THE EFFECTIVENESS OF AN ENGLISH CROSSWORD PUZZLE GAME TO IMPROVE VOCABULARY MASTERY OF 7TH GRADE STUDENTS AT SMPN 2 PONTIANAK

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Abstract

This study examines the effectiveness of crossword puzzle games in improving English vocabulary mastery among seventh-grade students at SMPN 2 Pontianak. Using a quasi-experimental design, the research involved 60 students divided into experimental and control groups. Data were collected through pre-tests and post-tests in written subjective format and analyzed using SPSS version 27 based on Agresti & Finlay's theory (2019). The results indicate a significant improvement in the experimental group, with the average score rising from 51.06 to 80.06, while the control group showed a modest increase from 48.56 to 65.13. A statistical test at a 5% significance level confirmed the effectiveness of crossword puzzles in enhancing vocabulary mastery (t-count = 11.349 > t-table = 2.042). These findings highlight the potential of interactive games as a valuable teaching strategy in the independent curriculum to support vocabulary acquisition.

Keywords:

Crossword Puzzle Games, Vocabulary Mastery, English Language Learning.

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INTRODUCTION

This study examined the effectiveness of using crossword puzzle games to improve the English vocabulary mastery of seventh-grade students at SMPN 2 Pontianak. The research objectives were to: 1) identify students' vocabulary mastery before the implementation of crossword puzzle games, 2) identify students' vocabulary mastery after the implementation of crossword puzzle games, and 3) describe the significance of the improvement in students' vocabulary mastery.

Vocabulary plays a crucial role in language proficiency, as it enables individuals to effectively communicate in both spoken and written forms (Read & Carthy, 2000). According to Read and Carthy (2000), "vocabulary mastery may be seen as a key area in language education, and exams are needed to evaluate learners' progress in acquiring vocabulary and determine whether their vocabulary knowledge is sufficient to meet the demands of their communication." Without a sufficient vocabulary, language learners will struggle to express themselves, even if they possess a strong grasp of grammar rules. Wilkins (1972:111-2) emphasized the importance of vocabulary, stating that "Without grammar, very little can be conveyed, without vocabulary,

nothing can be conveyed." This underscores the notion that vocabulary is the foundation for language use and that improving vocabulary mastery is essential for successful communication.

Furthermore, vocabulary proficiency exposes learners to a diverse range of cultures, ideas, and perspectives, fostering global awareness and critical thinking skills (Nagy & Townsend, 2012). As explained by Nagy and Townsend (2012), "*Theory of critical thinking English is a global language and proficiency in its vocabulary exposes students to a wide range of cultures, ideas, and perspectives from around the world. It fosters global awareness and appreciation for diversity.*" A robust vocabulary enables students to analyze information, make connections, and articulate reasoned arguments, supporting a deeper and more nuanced interpretation of ideas.

However, previous studies have revealed students' low vocabulary mastery, which is often attributed to a lack of interest in vocabulary development (Anwar & Efransyah, 2018; Tegu & Hadiwiyaja, 2022). Anwar and Efransyah (2018) investigated that "*Employed a quantitative research method and a pre-experimental design focusing on one class, which provided the foundation for the current research.*" Additionally, the study by Tegu and Hadiwiyaja (2022) "investigated the effectiveness of Crossword Puzzle Games on students' vocabulary at the seventh-grade level in SMPN 1 Ngaroro using a similar quantitative research and pre-experimental design." This condition occurs because the conventional teaching strategy of vocabulary memorization is not engaging for students. To address this issue, the current study investigates the use of crossword puzzle games as an interactive and motivating approach to improve vocabulary mastery among junior high school students.

Through preliminary studies and observations at SMPN 2 Pontianak, it is assumed that students' low vocabulary mastery is a result of their lack of interest in vocabulary development. This study aims to provide empirical evidence on the effectiveness of using crossword puzzle games to enhance students' vocabulary mastery and foster their enthusiasm for English language learning, filling the gap in the literature on the use of interactive and engaging activities in vocabulary instruction.

Teaching vocabulary in English requires creative strategies, and using games is an effective way to engage students in enjoyable, active learning. Games support language acquisition and physical, cognitive, and social development, creating a relaxed and motivated learning environment. Gardner (1983) emphasized that language recognition activities are most impactful when introduced at a young age, while Deci & Ryan's (2000) motivation theory highlights the importance of both intrinsic motivation and incentives in language learning.

The researcher selected crossword puzzles among various game-based strategies to help students master vocabulary. Crossword puzzles are interactive and engaging, promoting active recall as students solve hidden words, reinforcing their memorization and understanding of meanings. Kolb's (1984) active learning theory supports this, suggesting that games promote active participation, enhancing students' retention and comprehension by making learning dynamic and less monotonous. Siddik & Wijaksono (2022) also found that crossword puzzles add appeal to the learning process, encouraging students to repeatedly encounter and practice new words. Through this playful, repetitive method, students not only enjoy learning but also develop their English vocabulary effectively.

LITERATURE REVIEW

This literature review examines current knowledge and contributions on the use of games, specifically crossword puzzles, in enhancing vocabulary mastery among students.

Previous Study

Previous studies indicate the potential benefits of using interactive media to support English vocabulary acquisition but also highlight areas for improvement in research design and assessment.

Research by Hafizhah & Pratolo (2022) demonstrated that crossword puzzle games have a positive impact on students' vocabulary development. Their study found that students gained better vocabulary mastery and expressed higher enthusiasm when engaging with crossword puzzles. The design of the crossword puzzles, featuring across and down boxes with clues, facilitated students' vocabulary recall and understanding. However, Hafizhah & Pratolo (2022) acknowledged limitations in their study, suggesting that future research incorporate practical assessments like pre- and post-tests to yield more robust results.

Similarly, Anwar & Efransyah (2018) investigated the impact of crossword puzzles on vocabulary improvement in a technology-based learning environment. They conducted a quantitative study using pre- and post-tests and reported significant improvements in vocabulary mastery among seventh-grade students. Students showed a positive attitude toward this active learning tool, which enhanced their motivation and retention of new vocabulary.

Rizqi & Usman (2021) explored the role of crossword puzzles in vocabulary acquisition among eighth-grade students, aiming to assess vocabulary growth with and without the use of crossword puzzles. The study

revealed a substantial improvement in vocabulary skills after implementing crossword puzzles, evidenced by significant statistical results. Rizqi & Usman's findings underline the potential of crossword puzzles in creating an engaging learning environment that supports vocabulary retention.

Despite the positive findings, these studies highlight a need for more comprehensive research methodologies. Hafizhah & Pratolo (2022) and Anwar & Efransya (2018) used pre-experimental designs with limited samples and relied on multiple-choice instruments, which may restrict the depth of their findings. In contrast, the current study applies a quasi-experimental design with a larger sample size and employs subjective tests to provide a more nuanced understanding of vocabulary mastery through crossword puzzles.

Additionally, Rizqi & Usman (2021) noted the importance of context-specific vocabulary tools and recommended expanding research to different educational settings. This study, therefore, aims to fill these gaps by adopting a more rigorous research design, a larger sample, and different assessment tools to validate the effectiveness of crossword puzzles in vocabulary learning for middle school students.

METHODS

This study employed a quasi-experimental design, as Creswell (2008) described, to investigate the effectiveness of crossword puzzles in enhancing English vocabulary mastery among seventh-grade students at SMPN 2 Pontianak. A quantitative approach was chosen for precise measurement and statistical analysis of numerical data. The population consisted of all seventh-grade students at SMPN 2 Pontianak, comprising 60 (28 female and 32 male students) divided between classes VII-C and VII-D. Through purposive sampling, class VII-C was designated as the experimental class, which used crossword puzzles as a learning medium, while class VII-D served as the control class, following traditional vocabulary teaching methods.

For data collection, as Kumar (2019) stated, efficient tools can save time and resources while streamlining the process of gathering data. The main tool used was a subjective test using crossword puzzles to assess students' vocabulary mastery, administered as both pre-tests and post-tests. Performance tests and documentation were also utilized as data retrieval tools. Following Sugiono's (2014) framework for quantitative research, several statistical analyses were conducted, including validation tests to ensure instrument suitability, reliability tests for consistent results, normality tests to verify normal distribution of data, homogeneity tests to check variance equality between groups, and independent sample t-tests to compare means between the experimental and control groups.

Data analysis involved comparing the pre-test and post-test results to identify any significant differences in vocabulary improvement between the

groups. Statistical tests were used to determine the effectiveness of crossword puzzles in supporting vocabulary acquisition. This method provided a structured way to assess the impact of crossword puzzles, offering insights into their potential as an engaging educational tool in language learning.

RESULTS

The research investigated how crossword puzzle games affect English vocabulary acquisition among students at SMPN 2 Pontianak. This section outlines the findings and analyzes the impact of implementing crossword puzzles as a learning tool.

When considering statistical testing methods, sample size plays a crucial role in determining the appropriate approach. According to Hollander & Eric (2013), while the Shapiro-Wilk test proves more effective for analyzing smaller datasets (fewer than 50 samples), the Kolmogorov-Smirnov test is better suited for larger sample groups (50 or more). Both statistical methods operate under the null hypothesis that the data follows a normal distribution.

Based on these statistical principles, this study employs the Kolmogorov-Smirnov test, specifically utilizing the Two-Sample comparison method. This approach is particularly valuable for examining differences between distinct groups, such as comparing experimental and control groups in research settings.

The following section details the data analysis:

The Process During Data Collection of Experimental and Control Groups

Before beginning the experiment, a pre-test was administered to seventh-grade students at SMP Negeri 2 Pontianak on April 24, 2024, to assess their English vocabulary proficiency. The experimental class was given a subjective test consisting of 10 pages of crossword puzzles, while the control class completed 9 pages of similar exercises. Both groups were allotted 2 hours to complete their assessments.

Based on the pre-test results, classes VII C and VII D were selected as the experimental and control groups respectively, due to their comparable reading comprehension levels and lower overall scores. The study proceeded with a structured timeline: the control group (VII D) received their post-test on May 14, 2024, without exposure to the crossword puzzle game intervention. The experimental group (VII C) underwent the crossword puzzle game treatment on May 15, 2024, followed by their post-test on May 29, 2024.

The following was the result of the validity and reliability of test items.

In discussing test validity, Azwar (2010) explains that validity refers to the degree of accuracy and precision of a measurement instrument in performing its function. The validation process, which is fundamental to assessment

reliability, was thoroughly conducted and analysed by expert validators. The assessment utilized a five-tier scoring system, ranging from "not feasible" (0-54%) to "very feasible" (90-100%), with intermediate levels including "less feasible" (55-64%), "quite feasible" (65-74%), and "feasible" (75-89%). The validators were provided with a comprehensive checklist to evaluate the English learning assessment tools designed for seventh-grade students at SMPN 2 Pontianak. Following their thorough evaluation, the research instrument was deemed both valid and reliable, meeting all necessary validity criteria and thus suitable for collecting precise and meaningful data for the study.

Table 1
The Reliability Test of Experimental Class

Reliability Statistics

Cronbach's Alpha	N of Items
.786	2

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
EksPre	82.07	18.616	.682	.
EksPost	48.57	78.668	.682	.

Table 2
Reliability Test of Control class

Reliability Statistics

Cronbach's Alpha	N of Items
.698	2

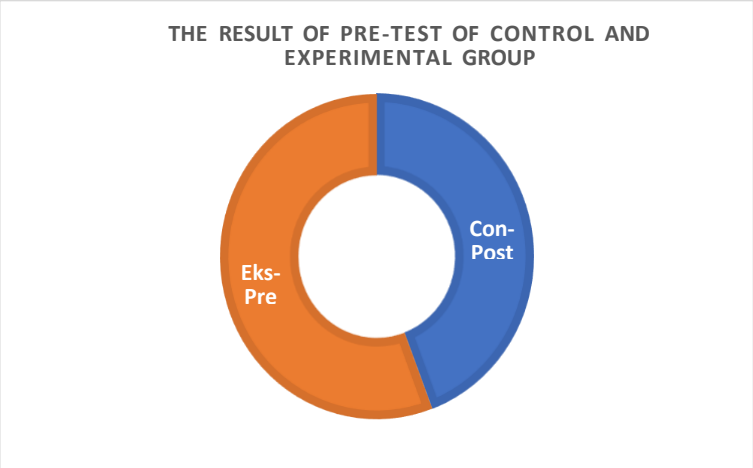
Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
ConPre	45.33	25.747	.682	.
ConPost	27.00	49.310	.682	.

Lance & Michels (2006) define reliability in research and measurement as the ability of an instrument or procedure to yield consistent and stable results across repeated applications under similar conditions. The study's reliability analysis, conducted using SPSS software, yielded reliability scores of 698 and 786, demonstrating that the assessment tool meets the established reliability standards. These scores fall within the high-reliability category, confirming that the test instrument provides consistent and dependable measurements for research purposes.

The students' scores of vocabulary mastery before the implementation of the Crossword Puzzle Game.

Figure 3

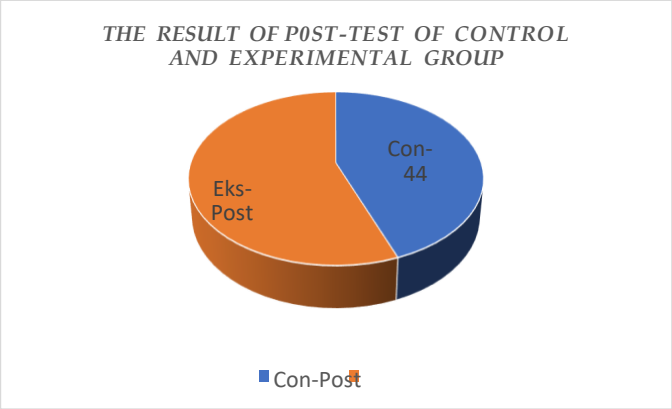


According to Bloom (1956), pre-test score calculation serves as a crucial component in evaluating learning effectiveness. Pre-tests are instrumental in establishing students' baseline capabilities before implementing any educational interventions or learning strategies. The pie chart illustrates the pre-test distribution between the control and experimental groups, with the experimental group (Eks-Pre) showing 56% and the control group (Con-Post) at 44% of the total distribution.

The detailed analysis of the pre-test results reveals comparable baseline performances between both groups. Students in both groups demonstrated similar minimum scores of 30, while their maximum scores differed slightly with 65 for the control group and 67 for the experimental group. The aggregate scores further highlight this distinction, with the control group achieving a total of 1457 (mean: 48.56) compared to the experimental group's 1532 (mean: 51.06). These statistics, reflected in the percentage distribution shown in the pie chart, indicate that the experimental group began with a marginally higher performance level than the control group.

The students' scores of vocabulary mastery after the implementation of the Crossword Puzzle Game

Figure 4



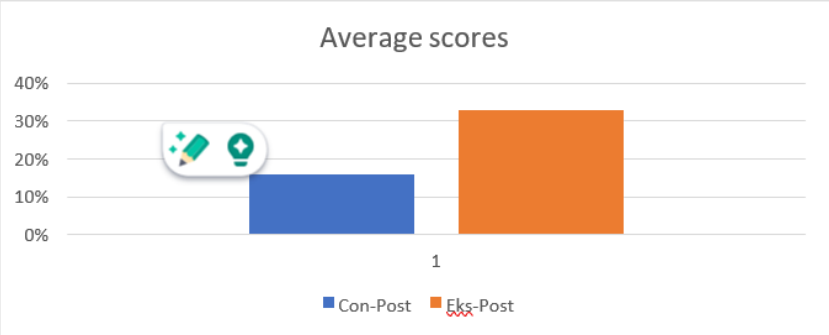
Gay & Airasian (2012) emphasize that post-test score calculation is an essential evaluation method for assessing the impact of educational interventions on student learning. This assessment process involves comparing students' performance after receiving treatment against their initial pre-test scores, providing valuable insights into the effectiveness of the implemented learning strategies.

The post-test analysis revealed significant differences between the control and experimental groups. The experimental group demonstrated notably higher performance metrics, with scores ranging from 73 to 91, resulting in a total score of 2462 and a mean of 80.06. In contrast, the control group's scores ranged from 57 to 78, with a total score of 1954 and a mean of 65.13. These results indicate that the experimental group achieved substantially better outcomes compared to the control group, suggesting the effectiveness of the implemented intervention.

Based on the results shown in the chart comparing the difference in values between using the crossword puzzle game and not using the crossword puzzle

game, the total value in the experimental class is 1005, whereas in the control class, it is 481. By calculating the mean values for both classes:

Table 5
The Average result of the Experimental and Control Group



The comparative analysis of mean values between the experimental and control classes reveals a notable distinction in performance, as depicted in the bar graph where the experimental group (Eks-Post) achieved approximately 32% compared to the control group's (Con-Post) 15%. This substantial difference in average scores demonstrates that students who engaged with the crossword puzzle game showed significantly enhanced vocabulary mastery compared to those who did not, providing strong evidence for the effectiveness of incorporating crossword puzzles as a teaching tool in English vocabulary instruction.

The significance of the student's vocabulary mastery after the implementation of the crossword puzzle game

The first is the experiment and control group findings of the normality test. According to Hollander & Eric (2013), the Shapiro–Wilk test is considered more suitable for small sample sizes (fewer than 50), although it can also be

applied to larger samples. Meanwhile, the Kolmogorov–Smirnov test is typically used for samples of 50 or more. In both tests, the null hypothesis assumes that the data originate from a normally distributed population. Based on these expert opinions, this study employs the Kolmogorov–Smirnov test, specifically for comparing two samples. This test is used to analyse differences in distributions between two distinct groups, such as a treatment group and a control group in an experimental study.

Table 6
Normality of Pre-Test and Post-Test Experiment And Control Class

	Kolmogorov-Smirnov[a]		
	Statistic	df	Sig.
EksPre	.158	30	.181
EksPost	.118	30	.200*
ConPre	.134	30	.130
ConPost	.106	30	.155*

Based on Hollander & Eric (2013), the analysis follows expert guidelines. Data were processed using SPSS 27, and normality was tested with the Kolmogorov–Smirnov test. A significance value > 0.05 indicates normal distribution. Table 12 shows that the experimental group's Pre-Test (0.181) and Post-Test (0.200), as well as the control group's Pre-Test (0.130) and Post-Test (0.155), all exceed 0.05. Thus, both groups are normally distributed.

The second is the results of the homogeneity test of the experiment groups. According to Montgomery & Vining (2012), homogeneity testing is conducted to confirm that the measured data originate from the same population. These populations have distinct characteristics such as age, gender, and education. The homogeneity test is performed to assess whether the data or samples in both classes are homogeneous or heterogeneous.

Table 7
Homogeneity of Experiment Class
Test of Homogeneity of Variance

		Levene Statistic	df1	df2	Sig.
Nilai	Based on Mean	.010	1	58	.922
	Based on Median	.016	1	58	.901
	Based on Median and with adjusted df	.016	1	57.270	.901
	Based on trimmed mean	.004	1	58	.947

According to Widhiarso (2011), the homogeneity test ensures data similarity and follows expert guidelines. Using SPSS 27, the test results in Table 7 show a Levene's Statistic of 0.10 with a significance of 0.947. Since 0.947 > 0.05, it confirms that the control and experimental classes are homogeneous.

The third is the results of the homogeneity test of the control groups.

Table 8
Homogeneity of Control Class
Tests of Homogeneity of Variances

		Levene Statistic	df1	df2	Sig.
hasil belajar	Based on Mean	2.920	1	58	.093
	Based on Median	2.319	1	58	.133
	Based on Median and with adjusted df	2.319	1	52.133	.134
	Based on trimmed mean	2.871	1	58	.096

According to Montgomery & Vining (2012), the homogeneity test ensures data similarity. Using SPSS 27, Table 8 shows a Levene's Statistic of 2.871 with a significance of 0.096. Since 0.096 > 0.05, it confirms that the experimental and control classes are homogeneous.

Next, the fourth is the results of the Independent Sample T-Test of experimental and control groups. According to Fraenkel (2015), the Paired Sample T-test compares the means of two related samples under the assumption of normal distribution. Meanwhile, the Independent Sample T-Test determines whether there is a significant difference in the mean between two independent groups with interval or ratio data. This parametric analysis is conducted using SPSS (Statistical Package for Social Science).

Table 9
Independent Sample T-Test of Experimental Class

Group statistics

	Kelas	N	Mean	Std. Deviation	Std. Error Mean
Hasil vocabulary	Kelas Eks	30	79.5000	10.93161	1.99583
	Kelas Con	30	67.0667	5.81279	1.06127

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means					95% Confidence Interval of the difference	
		F	Sig	T	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	lower	upper
Hasil vocabulary	Equal Variances assumed	.936	.337	5.500	58	<.001	12.43333	2.26045	7.90856	16.95811
	Equal Variances not assumed			5.500	44.185	<.001	12.43333	2.26045	7.87824	16.98842

Independent Sample Effect Sizes

				95% Confidence Interval	
		Standardize[a]	Point Estimate	Lower	Upper
Hasil vocabulary	Cohen's d	8.75467	1. 420	.847	1.983
	Hedges' correction	8.86995	1.402	.836	1.957
	Glass's delta	5.81279	2.139	1.384	2.876

According to Pallant (2020), the results align with expert guidelines. Levene's Test shows a significance value of 0.337 (> 0.05), confirming the assumption of equal variances. The T-test for Equality of Means yields a Sig. (2-tailed) value of 0.01 (< 0.05), leading to the rejection of the null hypothesis and indicating a significant difference between the two group means.

Table 10

Independent Sample T-Test of Control Class

Group statistics

	Kelas	N	Mean	Std. Deviation	Std. Error Mean
Hasil vocabulary	Kelas Eks	30	62.5333	1424595	2.60094
	Kelas Con	30	51.0667	9.81882	1.789266

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means					95% Confidence Interval of the difference	
		F	Sig	T	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	lower	upper
Hasil vocabulary	Equal Variances assumed	3.064	085	3.630	58	<.001	11.46667	3.15888	5.14347	17.78986
	Equal Variances not assumed			3.360	51.480	<.001	11.46667	3.15888	5.12638	17.80696

Independent Sample Effect Sizes

				95% Confidence Interval	
		Standardize[a]	Point Estimate	Lower	Upper
Hasil vocabulary	Cohen's d	12.23430	.937	.400	1.468
	Hedges' correction	12.39540	.925	.395	1.448
	Glass's delta	9.81882	1.168	.572	1.748

According to Pallant (2020), the findings align with expert guidelines. Levene's Test shows a significance value of 0.085 (> 0.05), confirming the assumption of equal variances. The T-test for Equality of Means yields a Sig. (2-tailed) value of 0.01 (< 0.05), leading to the rejection of the null hypothesis and indicating a significant difference between the two group means. To assess the significance of post-test averages, an independent sample t-test was conducted to compare the two groups. The results, analyzed using SPSS 27, are presented in Tables 9 and 10.

The last is Hypothesis Testing (T-test). This section presents the hypothesis test results regarding the significance of students' vocabulary mastery using crossword puzzle games. The null hypothesis (H_0) states that there is no significant difference, while the alternative hypothesis (H_1) suggests otherwise. Given that the population variance is unknown and the sample size is ≥30, a t-test is used with a significance level (α) of 0.05. Based on the Student's T-table, the critical value for a right-tailed test is 1.99. The decision rule states that if T ≥ 1.99, H_0 is rejected; otherwise, it is not. The calculated t-statistic is 47.34, which is lower than the critical value, leading to a failure to reject H_0. Additionally, the p-value (0.79) exceeds 0.05, further confirming that H_0 cannot be rejected. Thus, there is no significant difference in students' vocabulary mastery due to the use of crossword puzzle games.

DISCUSSION

The implementation of crossword puzzles as a vocabulary learning tool demonstrates significant potential in enhancing students' English vocabulary mastery. This finding aligns with multiple theoretical frameworks that support the effectiveness of such interactive learning approaches, and the empirical results provide strong evidence for their pedagogical value.

The study's results can be interpreted through several theoretical lenses that explain the mechanisms behind the observed improvement. First, as predicted by Flavell's (1976) metacognitive theory, crossword puzzles effectively engaged students in thinking about their learning processes. The substantial improvement in the experimental group's scores (from 48.57 to 80.06, a gain of 33.05 points) suggests that students developed stronger metacognitive strategies while working with crossword puzzles, actively monitoring and reflecting on their vocabulary learning process. This metacognitive engagement is particularly significant given the initial low performance (below KKTP standards) and the subsequent achievement of satisfactory performance levels.

The marked difference in performance between the experimental and control groups (gain scores of 33.05 versus 16.03) can be understood through Deci & Ryan's (1985) Self-Determination Theory. The crossword puzzle format

appears to have fostered intrinsic motivation by providing students with autonomy in their learning process and a sense of competence as they completed puzzles. The dramatic improvement in minimum scores (from 30 to 73 in the experimental group, compared to 30 to 57 in the control group) suggests that even struggling students benefited significantly from this approach. This aligns with Lave & Wenger's (1991) Situated Learning Theory, as the puzzles created a contextual learning environment that made vocabulary acquisition more meaningful and engaging.

The statistical significance of the results (t-count 11.349 > t-table 2.042) provides robust evidence for the effectiveness of crossword puzzles as a pedagogical tool. This effectiveness can be attributed to multiple learning mechanisms working in concert. Paivio's (1971) Dual Coding Theory helps explain why crossword puzzles are particularly effective - they engage both verbal and spatial processing pathways, strengthening vocabulary retention through multiple cognitive channels. The spatial arrangement of words in crossword puzzles creates a visual framework that supports memory formation, while the verbal clues engage linguistic processing, creating a powerful dual-coding effect.

The social dimensions of learning were also evident in the results. Bandura's (1977) Social Learning Theory helps explain how students benefited from collaborative puzzle-solving opportunities, learning through peer observation and interaction. The classroom environment during puzzle activities likely facilitated valuable peer learning experiences, with students observing and imitating successful strategies from their classmates. This social learning aspect may have contributed to the remarkably high maximum score (91) achieved in the experimental group's post-test.

The improvement in test scores also reflects Kearsley & Shneiderman's (1998) Engagement Theory, as crossword puzzles provided meaningful tasks that actively involved students in the learning process. The consistent improvement across all performance levels suggests that the puzzles successfully maintained student engagement regardless of initial ability. This engagement was further enhanced by the puzzle format's ability to help students elaborate on their existing knowledge, as described by Reigeluth's (1983) Elaboration Theory, through the use of contextual clues and associations.

Miller's (1956) Information Processing Theory provides additional insight into why the experimental group showed superior results. The crossword puzzle format naturally incorporates repeated exposure and practice, supporting the encoding and retrieval processes essential for vocabulary acquisition. The significant gap between experimental and control group outcomes (final averages of 80.06 versus 65.13) suggests that the structured

nature of crossword puzzles better supports these cognitive processes compared to traditional memorization techniques.

The normality and homogeneity analyses further strengthen these findings. The normal distribution of scores in both groups (experimental class: 0.93 and 0.861 > 0.05; control class: 0.250 and 0.334 > 0.05) and homogeneous samples (0.947 > 0.05) indicate that the improvements observed can be reliably attributed to the intervention rather than sampling bias or other external factors. This statistical validation adds weight to the theoretical interpretations of the results.

From a constructivist perspective, as outlined by Piaget (1954), the success of crossword puzzles can be attributed to their ability to facilitate active knowledge construction. Students were not merely passive recipients of vocabulary but actively engaged in constructing meaning through the puzzle-solving process. This constructivist approach appears to be particularly effective in vocabulary acquisition, as evidenced by the substantial improvement in post-test scores.

Furthermore, the Information Processing Theory (Miller, 1956) helps explain the superior retention observed in the experimental group. The structured nature of crossword puzzles provides systematic reinforcement of vocabulary items, supporting both short-term and long-term memory formation. This systematic approach to vocabulary practice appears to be more effective than traditional memorization methods, as reflected in the significant difference in gain scores between the experimental and control groups.

These findings suggest that crossword puzzles offer a theoretically sound and empirically validated approach to vocabulary instruction. The combination of cognitive engagement, intrinsic motivation, multiple processing pathways, and social learning opportunities appears to create an effective learning environment that significantly outperforms traditional memorization-based approaches. The consistent improvement across all performance levels, supported by robust statistical evidence, indicates that this approach could be valuable for diverse student populations and ability levels.

CONCLUSION

The study reveals that incorporating crossword puzzles as a teaching medium significantly enhances students' vocabulary mastery in English. Based on the pre-test and post-test scores, the experimental group—using crossword puzzles—consistently outperformed the control group. The lowest and highest scores, as well as the mean scores in the experimental group, were all notably higher, indicating a positive effect on vocabulary acquisition.

Statistical analysis supported these findings: normality and homogeneity tests showed that both the experimental and control groups were comparable,

allowing for valid comparisons. The Independent Sample T-Test confirmed a significant difference between the groups, with the experimental group showing a notably higher mean score. This led to the acceptance of the alternative hypothesis, confirming the effectiveness of the crossword puzzle game in teaching vocabulary. Therefore, this study concludes that crossword puzzles are an effective instructional tool for improving vocabulary mastery among students at SMP Negeri 2 Pontianak. These findings support the use of interactive games in educational activities to engage students and improve learning outcomes, especially in the 2024/2025 academic year.

However, this study is limited to two classes of SMP Negeri 2 Pontianak, with a total of 60 students, and utilizes a quasi-experimental design with a quantitative approach. Future researchers are encouraged to expand this research by employing different media or strategies, such as cards, songs, videos, pictures, and other educational games, to foster student interest and improve vocabulary comprehension. Incorporating games into learning can increase student engagement, strengthen concept retention, and create an enjoyable educational environment. Whether through simple educational activities or complex simulations, games can effectively contribute to students' motivation and understanding of the material.

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