can improve the quality of student learning to a very good level, with a percentage of 86% (Mohammad Andi Wasgito, 2014). In a study by Danawati Safitri et al., it was found that the use of game-based learning media in the form of puzzles can improve students' memory of vocabulary (D. Safitri et al., 2014). Games are not only a medium of entertainment, but also a means of creating active participation and improving cognitive abilities in students.

In addition to the use of educational media, effective learning methods are also needed in learning to create more independent learning. The discovery learning approach is one of the most effective learning methods in fostering student independence. Research by Dewi Paulina Silalahi states that discovery learning is effective in increasing student active involvement and in improving student understanding (Silalahi, 2024). However, there is still little research that examines the integration of game-based learning with discovery learning in the context of Arabic Language Learning (ALL).

ALL at Junior Islamic School NU 05 Sunan Katong is still dominated by conventional teacher-centered methods, such as lectures and memorization. This learning pattern tends to limit students' active participation in the teaching and learning process. In addition, there are various obstacles faced in ALL, one of which is that Arabic is a foreign language for students. This results in low student interest in learning Arabic and difficulty in understanding the material, especially in the communicative use of vocabulary. The use of media and learning methods that involve student activity is also rarely implemented. In practice, Arabic teachers at Junior Islamic School NU 05 Sunan Katong usually deliver material by writing lessons on the blackboard and asking students to copy them into their notebooks. As an effort to overcome students' learning difficulties, a commonly used strategy is the application of a memorization system.

Previous studies discussing discovery learning by (D. R. Safitri et al., 2022) researched the discovery learning model using crossword puzzles. Research on developing discovery learning using vocabulary cards to improve the ability to use complete sentences (Heri Sugriwa & Iis Ristiani, 2024), Implemented discovery learning using a scientific approach (Budiarti, 2018), A study conducted by (Fasekhah, 2023) on Arabic vocabulary mastery through the discovery learning model, (Selviani & Gumiandari, 2025) on the implementation of discovery learning with a scientific approach to improve students' critical thinking. The study (Shulhan Khairy et al., 2016) analyzed the impact of educational games on foreign language vocabulary acquisition using a case study of Arabic educational research by (Aliya & Ilmiani, 2024) on Arabic vocabulary learning assistance through puzzle media, a study on the application of a cooperative learning model of the team games tournament type, using puzzle media to improve student learning outcomes by (Izzatunnafiza Bustami et al., 2024), research conducted by (Muhlisoh & Uyuni, 2025) on the effect of snakes and ladders games on Arabic vocabulary learning outcomes, in the same context, research conducted by (Masnah et al., 2024) on the application of educational games in the form of flashcards in ALL, as well as another study by (Hakim, 2018) on the use of interactive game learning media in Arabic vocabulary learning.

A study by (Farida & Uyuni, 2022) on the development of puzzle learning media in quantum-based vocabulary learning, research was also conducted by (Nabila et al., 2024) which tested the effectiveness of the jigsaw method using puzzle media to improve vocabulary mastery, Research by (Ramadan et al., 2025) On the effect of using quizzes and games on students' vocabulary mastery, a study on educational games in Arabic vocabulary learning (Saleh & Althaqafi, 2022), and research conducted by (Wahyuni, 2021) tested crossword puzzles as an educational method for teaching Arabic vocabulary to students.

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Based on previous studies, many studies have shown various studies have shown the success of vocabulary learning using the discovery learning model and the use of educational game-based learning media. However, there has not been much research that integrates puzzle learning media with the discovery learning approach simultaneously. The majority of these studies focus on students' cognitive outcomes without examining in depth the affective domain, such as student learning independence. This gap indicates that research is needed that integrates game-based learning with the discovery learning model for Arabic vocabulary learning. So, this study formulates four main questions: (1) How is vocabulary learning through puzzle media for students at Junior Islamic School NU 05 Sunan Katong? (2) How is Discovery Learning implemented in the vocabulary learning through puzzle media for students at Junior Islamic School NU 05 Sunan Katong? (3) How effective is vocabulary learning with Discovery Learning through puzzle media for Junior Islamic School NU 05 Sunan Katong students? (4) How can vocabulary learning through puzzle media with the Discovery Learning model increase the learning independence of Junior Islamic School NU 05 Sunan Katong students?

The purpose of this study is to determine the effectiveness of game-based Arabic vocabulary learning in improving the learning independence of students at Junior Islamic School NU 05 Sunan Katong. The novelty in this study is vocabulary learning based on games that combine puzzle media with the discovery learning model in improving the learning independence of Junior Islamic School students.

Method

The method used in this study is quantitative (Azzahra et al., 2025; Huwaiza et al., 2025; Inayah et al., 2024; Sofiyah et al., 2025) with experimental research (Inayah et al., 2022; Inayah & Husna, 2023). The research design used is pre-experimental (Aini et al, 2024; Inayah et al., 2022; Setiawan et al., 2024) with a one-group pretest-posttest model. This model includes a pretest before treatment is given, allowing the results of the treatment to be determined more accurately, as they can be compared with the situation before treatment was given (Nurman, 2021). This is to see the differences before and after treatment was given. The research was conducted at Junior Islamic School NU 05 Sunan Katong Kaliwungu. The population in this study was all 8 grade students at Junior Islamic School NU 05 Sunan Katong, totalling 90 students. The sample used was class 8C, which consisted of 26 students. The data collection methods used in this study were observation, interviews, documentation, and tests. Observation is a data collection technique that involves observing and taking notes on a situation (Satriadi et al., 2023). The observation was conducted to determine the level of student learning independence. The observation used an observation sheet, with a range of categories: 1-5 = not independent, 6-10 = less independent, 11-15 = fairly independent, 16-20 = independent, 21-25 = very independent. The aspects observed can be seen in the following table.

Table 1. Test Question Grid

Aspect	Details
Learning Initiative	Teachers observe students' willingness to start learning and complete tasks without being told to do so by the teacher.
Self-Regulation	Teachers observe how students manage their time and the strategies they use when learning.
Responsibility	This aspect includes students' awareness of completing tasks on time and thoroughly.

Motivation	Teachers observe students' enthusiasm for achieving success in learning or completing tasks.
Self-Evaluation	Teachers observe how students assess their own work and their awareness of the need to improve their learning outcomes.

The type of interview was a semi-structured interview, in which the interviewer prepared a list of questions to be asked to the interviewee, although the order in which the questions were asked was flexible, depending on the direction of the conversation (Fadhallah, 2020). Documentation is a record of events in the form of writing, images, or works by a person (Sugiyono, 2016). The data collection method using tests was carried out with two types of tests, namely pretest and posttest, with 25 multiple-choice questions. The test question grid can be seen in Table 2.

Table 2.Test Question Grid

No	Question Indicator	Question Number	Total
1	Determining the meaning of vocabulary	1, 4, 7, 8, 10, 14, 15	7 Questions
2	Determining the meaning of vocabulary in sentences	2, 21, 22, 23, 24, 25	6 Questions
3	Determining Arabic equivalents	3, 5, 9, 17, 18, 19, 20	7 Questions
4	Determining the workplace according to profession in Arabic	11, 12, 13	3 Questions
5	Determining the profession according to the workplace	16	1 Question
6	Distinguishing vocabulary that is not a profession	6	1 Question
	Total	**25 Questions**	

The data analysis methods used in this study were statistical analysis and analysis of pretest and posttest results using SPSS 27 software, validity testing using product-moment correlation (Inayah et al., 2025) with the formula $rxy = \frac{N(\sum xy)-(\sum x)(\sum y)}{\sqrt{[N\sum x^2-(\sum x)^2][N\sum y^2-(\sum y)^2]}}$, and data reliability testing using the Cronbach's Alpha method, using the formula $\boldsymbol{\alpha} = \frac{k}{(k-1)}\left[1 - \frac{\sum \boldsymbol{\sigma}_i^2}{\boldsymbol{\sigma}_t^2}\right]$, whereby a data instrument is considered reliable if the Cronbach's Alpha value is > 0.7 (Putu Gede Subhaktiyasa, 2024). The normality test was performed using the Shapiro-Wilk method, because the sample used consisted of fewer than 50 students. If the data obtained were not normal, it would be tested using a nonparametric test method in the form of a Wilcoxon test, so that a paired t-test could be performed. A paired t-test was also used to compare the pretest and posttest results to see if there were any significant differences. The N-gain test uses the formula $NGain = \frac{\text{Skor Posttest} - \text{Skor Pretest}}{\text{Skor Ideal} - \text{Skor Pretest}}$ To determine the effectiveness of the learning media used. The research hypothesis is H_0 = there is no significant effect between game-based vocabulary learning with puzzle media and discovery learning on student learning independence, H_1 = there is a significant effect between game-based vocabulary learning with puzzle media and discovery learning on student learning independence. The hypothesis uses a 95% confidence level or an alpha value of 0.05 (Elsayir, 2024).

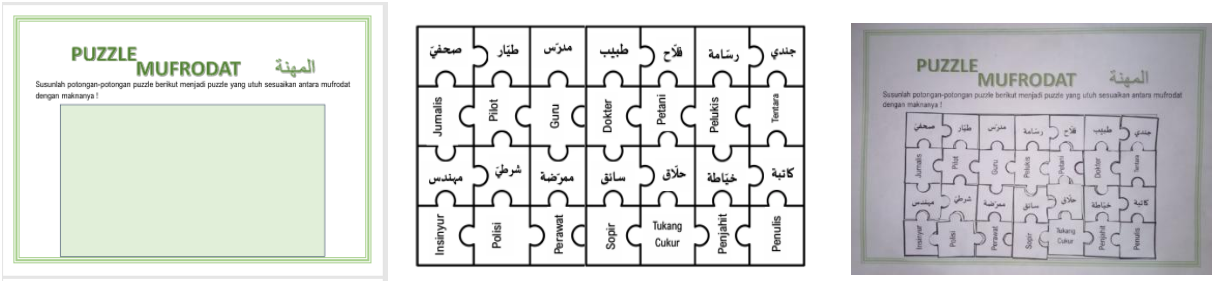
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Results

Learning Vocabulary with Puzzle Media

Puzzle media is a type of media in the form of an image that is divided into several pieces with the aim of sharpening thinking skills, patience, and accuracy (Hasriani, 2015). From the results of observations, learning vocabulary with puzzle media can increase student participation and enthusiasm. The puzzle media used by the researcher consisted of pieces of cards containing Arabic vocabulary and their meanings, where students had to arrange the puzzle pieces according to the vocabulary and their meanings. Vocabulary learning through puzzles began with preparing several pieces of cards containing vocabulary and their meanings separately. Students were divided into five groups, each group receiving an envelope containing puzzle pieces that had to be assembled by the students. Students are given time to discuss and complete the puzzle. After finishing, each group comes forward to present the results of the puzzle they have assembled. This learning method creates a more enjoyable learning atmosphere because students are actively involved and participate rather than focusing on the teacher, and it encourages students to memorize Arabic vocabulary.

Picture 1. Display of Puzzle Learning Media



Picture 1 shows the puzzle media used in learning activities. This media was created to increase students' interest in learning and create a more interactive learning atmosphere. In addition, this media was also designed to help students learn Arabic vocabulary in a more enjoyable way.

Implementation of Discovery Learning in Vocabulary Learning Through Puzzle Media

The application of discovery learning in vocabulary learning at Junior Islamic School NU 05 Sunan Katong was carried out in six stages, namely Stimulation, Problem Statement, Data Collection, Data Processing, Verification, and Generalization. Starting with stimulation, students are reminded of the material that has been discussed, related to the puzzle that will be assembled. Then, students are shown several puzzle pieces that have been prepared so that they become curious about what the puzzle is for. In the problem Statement stage, students must find the pairs between the vocabulary and their meanings. In the data collection stage, students begin to search for the meanings of the vocabulary through discussion. In the data processing stage, students arrange the puzzle pieces that match the vocabulary with their meanings on the paper provided. In the final stage of Generalization, students mention all the vocabulary and their meanings that have been arranged in the puzzle.



Picture 2. Students Arranging Puzzles

Picture 2 shows the process of students assembling a puzzle. They begin by matching vocabulary words with their meanings and adjusting the pieces into the correct positions to form a complete puzzle, which they then assemble on the answer sheet provided. During this activity, students actively interact, discuss, and work together with their group members to find the right puzzle pieces. During the learning process or puzzle assembly, students work in groups to complete the puzzle under the guidance of the teacher, as shown in the image below.



Picture 3. Assistance in Arranging the Puzzle

Picture 3 shows the learning process where the teacher acts as a facilitator in puzzle-making activities carried out in groups by students. The teacher actively guides and gives directions to students during the learning process, so that the learning process using puzzles can take place systematically while still emphasizing student activity. The final results of the puzzles made by the students are shown in the picture below.

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Picture 4. The completed puzzle

Picture 4 shows the results of the puzzle that has been completely assembled by the students. The puzzle shows the integration between the pieces containing vocabulary and their meanings. In the picture, the students have successfully identified, matched, and integrated the puzzle pieces into a complete puzzle. Based on the images presented, the images as a whole show the stages in the learning process using discovery learning. Picture 1 presents the process of providing stimulation to students, picture 2 shows the process of problem statement and collecting data, picture 3 shows the stage of data processing and verification, and picture 4 shows the process of generalization.

The Effectiveness of Vocabulary Learning with Discovery Learning through Puzzle Media

The level of effectiveness of vocabulary learning with discovery learning through puzzle media was determined through hypothesis testing and research data analysis. The data were obtained from tests that had been conducted, namely pretest and posttest. The pretest was given to students before the application of the discovery learning method with puzzle media, while the posttest was conducted after students received the vocabulary learning treatment with the discovery learning method through puzzle media. The results of the students' pretest and posttest scores are described in the following table.

Table 3. Pretest dan Posttest Results

No	Name	Pretest	Posttest
1	AUA	48	80
2	ASZ	52	64
3	AR	68	96
4	AAPP	32	96
5	BJ	56	88
6	DH	24	36
7	FNL	44	88
8	FA	44	72
9	FAS	36	36
10	HHH	20	76
11	JC	36	84
12	MRSM	44	60
13	MIS	44	56

14	MAI	56	84
15	MFU	28	84
16	MS	48	76
17	MSI	24	76
18	ML	92	96
19	OGW	68	80
20	RTP	44	80
21	SAK	68	84
22	TH	68	88
23	VKZ	44	96
24	ZMNI	44	80
25	FH	48	76
26	JA	44	88

The results of the data analysis, which were obtained by comparing the pretest and posttest results, show an increase in the scores obtained by the students, as shown in the table below.

Table 4. Average Pretest and Posttest

Test Type	Number of Student	Average Score
Pretest	26	47,08
Posttest	26	77,69

Data validity analysis was conducted to determine valid and invalid test instruments. Calculations were performed using SPSS and are summarized in the following table.

Table 5. Validity Test Results

Item Number	Total	Criteria
2, 3, 4, 5, 6, 8, 10, 11, 12, 13, 14, 15, 16, 17, 18, 20, 21, 22, 23, 24, 25	21	Valid
1, 7, 9, 19	4	Not Valid

From the validity test results, 21 out of 25 research instrument items were considered valid, involving 25 students. The other 4 items were considered invalid. The reliability analysis of the research data instrument used the Cronbach's Alpha method, whereby a data instrument is considered reliable if the Cronbach's Alpha value is > 0.7 (Putu Gede Subhaktiyasa, 2024). The reliability calculation using SPSS can be seen in the following table.

Table 6. Reliability Test Results

Reliability Statistics

Cronbach's Alpha	N of Items
.847	25

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From the calculation results, a Cronbach's alpha of 0.847 was obtained, which means that the result shows a value > 0.7, so the instrument is declared reliable. The data normality test was performed using the Shapiro-Wilk method because the sample in this study was less than 50. The results of the normality test calculation are as follows.

Table 7. Normality Test Results

Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Pretest	.170	26	.052	.934	26	.095
Posttest	.227	26	.001	.850	26	.001

a. Lilliefors Significance Correction

Based on the normality test of the data in the table, the significance value of the pretest data was 0.095, and the significance value of the posttest data was 0.001. Based on this data, the pretest data showed a value > 0.05, meaning that the data was normally distributed. Meanwhile, the posttest data shows a result < 0.05, which means that the posttest data is not normally distributed. Therefore, the normality test was repeated using a non-parametric test, namely the Wilcoxon test. The results obtained from the Wilcoxon test are presented in the following table.

Table 8. Wilcoxon Test Results

Ranks

		N	Mean Rank	Sum of Ranks
Posttest - Pretest	Negative Ranks	0[a]	.00	.00
	Positive Ranks	25[b]	13.00	325.00
	Ties	1[c]		
	Total	26		

a. Posttest < Pretest

b. Posttest > Pretest

c. Posttest = Pretest

Test Statistics

	Posttest - Pretest
Z	-4.380[b]
Asymp. Sig. (2-tailed)	.000

a. Wilcoxon Signed Ranks Test

b. Based on negative ranks.

The research hypothesis is: H0 = there is no significant effect between game-based vocabulary learning with puzzle media and discovery learning on student learning independence. H1 = There is a significant effect between game-based vocabulary learning with puzzle media and discovery learning on student learning independence. The significance level used is 0.05. If the significance value obtained is > 0.05, then H0 is accepted. If the significance value obtained is < 0.05, then H0 is rejected. From the Wilcoxon test results, a significance value of 0.000 was obtained, which means that the value is < 0.05. Thus, H0 is rejected, and H1 is accepted. In

addition to the Wilcoxon test, data analysis was also carried out using the N-Gain test to measure the level of effectiveness of vocabulary mastery after learning with puzzle media. The N-Gain value is categorized into several groups, namely.

Table 9. N-Gain Value Categories

Score	Criteria
g > 0,7	High
0,3 ≤ g ≤ 0,7	Medium
g < 0,3	Low

Table 10. Categories of N-Gain Effectiveness Interpretation

Percentage	Interpretation
< 40	Ineffective
40 – 55	Less Effective
56 – 75	Moderately effective
> 76	Effective

Source :(Kolopita et al., 2022)

The N-Gain test is presented in the following table:

Table 11. N-Gain Test Results

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Ngain_Score	26	.00	.94	.5761	.24175
Ngain_Persen	26	.00	94.12	57.6066	24.17462
Valid N (listwise)	26				

Based on the table, the N-Gain test results show that the average value obtained is 0.5761. Meanwhile, the N-Gain percentage is 57.6066. Based on the N-Gain value category, an average value of 0.5761 falls into the moderate category, and a percentage value of 57.6066 falls into the moderately effective category. Thus, the application of discovery learning using puzzles is quite effective in game-based vocabulary learning.

Student Learning Independence in Vocabulary Learning Through Puzzle Media Using the Discovery Learning Model

Student learning independence in this study was measured using an observation checklist, with the researcher acting as the observer. This observation was conducted while the researcher was teaching vocabulary in class or while the researcher was conducting the treatment on the research subjects. The aspects observed in this assessment included learning initiative, self-regulation, responsibility, motivation, and self-evaluation. The range of categories in the observation of student learning independence was 0-5: not independent, 6-10: less independent, 11-15: moderately independent, 16-20: independent, 21-25: very independent. The observation results are presented in the following table.

Table 12. Observation Results

No	Student Name	Learning Initiative	Self-Regulation	Responsibility	Motivation	Self-Evaluation	Total Score	Category
1	AUA	3	3	4	2	2	14	moderately independent
2	ASZ	2	3	3	3	2	13	moderately independent
3	AR	5	4	5	3	3	20	independent

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4	AAPP	4	4	4	2	3	17	independent
5	BJ	3	3	4	3	2	15	moderately independent
6	DH	2	2	3	2	2	11	moderately independent
7	FNL	3	3	4	3	3	16	independent
8	FA	3	3	3	3	3	15	moderately independent
9	FAS	2	3	3	2	2	12	moderately independent
10	HHH	2	3	3	3	2	13	moderately independent
11	JC	3	4	4	3	3	17	independent
12	MRSM	2	3	3	2	3	13	moderately independent
13	MIS	2	3	3	4	2	14	moderately independent
14	MAI	2	3	3	3	2	13	moderately independent
15	MFU	4	3	4	3	3	17	independent
16	MS	3	3	3	2	2	13	moderately independent
17	MSI	2	2	3	2	2	11	moderately independent
18	ML	3	3	3	3	3	15	moderately independent
19	OGW	4	4	5	4	3	20	independent
20	RTP	4	3	4	3	3	17	moderately independent
21	SAK	3	3	2	2	3	13	moderately independent
22	TH	3	3	3	2	2	13	moderately independent
23	VKZ	2	3	3	2	2	12	moderately independent
24	ZMNI	4	4	5	4	3	20	independent
25	FH	3	3	4	3	3	16	independent
26	JA	3	3	3	3	3	16	moderately independent

From this data, the average student falls into the moderately independent category, with a total of 18 students, while 8 other students fall into the independent category. It can be concluded that game-based vocabulary learning through puzzles and discovery learning can encourage student independence in learning.

Discussion

The results of the study indicate that the application of game-based learning through puzzles and discovery learning has a positive impact and is quite effective in increasing student learning independence. It improves student learning outcomes and enhances student memory in vocabulary learning. The increase in the average pretest and posttest scores of 33,61 points shows that students experienced significant development and improvement in vocabulary learning. Therefore, the application of learning through puzzle media and discovery learning can encourage students to be more active in learning. These findings are in line with the results of research conducted by (Nabila et al., 2024), which explains that learning using jigsaw puzzles is effective in improving students' vocabulary mastery. Furthermore, this is reinforced by findings

discussing the application of discovery learning, which shows an increase in students' vocabulary mastery (Fasekhah, 2023).

Learning today requires the development of learning methods, models, and media. This is necessary so that students are more active and enjoy learning more. When students are actively involved in learning, they will not easily get bored, and they will tend to enjoy and focus on learning more. Through game-based learning with puzzles and discovery learning media, students not only learn theory, but also practice working well together, solving problems collaboratively, learning to manage time well, and becoming more independent in solving problems. According to (Masnah et al., 2024), the results of learning with the application of educational games can improve students' vocabulary skills.

Game-based learning can also shape and improve students' independence in learning. This is in line with research conducted by (Purnamasari, 2014) which shows that cooperative learning with games gives students a high level of independence in learning, and students are more enthusiastic in learning, and create more enjoyable learning experiences. Based on observations conducted to observe students' independence in learning, most students were categorized as fairly independent. From several aspects that were observed, student independence was seen in terms of responsibility, where the total observation score for the responsibility aspect was 91 points, with the highest score being 3, which means neutral, indicating that students already have the awareness to complete tasks in learning well. Conversely, the aspects of motivation and self-evaluation showed fairly low scores based on the five aspects observed. Based on these observations, motivation showed a score of 71 points, and self-evaluation showed a score of 66 points, indicating that the students' internal motivation or drive to learn and their reflection on their shortcomings in learning are still quite weak and need to be strengthened. These findings are in line with research (Maksum & Lestari, 2020) This shows that independent learning is driven by a strong sense of responsibility and initiative, and that independent learning will be realized if students can take responsibility for solving their own learning problems. However, this finding is contrary to research (Paseleng et al., 2022) which explains that independent learning is influenced by strong learning motivation and high self-evaluation.

Conclusion

From the results of the research and discussion presented, it can be concluded that the application of game-based learning through puzzles and discovery learning can improve students' vocabulary learning and independence in learning. The increase in pretest and posttest scores shows that students have experienced significant progress. In addition, classroom learning has become more active and enjoyable. This study shows quite effective results in the application of learning media in the form of puzzles integrated with discovery learning. Indirectly, this study shows that learning that actively and collaboratively involves students is relevant in developing students' cognitive and psychomotor skills. The implications of this study indicate that learning requires the integration of enjoyable learning media with the discovery learning model, as well as the application of strategies that actively engage students. Active and enjoyable learning for students can increase knowledge and be more effective in implementation. However, there are still limitations in this study. This study was only conducted on one group of students in one class with a limited number of students. In addition, the measurement of student independence was only through observation without the support of interview data or student questionnaires. For further research, it is recommended that game-based learning through puzzles and discovery learning be tested on a larger sample size with another group

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serving as a control group. In addition, future research should include measurement data to assess student learning independence.

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