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THE EFFECTIVENESS OF ARCADE GAMES IN IMPROVING THE UNDERSTANDING OF POETIC FIGURATIVE SPEECH

Siswantia Sar[1*], Wita Dwi Payana[2]
[1]siswantia@isbiaceh.ac.id, [2]witadwipayana@isbiaceh.ac.id

INSTITUT SENI BUDAYA INDONESIA ACEH

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ABSTRACT

This study explores the effectiveness of arcade games in improving high school students' understanding of figurative speech and examines students' perceptions of using arcade games as a learning tool. The study presents a novel and captivating strategy to enhance students' literary comprehension, particularly in the use of figurative speech at the high school level. Using a mixed method of quantitative and qualitative approach, four selected student groups from two different schools were studied. The experimental group participated in sessions incorporating arcade games designed to teach figurative speech, while the control group followed traditional learning methods. Data was collected through pre- and post-intervention tests measuring students' understanding, along with a questionnaire evaluating their perceptions of arcade games as a learning tool. Statistical analysis was used to compare the differences in understanding between the two groups, providing knowledge into the effectiveness of arcade games in improving students' comprehension of figurative speech. The main finding from this research is that the use of arcade games significantly improves high school students' understanding of figurative speech and the students' response toward the arcade game is mostly positive. The results suggest that arcade games can be a more effective and engaging method for teaching figurative speech compared to conventional approaches.

Keywords: Arcade Game; Figurative Speech; High School Students; Learning Innovation

A. INTRODUCTION

Every literary work possesses unique characteristics that contribute to its aesthetic and intellectual appeal. Elements such as theme, plot, characters, and genre all add depth and relevance to human experience (Sar & Murni, 2012). Among various literary forms, poetry stands out due to its distinctive use of language, which is often enhanced by figurative speech. Alongside diction, rhyme, and rhythm, figurative language plays a crucial role in elevating the artistic quality of poetry, adding layers of meaning and emotional depth (Septiani & Sari, 2021). Given its significance, a solid understanding of figurative speech is essential for fostering literary appreciation and developing students' analytical skills.

However, understanding figurative speech presents challenges not only for elementary and middle school students but also for high school students, who often find it difficult to interpret and apply in their own writing and literary appreciation. Not all teenagers, especially high school students, understand the various types of figurative speech and the use of figurative language in the choice of words in poetry (Auliyani et al., 2022). This difficulty is further exacerbated by conventional teaching methods, which often fail to provide engaging and interactive learning experiences. Research by Sasmita & Purnamasari (2018) found that conventional teaching methods do not significantly improve student achievement. On the other hand, edutainment teaching methods can enhance student performance more effectively than conventional methods (Panse et al., 2018). Edutainment is a teaching methodology that incorporates various forms of entertainment, such as games, multimedia, storytelling, and interactive activities, into the learning process (Ramnath et al., 2019).

In recent years, game-based teaching methods have increasingly been integrated into education at various levels, providing interactive and enjoyable learning experiences that stimulate student engagement and facilitate deeper understanding (Dahalan et al., 2024; Metwally et al., 2021; Orsoni et al., 2023). Through interaction and engagement, games have shown potential for enhancing student motivation and comprehension (Chan et al., 2021; Hidayatulloh et al., 2020; Kaya & Ercag, 2023). Games can be classified into several types, based on platform, dimensions, and genre. One type of game based on platform is arcade (Tanjung, 2013). Several well-known examples of arcade games that have had a significant cultural and historical impact include Pac-Man, Manic Miner, Asteroids, and Pong (Cardoso, 2016). These games represent a foundational era in the development of arcade gaming, each contributing uniquely to the evolution of gameplay mechanics and player interaction. Pac-Man, for instance, introduced maze-navigation dynamics, while Pong is widely regarded as one of the earliest video games to simulate real-world sports, thereby shaping the future of arcade game design and player engagement (Newman, 2016; Rohlfshagen et al., 2017). The term "arcade" refers to action video games designed to be played similarly to arcade games, with simple gameplay that can be played repeatedly. Arcade games emphasize the player's reflex speed in pressing buttons and are often repetitive, without many puzzle or strategy elements (Gao et al., 2022; Kaban et al., 2022). The inherent interactivity and immediate feedback loops of arcade games can cultivate an immersive and motivating learning environment. Furthermore, the use of arcade games, with their visual and interactive elements (Liapis, 2016), offers an attractive alternative medium to deepen high school students' understanding of figurative speech.

Research on educational technology, particularly the application of gamified learning media, has been widely conducted. However, there has been no specific research exploring the effectiveness of arcade games in the context of literature learning, particularly in understanding figurative speech. In 2023, Harsanti & Lathifah (2023) found that the use of the Wordwall platform increased student engagement in Indonesian language learning. Other studies (Ariyanto et al., 2023; Mahyudi, 2022; Pradani, 2022; Safitri & Rasyid, 2022) have reported similar findings, showing how the Wordwall platform can help boost student interest and learning outcomes. In addition to Wordwall, several studies (Iskandar et al., 2022; Kusyani & Ray, 2023) on the use of the Baamboozle platform have also been conducted. Similar to Wordwall, these studies found that Baamboozle enhanced students' learning enthusiasm and their ability to grasp the material being taught. Overall, the strength of this study lies in its innovative approach and arcade game design, which contributes

significantly to more effective learning in deepening high school students' understanding of figurative speech. Therefore, this study aims to fill that knowledge gap by evaluating the effectiveness of arcade games in improving high school students' understanding of figurative speech.

B. METHOD

This study employed a hybrid quantitative and qualitative approach as its methodology. In order to evaluate the effects of a particular treatment, the research method collects and analyzes quantifiable data using numbers and statistics (Mohajan, 2020). A quasi-experimental design with randomly allocated control groups was employed in the quantitative method. This approach allows for a comparison between the two groups to evaluate the effectiveness of using arcade games.The study was conducted in two high schools in Aceh Besar District: SMA Negeri 1 Darul Imarah and SMA Bina Bangsa, involving four selected student groups of tenth-grade students. They were split up into two groups: the control group, which got traditional training, and the experimental group, which used arcade games to learn.

Data collection in this study involved both quantitative and qualitative methods. Quantitative data were gathered through pre-tests and post-tests to measure students' understanding of figurative speech before and after the intervention. Qualitative data were obtained using a Yes-No questionnaire to assess students' perceptions of arcade game-based learning, focusing on engagement, motivation, and effectiveness. To complement the quantitative data, a questionnaire with a Yes-No response format was administered to gather students' perceptions of the learning media. This type of questionnaire provides clear and straightforward responses, allowing for an easy interpretation of students' engagement and opinions regarding the effectiveness of arcade game-based learning (Iskandar et al., 2022; Kusyani & Ray, 2023). The percentage of students selecting "Yes" or "No" for each statement was then calculated to analyze their level of interest, motivation, and perceived benefits of the learning media.

Both quantitative and qualitative data analysis were used in the study. Pre-test and post-test results were analyzed quantitatively using inferential statistics (paired-sample and independent-sample t-tests) to evaluate improvements and compare groups, and descriptive statistics (mean and standard deviation) to characterize performance. While, qualitative analysis focused on Yes-No questionnaire responses, calculating percentages to evaluate engagement, motivation, and perceived benefits. Recurring themes were identified to highlight patterns in students' perceptions.

C. FINDINGS AND DISCUSSION

1. Pretest and Posttest Results of Control and Experimental Classes at SMA Negeri 1 Darul Imarah and SMA Bina Bangsa

The results of this study are based on the implementation of both conventional teaching methods and gamified learning media, specifically arcade games, across control and experimental classes. Data were collected through pre-tests and post-tests conducted at two schools: SMA Negeri 1 Darul Imarah and SMA Bina Bangsa. The purpose of this analysis

was to evaluate the impact of each instructional method on students' performance and to assess the effectiveness of arcade game-based learning compared to conventional methods.

The results from both schools' control and experimental classes are shown in the part that follows, with an emphasis on the patterns seen in the students' pre- and post-test results. These findings are categorized into several performance levels, including very poor, poor, fair, good, and very good. The comparative analysis aims to provide insights into the effectiveness of arcade games as a learning tool, while also highlighting the outcomes achieved through traditional teaching approaches.

SMA Negeri 1 Darul Imarah

To examine the impact of the implemented treatment, descriptive statistical analysis was conducted on the pretest and posttest scores of both the experimental and control groups at SMA Negeri 1 Darul Imarah. The analysis includes measures such as the range, minimum, maximum, mean, and standard deviation for each group. The results provide an initial overview of students' performance before and after the intervention, offering insights into potential improvements. The descriptive statistics are summarized in Table 1.

Table 1. Descriptive Statistics

	N	Range	Min	Max	Mean	Std. Deviation
Pretest Experiment	25	60	30	90	51.20	17.635
Posttest Experiment	25	60	40	100	78.40	17.720
Pretest Control	25	60	30	90	50.80	17.540
Posttest Control	25	60	40	100	62.40	16.653
Valid N (listwise)	25					

According to the findings of the descriptive statistical analysis shown in the above table, there were 25 participants in total for both the experimental and control groups in this study. Each variable has a score range of 60, which includes the pretest and posttest. The pretest has a minimum score of 30 and a maximum score of 90, while the posttest has a minimum score of 40 and a maximum score of 100. This suggests that there is a fair amount of variety in the score distribution between the two groups. The experimental group also had a mean pretest score of 51.20 with a standard deviation of 17.635, and a mean posttest score of 78.40 with a standard deviation of 17.720. This notable rise indicates that the treatment given to the experimental group had a beneficial impact. With a standard deviation of 17.540 and a mean pretest score of 50.80, the control group's mean posttest score increases to 62.40 with a standard deviation of 16.653. Although the control group also demonstrates an increase in scores after the intervention, the improvement is not as substantial as that observed in the experimental group.

Table 2. Tests of Normality

Class	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Pretest Experiment	.157	25	.113	.952	25	.285
Posttest Experiment	.089	25	.200*	.979	25	.855
Pretest Control	.126	25	.200*	.964	25	.506
Posttest Control	.067	25	.200*	.984	25	.954

Pretest and posttest data in both the experimental and control groups can be examined to see if they follow a normal distribution using the normality test results from the Kolmogorov-Smirnov and Shapiro-Wilk tests, which are shown in the above table. According to the results of the Kolmogorov-Smirnov test, the experimental group's pretest had a significance value of 0.113, while their posttest had a value of 0.200. In the meantime, the control group's pretest and posttest both had significance values of 0.200. Similar findings are obtained using the Shapiro-Wilk test, which is more sensitive to small sample sizes. In the experimental group, the pretest had a significance value of 0.285, whereas the posttest had a significance value of 0.855. The pretest and posttest significance values for the control group are 0.506 and 0.954, respectively. If the significance value (Sig.) in a normality test is higher than 0.05, the data are said to follow a normal distribution. The pretest and posttest results in both groups are normally distributed, as indicated by the fact that all significant values, according to both tests, are greater than 0.05.

Table 3. Test of Homogeneity of Variance

Students' Result	Levene Statistic	df1	df2	Sig.
Based on Mean	.115	3	96	.951
Based on Median	.138	3	96	.937
Based on Median and with adjusted df	.138	3	95.465	.937
Based on trimmed mean	.105	3	96	.957

These significance values are 0.951 based on the mean, 0.937 based on the median, 0.937 based on the median with adjusted degrees of freedom, and 0.957 based on the trimmed mean, according to the findings of the homogeneity of variance test using Levene's test, which are shown in the above table. If the significance value (Sig.) in the homogeneity of variance test is higher than 0.05, the homogeneity assumption is satisfied. There is no discernible difference in variance between groups, according to the test's results, which show that all significance values are greater than 0.05. In other words, the homogeneity assumption needed for some parametric statistical analyses, such the t-test, is satisfied by the data utilized in this study, which show homogeneous variance.

Table 4. Paired Samples Test

		Paired Differences							Significance	
					95% Confidence Interval of the Difference					
		Mean	Std. Deviation	Std. Error Mean	Lower	Upper	t	df	One-Sided p	Two-Sided p
Pair 1	PreExperiment - PostEkperimen	-27.200	27.160	5.432	-38.411	-15.989	-5.007	24	<.001	<.001
Pair 2	PreControl - PostControl	-11.600	24.610	4.922	-21.759	-1.441	-2.357	24	.013	.027

Both the experimental and control groups' pretest and posttest scores differ significantly, according to the Paired Samples Test results. The experimental group's 95% confidence interval is between -38.411 and -15.989, and the mean difference in scores is -27.200 with a standard deviation of 27.160. A very significant result ($p < 0.001$) is indicated by the estimated t-value of -5.007 with df = 24, which suggests a considerable improvement in learning outcomes following the application of the treatment. In contrast, the control group's 95% confidence interval is between -21.759 and -1.441, and the mean difference in scores is -11.600 with a standard deviation of 24.610. A two-tailed significant value of p=0.027 is obtained from the computed t-value of -2.357 with df = 24, suggesting that learning outcomes have improved, but less so than in the experimental group. These results imply that, in comparison to the control group, the approach or intervention used with the experimental group is more successful in improving the learning outcomes of the students.

SMA Bina Bangsa

Descriptive statistical analysis was performed on the pretest and posttest results of the experimental and control groups at SMA Bina Bangsa in order to investigate the effects of the implemented treatment. Each group's range, lowest, maximum, mean, and standard deviation are among the metrics used in the research. The findings give a preliminary picture of how well the students performed both before and after the intervention, revealing areas for possible development. Table 5 provides a summary of the descriptive statistics.

Table 5. Descriptive Statistics

	N	Range	Min	Max	Mean	Std. Deviation
Pretest Experiment	25	60	30	90	49.20	17.540
Posttest Experiment	25	60	40	100	78.00	16.833
Pretest Control	25	60	30	90	48.40	17.000
Posttest Control	25	60	40	100	63.20	18.193
Valid N (listwise)	25					

The data showed that the total sample employed in this study comprises 25 people in each group, the experimental group and the control group, according to the findings of the descriptive statistical analysis shown in the above table. Each variable has a score range of 60, with the pretest having a minimum score of 30 and a maximum score of 90, and the

posttest having a minimum score of 40 and a maximum score of 100. Furthermore, the experimental group's mean pretest score was 49.20 with a standard deviation of 17.540, but the posttest findings showed an increase 78.00 with a standard deviation of 16.833. This rise implies that learning outcomes were significantly improved by the treatment given to the experimental group. In the control group, on the other hand, the mean posttest score rises to 63.20 with a standard deviation of 18.193, whereas the mean pretest score is 48.40 with a deviation of 17.000. Even while the control group's scores increased following the intervention, it did so at a slower rate than the experimental group. Overall, these findings show that the experimental group's approach or intervention is more successful than the control groups in improving learning outcomes, pointing to a beneficial effect of the treatment given.

Table 6. Tests of Normality

Class	**Kolmogorov-Smirnov[a]**			**Shapiro-Wilk**		
	Statistic	df	Sig.	Statistic	df	Sig.
Pretest Experiment	.138	25	.200	.931	25	.093
Posttest Experiment	.145	25	.186	.952	25	.278
Pretest Control	.136	25	.200	.915	25	.040
Posttest Control	.141	25	.200	.937	25	.129

According to the Shapiro-Wilk and Kolmogorov-Smirnov normality tests, the majority of the data had a normal distribution. All variables have significance values over 0.05 according to the Kolmogorov-Smirnov results, indicating normality. However, the control pretest had a significance value of 0.040, indicating a little departure from normalcy, according to Shapiro-Wilk, which is more sensitive to small samples. Nevertheless, the total data were regarded as normally distributed, which permitted the cautious use of parametric statistical tests with respect to the control pretest variable.

Table 7. Test of Homogeneity of Variance

Result	**Levene Statistic**	**df1**	**df2**	**Sig.**
Based on Mean	.029	3	96	.993
Based on Median	.009	3	96	.999
Based on Median and with adjusted df	.009	3	91.646	.999
Based on trimmed mean	.015	3	96	.998

Levene's test findings for the homogeneity of variance test yielded the following significance values: 0.993 for the mean, 0.999 for the median, 0.999 for the median with adjusted degrees of freedom, and 0.998 for the trimmed mean. If the significance value (Sig.) in the homogeneity of variance test is higher than 0.05, the homogeneity assumption is satisfied. These findings imply that there is no discernible variation in variance across groups because all significance values are significantly higher than the 0.05 cutoff. Put another way, the homogeneity assumption necessary for parametric statistical analyses like the t-test is satisfied by the data in this study, which show homogeneous variance.

Table 8. Paired Samples Test

	Paired Differences					t	df	Significance	
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				One-Sided p	Two-Sided p
				Lower	Upper				
Pre- Post Experiment (Pair 1)	-28.800	23.509	4.702	-38.504	-19.096	-6.125	24	<.001	<.001
Pre-Post Control (Pair 2)	-14.800	23.473	4.695	-24.489	-5.111	-3.153	24	.002	.004

Both the experimental and control groups' pretest and posttest scores differ significantly, according to the Paired Samples Test results. With a standard deviation of 23.509 and a mean score difference of -28.800, the experimental group's 95% CI falls between -38.504 and -19.096. A very significant result ($p < 0.001$) is indicated by the computed t-value of -6.125 with df = 24, which suggests a considerable increase in learning outcomes following the administration of the treatment. In contrast, the 95% CI for the control group is between -24.489 and -5.111, and the mean score difference is -14.800 with a standard deviation of 23.473. Although not as much as in the experimental group, the computed t-value of -3.153 with df = 24 yields a significance value of $p = 0.004$ (two-tailed), suggesting a substantial improvement in learning outcomes. These results imply that, in comparison to the control group, the experimental group's strategy or intervention is more successful in improving learning outcomes.

According to the results presented in Tables 1 and 5, the control group of students at SMA Negeri 1 Darul Imarah had an average pretest score of 50.8 and an average posttest score of 62.4. In contrast, the experimental class had an average score of 51.2 on the pretest and 78.4 on the posttest. In the same way, the experimental class at SMA Bina Bangsa recorded an average pretest score of 49.2 and a posttest score of 78, while the control class had an average pretest score of 48.4 and a posttest score of 63.2. Moreover, the table 2 and Table 6 present normality test results for pretest and post-test scores in experimental and control classes at two different schools, SMA Negeri 1 Darul Imarah and SMA Bina Bangsa The Shapiro-Wilk and Kolmogorov-Smirnov tests are used, and the significant values show whether or not the data are normally distributed. At SMA Negeri 1 Darul Imarah, most of the pretest and post-test data also show p-values below 0.05 in at least one test. Similarly, at SMA Bina Bangsa, the majority of significance values, particularly in the Shapiro-Wilk test, are below 0.05. Next, the data can be examined through a homogeneity test to determine whether it is homogeneous before being tested using a T-test if it has been confirmed as normal.

Additionally, the results of the homogeneity of variance test for student scores at SMA Negeri 1 Darul Imarah and SMA Bina Bangsa using Levene's test are shown in Tables 3 and 7. The data variances are homogeneous, as evidenced by the significance (Sig.) values for all test methods (trimmed mean, median, median with adjusted degrees of freedom, and

mean) being significantly over 0.05 in both schools. This homogeneity implies that the assumption of equal variances is satisfied, which makes it possible to perform additional parametric statistical analysis more reliably and correctly, including the sample paired t-test.

The significant value (two-tailed) is 0.00 less than 0.05, as determined by Tables 4 and 8. The average scores of the pupils in the experiment class utilizing the arcade games varied, it can be determined. Consequently, the hypothesis (Ha) is accepted and the null hypothesis (Ho) is rejected. This indicates that when compared to traditional teaching techniques, the arcade game-based learning approach significantly improves students' learning outcomes. According to these findings, there was no discernible increase in the average scores of students who received instruction using traditional methods. This is due to their lack of active participation in the learning process, as they appeared disengaged and passive. In this approach, the teacher played a dominant role by explaining the material while students simply listened and absorbed the information. As a result, students had limited opportunities to develop their own ideas and understanding of figurative language.

On the other hand, the experimental class showed a significant improvement in learning outcomes. This can be attributed to the use of arcade game-based learning, which placed greater emphasis on student engagement and direct experience. Students were inspired to be more engaged and creative during the learning process by the interactive nature of arcade games. The instructor served as a facilitator in this situation, helping the students explore the figurative language content through the arcade games. Keller's ARCS motivation theory, which prioritizes Attention, Relevance, Confidence, and Satisfaction, is consistent with these findings (Afjar et al., 2020). Arcade games capture students' attention through engaging visual and interactive elements. The games can be tailored to the learning material, making them more relevant and meaningful. The gradual challenges presented in the games help build students' confidence in completing tasks. Additionally, the immediate feedback provided, such as displaying scores upon task completion enhances student satisfaction, allowing them to learn while enjoying the game.

2. Students' Perception toward the use of Learning Media

Surveys were used to examine how students felt about using learning materials based on arcade games. Since perception affects how students understand and use educational resources, it is essential in determining how individuals react to learning media. According to Rookes & Willson (2000), perception is a complex cognitive process involving the organization and interpretation of sensory input, which is influenced by prior knowledge, experiences, and expectations. This means that students' engagement with learning media is not solely dependent on its availability but also on how they perceive its effectiveness and relevance to their learning needs. The following pie chart presents a detailed analysis of the findings from the questionnaire.

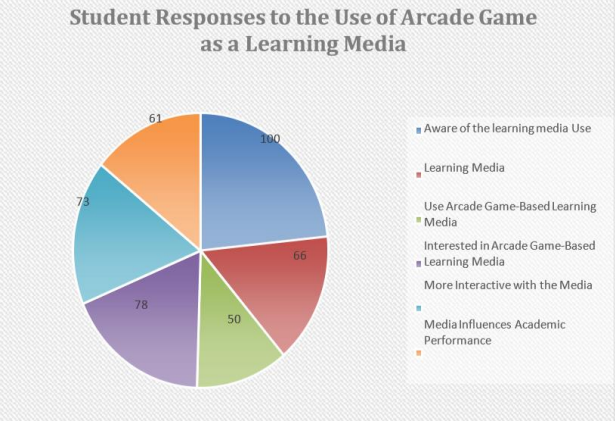

Figure 1. Tabulation of questionnaires

The following section presents a detailed analysis of the questionnaire results, highlighting students' perceptions in five key areas.

Students' Awareness of Learning Media

The data from the questionnaires revealed that all respondents were aware of the learning media used. This indicates that all respondents (100%) involved in the study had a clear understanding of its role in their learning process. This awareness is crucial, as prior studies suggest that edutainment teaching methods can enhance student performance more effectively than conventional methods (Panse et al., 2018).

Utilization of Learning Media in Learning Activities

The questionnaire data revealed that 66% of students actively used the learning media in the learning process, while 34% had yet to utilize it. This demonstrates that the majority of students were not only aware of the media but also utilized it to support their studies. Moreover, this proportion highlights the growing role of learning media in the classroom, although 34 students had yet to utilize it. This finding is supported by several studies (Iskandar et al., 2022; Kusyani & Ray, 2023), which have also emphasized the effectiveness of digital learning media in enhancing student engagement and academic performance.

Students' Interest in Arcade Game-Based Learning Media

The data also revealed that 50% of students utilized arcade game-based learning media in their studies, indicating a strong interest in interactive and engaging learning methods. This suggests that arcade games effectively enhance student engagement and learning experiences. Additionally, 78% of students expressed interest in using arcade game-based learning media. The strong interest could indicate that students perceive arcade games as providing a more engaging and motivating learning experience compared to conventional teaching methods. Game-based media might also offer students a practical and enjoyable way to learn, thus increasing their interest and participation in the learning process. The significant interest points to the potential of arcade games as an innovative solution to enhance student engagement in education. This result is consistent with earlier research showing that game-based learning offers engaging and interactive learning opportunities that increase student participation and promote deeper comprehension (Dahalan et al., 2024; Metwally et al., 2021; Orsoni et al., 2023).

Interactivity and Engagement through Learning Media

The questionnaire data revealed that a total of 73 % of students stated that the learning media made them more interactive during the learning process. This suggests that the majority of students found that the media encouraged active participation and higher engagement in class. Interactive learning media allows students not only to receive material passively but also to actively explore, communicate, and collaborate with peers. By encouraging students to interact more in the learning process and promoting better understanding through direct engagement, it can be stated that the learning media successfully created a more dynamic learning environment. It supports the claim made by Harsanti & Lathifah (2023) that using a technological platform raised student interest in studying Indonesian.

Impact of Learning Media on Academic Performance

By integrating interactive and engaging elements, game-based learning can facilitate knowledge acquisition, improve problem-solving skills, and increase motivation. As presented by the data of the questionnaire, 61 % of students reported that the learning media positively impacted their academic performance. According to this, most students believed that the media improved their learning achievements. It is consistent with earlier research that indicates games have the ability to improve student motivation and comprehension through interaction and participation. (Chan et al., 2021; Hidayatulloh et al., 2020; Kaya & Ercag, 2023).

The results mentioned previously suggest that students' opinions of arcade games positively affect their learning. As a result, this study supports earlier research that has effectively integrated games into education, such Cheong et al. (2014), which discovered that undergraduate students are interested in using game-based learning systems and have a favorable opinion of them. Furthermore, other research has shown that gamification techniques have a good impact on students' effectiveness, motivation, and general involvement. Furthermore, students tend to adopt a generally positive perspective on the process of gamification in education (Devendren & Nasri, 2022; Yıldırım, 2017).

D. CONCLUSION

The need for more engaging and interactive learning approaches in literature education, particularly in teaching poetic figures of speech, has been widely recognized. By investigating the efficacy of learning materials based on arcade games in improving students' comprehension, this study helps close this gap. The results demonstrate the beneficial effects of interactive and gamified learning methodologies by showing that students in the experimental group, who participated in arcade game-based learning, obtained higher posttest scores than those in the control group. These findings support the hypothesis that interactive learning media fosters better student engagement and improved learning outcomes. Additionally, students' perceptions of arcade game-based learning further support its effectiveness. The majority of students reported that using arcade games in their learning made them more interactive, motivated, and positively impacted their academic performance. Furthermore, a significant number of students expressed interest in using arcade games as learning media, indicating that they perceive game-based learning as an engaging and enjoyable method that enhances their participation and comprehension. Given these results, it is recommended that educators consider integrating arcade game-based media or other gamified learning platforms into their teaching strategies, particularly for subjects that require higher engagement. However, it is also essential to recognize the need for additional

research into how these tools can be optimized for various student learning styles and how to address the challenges faced by students who may not initially engage with the media. Providing necessary training and support for both students and educators could further enhance the effectiveness of these tools.

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