

Beyond the Digital Divide: The Effectiveness of Mind Mapping in Arabic Vocabulary Learning in Resource-Limited Madrasahs

Sari Khusna Nabila^{1*}, Anyes Lathifatul Insaniyah²

^{1,2}Universitas KH Mukhtar Syafaat Blokagung Banyuwangi, Indonesia

Article History:

Received : 01 February 2026

Revised : 04 May 2026

Published : 05 May 2026

Keywords:

Low-Technology Strategy; Mind Mapping; Vocabulary Memorization.

*Correspondence Address:

khusnanabillaa@gmail.com

©authors 2026



This work is licensed under a [Creative Commons Attribution-ShareAlike 4.0 International License](https://creativecommons.org/licenses/by-sa/4.0/).

DOI: 10.32332/ijalt.v8i01.12982

Abstract: The digital divide has limited technology-based instruction in many madrasahs, leading to continued reliance on rote learning for Arabic vocabulary memorization. This study examines the effectiveness of mind mapping as a low-technology strategy to improve Arabic vocabulary retention in a resource-limited madrasah context. A quasi-experimental nonequivalent control group pretest-posttest design was used involving 50 tenth-grade students divided into experimental and control groups. Data were collected using a 30-item multiple-choice test and analyzed using descriptive statistics, Shapiro-Wilk and Levene tests, independent samples t-test, and N-Gain analysis. The results showed that the experimental group achieved higher posttest scores ($M = 87.48$) than the control group ($M = 64.68$), with a significant difference ($p < .001$) and a large effect size ($d = 2.50$). The N-Gain score indicated greater improvement in the experimental group (73.96%) compared to the control group (16.77%). These findings demonstrate that mind mapping is an effective, context-sensitive strategy for enhancing Arabic vocabulary memorization. The study provides evidence from a resource-constrained context and challenges the assumption that learning effectiveness depends on digital technologies. It highlights cognitive organization as a key factor in vocabulary learning and recommends its adoption in similar educational settings.

INTRODUCTION

The widening digital divide has created persistent challenges for educational institutions operating in resource-limited environments, particularly in religious schools.¹ In many Indonesian madrasahs, limited access to technological infrastructure constrains the adoption of digitally driven instructional innovations. While digital transformation is often positioned as a solution for improving learning outcomes, such assumptions are not always

¹ Evelyn Wong et al., "Bridging the Digital Divide: A Practical Roadmap for Deploying Medical Artificial Intelligence Technologies in Low-Resource Settings," *Population Health Management* 28, no. 2 (2025): 105-14, <https://doi.org/10.1089/pop.2024.0222>.

applicable in contexts where access, training, and infrastructure remain inadequate.² Consequently, there is a need to re-examine the effectiveness of low-technology pedagogical approaches that are contextually appropriate and sustainable.

One area where this challenge is especially evident is in Arabic vocabulary memorization. Vocabulary memorization constitutes a fundamental component of language proficiency,³ yet students in madrasahs frequently encounter difficulties in memorizing and retaining vocabulary. According to the Depth of Processing Theory, information that is processed more deeply and meaningfully is more likely to be retained in long-term memory.⁴ However, instructional practices in many classrooms remain teacher-centered and rely heavily on rote memorization. This mismatch often results in low retention rates and reduced student engagement, particularly in contexts with limited instructional variation.

Previous studies on language learning have predominantly emphasized the role of advanced technologies.⁵ For instance, highlight the effectiveness of mobile-assisted language learning in improving vocabulary memorization,⁶ while recent studies on AI-based tools demonstrate increased learner autonomy and personalization.⁷ However, these studies largely assume the availability of stable digital infrastructure and are typically conducted in well-resourced or higher education contexts. As a result, their findings are not fully transferable to madrasahs or Islamic boarding schools, where technological access and support remain limited.

In contrast, research on mind mapping and concept mapping has shown promising results in enhancing vocabulary learning.⁸ The effectiveness of these

² Abdul Basith and Ana Masruroh, "Meningkatkan Minat Belajar Bahasa Arab Dengan Metode Ice Breaking Di Madrasah Aliyah Al-Amiriyah Banyuwangi," *TADRIS AL-ARABIYAT: Jurnal Kajian Ilmu Pendidikan Bahasa Arab* 3, no. 2 (2023): 214-27, <https://doi.org/10.30739/arabiyat.v3i2.2364>.

³ Amr Rabie-Ahmed and Ayman Mohamed, "Collaborative and Individual Vocabulary Learning in the Arabic Classroom: The Role of Engagement and Task Demands," *Foreign Language Annals* 55, no. 4 (2022): 1006-24, <https://doi.org/10.1111/flan.12636>.

⁴ Rebecca Ovalle-Fresa, Arif Sinan Uslu, and Nicolas Rothen, "Levels of Processing Affect Perceptual Features in Visual Associative Memory," *Psychological Science* 32, no. 2 (2021): 267-79, <https://doi.org/10.1177/0956797620965519>.

⁵ Hasifatur Rahmah and Imam Fauji, "Enhancing Arabic Vocabulary Mastery in Primary Students through Powtoon-Based Web Media: Meningkatkan Penguasaan Kosakata Bahasa Arab Pada Siswa Sekolah Dasar Melalui Media Web Berbasis Powtoon," *Indonesian Journal of Islamic Studies* 12, no. 2 (2024), <https://doi.org/10.21070/ijis.v12i2.1692>.

⁶ Yonghong Zhou and Mingming Zhou, "A Meta-Analysis on Mobile-Assisted Vocabulary Learning: Do Mobile Applications Help?," *ReCALL* 38, no. 1 (2026): 75-93, <https://doi.org/10.1017/S0958344025100335>.

⁷ Wadim Strielkowski et al., "AI-driven Adaptive Learning for Sustainable Educational Transformation," *Sustainable Development* 33, no. 2 (2025): 1921-47, <https://doi.org/10.1002/sd.3221>.

⁸ Muhammad Afif Amrulloh and Essam Mustafa Ahmed, "Improving Arabic Vocabulary Mastery with a Constructivist Approach through Mind Map: Meningkatkan Penguasaan Kosakata Bahasa Arab Dengan Pendekatan Konstruktivis Melalui Mind Map," *Al Mahāra: Jurnal Pendidikan Bahasa Arab* 11, no. 1 (2025): 83-102, <https://doi.org/10.14421/almahara.2025.0111-05>.

strategies can be explained through Dual Coding Theory,⁹ which suggests that information presented both visually and verbally is more easily processed and remembered.¹⁰ Studies suggest that visual organization of information can improve comprehension and retention.¹¹ Similarly, concept mapping supports meaningful learning by helping learners establish relationships between concepts, aligning with principles of meaningful learning theory.¹²

Nevertheless, most of these studies are conducted in general education settings and do not specifically address Arabic vocabulary memorization or low-resource environments.¹³ Furthermore, limited attention has been given to how such strategies can be systematically implemented as low-tech solutions in contexts where digital tools are unavailable. Research focusing specifically on low-resource or technology-limited educational settings remains relatively scarce. While some studies acknowledge the importance of context-sensitive pedagogy,¹⁴ few provide empirical evidence on effective instructional strategies that do not rely on digital tools. This indicates a clear gap in literature the lack of integrated research examining Arabic vocabulary memorization, mind mapping as a pedagogical strategy, and the realities of resource-constrained educational environments.¹⁵

Mind mapping, as a visual and organizational learning strategy, offers potential in addressing these challenges.¹⁶ By structuring vocabulary into interconnected concepts, this method may support deeper processing and facilitate retention. Unlike technology-dependent approaches, mind mapping can be implemented using minimal resources, making it particularly relevant for

⁹ Sifan Wu et al., "Dual Coding Theory in Action: Language-Assisted Human Pose Estimation in Videos," in *Proceedings of the AAAI Conference on Artificial Intelligence*, vol. 40, 2026, 10745–53, <https://doi.org/10.1609/aaai.v40i13.38049>.

¹⁰ Kate F Higdon et al., "Distinctiveness, Not Dual Coding, Explains the Picture-Superiority Effect," *Quarterly Journal of Experimental Psychology* 78, no. 1 (2025): 180–91, <https://doi.org/10.1177/17470218241235520>.

¹¹ Nidal Al Said and Khaleel M Al-Said, "The Effect of Visual and Informational Complexity of News Website Designs on Comprehension and Memorization among Undergraduate Students," *AI & Society* 37, no. 1 (2022): 401–9, <https://doi.org/10.1007/s00146-021-01164-6>.

¹² Menik Mahmudah et al., "Enhancing Arabic Rhetoric Education through Mind Mapping: A Focus on Bayan & Badi'," *Lughawiyat: Jurnal Pendidikan Bahasa Dan Sastra Arab* 8, no. 1 (2025): 32–55, <https://doi.org/10.38073/lughawiyat.v8i1.2208>.

¹³ Anyes Lathifatul Insaniyah, Ro'fat Hizmatul Himmah, and Aryn Nia Agustin, "Efektifitas Teknik Pembelajaran Chain Reaction Untuk Meningkatkan Penguasaan Mufradat," *Kilmatuna: Journal Of Arabic Education* 3, no. 2 (2023): 157–64, <https://doi.org/10.55352/pba.v3i2.673>.

¹⁴ Marcos Belver et al., "Requirements Elicitation Based on Psycho-Pedagogical Theatre for Context-Sensitive Affective Educational Recommender Systems," *IEEE Access* 11 (2023): 76284–99, <https://doi.org/10.1109/ACCESS.2023.3297509>.

¹⁵ Muhamad Bisri Ihwan et al., "Intensive Arabic Language Teaching to Acquire the Four Linguistic Skills | Tadrīs Al-Lughah Al-'Arabiyyah Al-Mukāṣṣaf Li Iktisāb Al-Mahārāt Al-Lugawiyah Al-Arba,'" *Jurnal Al Bayan: Jurnal Jurusan Pendidikan Bahasa Arab* 12, no. 2 (2020): 281–300, <https://doi.org/10.24042/albayan.v12i2.6329>.

¹⁶ Miftahul Khaerah et al., "The Impact of Mind Map as Project-Based Learning on Arabic Vocabulary Learning Outcomes at Ma'had Babul Khairat," *Langkawi* 10, no. 2 (2024): 178–94, <https://doi.org/10.31332/lkw.v0i0.8495>.

under-resourced institutions. Its adaptability also aligns with the pedagogical practices commonly found in madrasahs, which emphasize both individual understanding and collaborative learning.

This study focuses on students at Madrasah Aliyah Al-Amiriyyah Blokagung Banyuwangi as a representative case of a resource-limited religious educational institution. It aims to examine the effectiveness of mind mapping as a low-tech instructional strategy for improving Arabic vocabulary memorization. The central research question guiding this study is: “To what extent can mind mapping enhance students’ retention of Arabic vocabulary in a low-resource educational context?”

By addressing this question, this study seeks to contribute to three key areas. First, it provides empirical evidence on Arabic vocabulary memorization within the specific context of madrasahs, which has received limited attention in previous research.¹⁷ Second, it evaluates mind mapping not merely as a general learning technique but as a context-sensitive pedagogical strategy for low-resource environments. Third, it challenges the assumption that effective learning is inherently dependent on advanced technology, by emphasizing the role of instructional design and accessibility in shaping learning outcomes.

The hypothesis of this study is that students who are taught using mind mapping will demonstrate significantly better vocabulary memorization than those who are taught using conventional methods. This assumption is grounded in the principle that structured and meaningful organization of information can enhance memory retention. Therefore, this study is expected to offer both theoretical and practical contributions, particularly in informing instructional practices and educational policies for institutions operating under technological constraints.

METHOD

This study employed a quasi-experimental design using a Nonequivalent Control Group Pretest–Posttest Design. This design was selected because the research was conducted in naturally formed classroom settings, where random assignment of participants was not possible. The study compared two groups: an experimental group taught using the mind mapping strategy and a control group taught using conventional instruction.

The research was conducted at Madrasah Aliyah Al-Amiriyyah Blokagung Banyuwangi. This location was selected based on several considerations. First, the school provided accessibility and official permission for the researcher to conduct

¹⁷ Nur Maya Badriyatul Jamroh and Khoiratun Nisa, “Implementasi Metode Drill Dalam Meningkatkan Hafalan Kosakata Bahasa Arab Di Madrasah Aliyah Al Amiriyyah Blokagung Banyuwangi,” *TADRIS AL-ARABIYAT: Jurnal Kajian Ilmu Pendidikan Bahasa Arab* 1, no. 02 (2021): 317-33, <https://doi.org/10.30739/arabiyat.v1i02.1405>.

the study. Second, based on preliminary observations, students' Arabic vocabulary memorization was still relatively limited, indicating the need for more effective instructional strategies. Third, the mind mapping technique had not been widely implemented in Arabic language instruction at this school, making it a relevant context for investigating its effectiveness.

The population consisted of all 100 tenth-grade students at Madrasah Aliyah Al-Amiriyah Blokagung Banyuwangi, distributed across four parallel classes. The sample was selected using purposive sampling based on intact classrooms.

The selection of the two classes was based on several equivalent criteria to ensure comparability between groups. Both classes were taught by the same Arabic language teacher to minimize instructional variation. In addition, the classes demonstrated comparable prior achievement in Arabic, as indicated by their previous semester scores, with differences remaining within an acceptable range of less than five points. The number of students in each class was also relatively similar, and neither class was categorized as a special program, such as an accelerated or remedial class.¹⁸

Based on these criteria, two comparable classes were chosen, consisting of 50 students in total. One class (25 students) served as the experimental group, while the other class (25 students) served as the control group. The study was conducted over a period of four weeks, consisting of eight meetings, with each session lasting 90 minutes. The first meeting was devoted to administering the pretest to assess students' initial vocabulary ability. This was followed by six meetings dedicated to instructional treatment, and the final meeting was used to administer the posttest to measure students' vocabulary memorization after the intervention.

In the experimental group, students were taught using the mind mapping method. The instructional process began with the teacher introducing the learning objectives and the topic of "hobbies" in Arabic. Students were then guided to understand the concept and principles of mind mapping. The main idea was placed at the center of the map, from which students developed branches containing relevant vocabulary, including verbs and nouns related to hobbies. To strengthen memory associations, students were encouraged to use colors, symbols, and images in their maps.¹⁹ During the learning process, students presented and discussed their mind maps, after which the teacher provided feedback and reinforcement.

¹⁸ Thomas S Dee and Elizabeth Huffaker, "Accelerating Opportunity: The Effects of Instructionally Supported Detracking," *American Educational Research Journal* 63, no. 2 (2026): 307-50, <https://doi.org/10.3102/00028312251408539>.

¹⁹ Rui Feng et al., "Impact of Mind-Mapping Technique on EFL Learners' Vocabulary Recall and Retention, Learning Motivation, and Willingness to Communicate," *Heliyon* 9, no. 6 (2023), <https://doi.org/10.1016/j.heliyon.2023.e16560>.

In contrast, the control group received instruction through conventional methods. The teacher presented vocabulary in a linear list format, and students were asked to copy the words along with their meanings. Vocabulary learning was conducted through repetition and memorization drills. Students also completed translation and vocabulary exercises, and the teacher reviewed their answers and provided corrections.

The primary data source in this study was the tenth-grade students, who served as the research participants. The data were obtained directly from the students' pretest and posttest scores, which measured their vocabulary mastery before and after the instructional treatment.

The primary instrument used in this study was a written test administered as both a pretest and a posttest. The test consisted of 30 multiple-choice questions, each with four response options (A–D). Scoring was conducted by assigning one point for each correct answer and zero for incorrect responses, resulting in a maximum possible score of 30. The test items were developed based on three main indicators: students' ability to comprehend vocabulary meaning, their ability to use vocabulary in context, and their ability to identify appropriate vocabulary in specific situations, with each indicator represented by an equal number of items.

Sample item:

What is the correct meaning of the Arabic word “يَلْعَبُ”?

- A. To read
- B. To write
- C. To play
- D. To study

Instrument validity was tested using the Product Moment correlation. Prior to the analysis, the test items were administered to a group of students with characteristics similar to those of the research sample. The results indicated that all items met the validity criteria, with correlation coefficients (r_{count}) ranging from 0.42 to 0.78, all of which exceeded the critical value ($r_{\text{table}} = 0,361$) at the 5% significance level; therefore, all items were considered valid.

In addition, content validity was established through expert judgment involving two Arabic language education lecturers and one Arabic language teacher. The experts evaluated the alignment of the test items with the learning indicators, the clarity of language, and the relevance of the content. Based on their evaluation, several items were revised to improve clarity and alignment with the learning objectives.

Instrument reliability was measured using Cronbach's Alpha. The analysis yielded a reliability coefficient of $r_{11} = 0,81$, indicating a high level of internal consistency.

Data was collected using a written test method consisting of a pretest and a posttest. The pretest was administered to measure students' initial vocabulary memorization, while the posttest was conducted to assess students' vocabulary improvement after the instructional treatment.

The data were analyzed in several stages. First, descriptive statistics were used to determine the mean and standard deviation of the test scores. Prior to hypothesis testing, assumption testing was conducted using the Shapiro–Wilk test to examine data normality and Levene's test to assess the homogeneity of variance. After the assumptions were met, hypothesis testing was carried out using an Independent Samples t-test to compare the differences between the two groups. In addition, the effectiveness of the treatment was analyzed using the Normalized Gain (N-Gain) score, which was calculated to measure the level of students' improvement in vocabulary memorization.

Hake's N-Gain Score Formula (1999)²⁰

$$N - Gain = \frac{Posttest - Pretest}{Maximum\ score - Pretest}$$

Table 1. N-Gain value category

Score N- Gain	Interpretation
$g > 0.7$	High
$0.3 \leq g \leq 0.7$	Moderate
$g < 0.3$	Low

This study was conducted with official permission from the school administration. The participants were informed about the purpose of the study, and their participation was voluntary. All student data were kept confidential and were used solely for academic purposes to ensure ethical compliance.

This study has two main limitations. The first is the absence of random assignment, as the research utilized existing classroom groups. The second limitation is that the study was conducted in only one institution, which may limit the generalizability of the findings to other contexts. Despite these limitations, the detailed description of the research procedures allows the study to be replicated in similar educational settings.

RESULT AND DISCUSSION

In order to address the research objectives in a systematic manner, the analysis in this study is organized into several key focuses. First, the study examines whether there is any initial difference in vocabulary memorization between the control and experimental groups prior to the intervention. Second, it

²⁰ Atania Rosbina, Sri Wardani, and Haryono Haryono, "Development of Web-Based Learning Media with an Inquiry Model to Enhance Learning Outcomes and Student Independence in Elementary Schools," *Journal of Innovation and Research in Primary Education* 4, no. 3 (2025): 673–83, <https://doi.org/10.56916/jirpe.v4i3.1354>.

analyzes the extent of learning improvement within each group following the instructional process. Third, the study compares the effectiveness of the mind mapping technique with conventional teaching methods in enhancing students' Arabic vocabulary mastery. Finally, the magnitude of improvement is evaluated through the N-Gain analysis to determine the overall effectiveness of the intervention.

The results of studies on the effectiveness of the mind mapping technique in raising students' proficiency with Arabic vocabulary are shown in this section. Mind mapping was assessed as a low-technology instructional strategy to examine its effectiveness in organizing cognitive information compared to conventional learning methods. SPSS version 26 was used as an analysis tool for quantitative data processing in this investigation.

The collected data were analyzed using descriptive statistics based on validated and reliable research instruments. This analysis examines the consistency of learning outcomes within each group and identifies patterns of improvement in students' scores. It provides an overview of students' vocabulary memorization before and after the implementation of the mind mapping approach, including minimum, maximum, mean, and standard deviation values. The following table presents a comparison of average learning outcomes between the control and experimental groups.

Table 1. Descriptive Analysis Test Results

Class	N	Minimum	Maximum	Mean	Standard Deviation
Control Pretest	25	40	77	58.00	9.539
Control Posttest	25	47	83	64.68	9.499
Experimental Pretest	25	37	77	57.36	10.388
Experimental Posttest	25	70	100	87.48	8.699

The pretest results show that the mean scores of the control group (58.00) and the experimental group (57.36) were comparable, indicating that both groups began at a similar level. After the intervention, the experimental group obtained a markedly higher posttest mean (87.48) than the control group (64.68). The rise in the minimum score in the experimental group also reflects more consistent improvement among students.

The experimental group demonstrated a greater increase in mean scores than the control group, indicating a stronger improvement from pretest to posttest. Overall, these findings provide evidence that the intervention effectively enhanced students' learning outcomes, as reflected in the greater improvement observed in the experimental group.

Following the descriptive analysis, a normality test was conducted to determine whether the data met the assumption of normal distribution before further statistical analysis.

Table 2. Shapiro-Wilk Results of the Normality Test

Class	Statistic	df	Sig	Description
Pretest Control	.984	25	.946	Normal
Posttest Control	.981	25	.912	Normal
Pretest Experiment	.984	25	.954	Normal
Posttest Experiment	.956	25	.348	Normal

The results of the Shapiro-Wilk normality test indicate that all significance (Sig.) values for both the control and experimental groups are greater than 0.05. Specifically, all Sig. values exceed the 0.05 threshold. These results confirm that the data in both groups are normally distributed. Therefore, the assumption of normality is satisfied, and parametric statistical analysis can be applied. Accordingly, the Independent Sample T-Test can be used to examine the effectiveness of the intervention. Prior to conducting this test, a homogeneity test is required to ensure that the variance between groups is equal.

Table 3. Homogeneity Test Results

Class	Sig	Description
Pretest (Control + Experiment)	.701	Homogeneous
Posttest (Control + Experiment)	.662	Homogeneous

The results of the homogeneity test indicate that the significance (Sig.) values for both pretest (0.701) and posttest (0.662) are greater than 0.05. This indicates that the data variance in the control and experimental groups is homogeneous at both the pretest and posttest stages.

Therefore, the assumption of homogeneity is satisfied, allowing for the use of parametric statistical analysis. Accordingly, the Independent Sample T-Test can be applied to examine the differences between the two groups.

Table 4: Results of the Independent Sample T-Test

Comparison	N	Mean	SD	t	df	p-value	95% CI	Cohen's d	Interpretation
Pretest (Control vs Experiment)	25 vs 25	58.00 vs 57.36	9.539 vs 10.388	0.23	48	0.821	-5.02, 6.30	0.06	Not statistically significant
Post test (Control vs Experiment)	25 vs 25	64.68 vs 87.48	9.499 vs 8.699	- 8.84	48	<0.0001	- 27.99, -17.61	2.50	Statistically significant

The pretest results show no statistically significant difference between the control and experimental groups ($t = 0.23$, $p = .821$; 95% CI [-5.02, 6.30]; $d = 0.06$),

indicating that both groups were comparable at baseline. After the intervention, a statistically significant difference emerged ($t = -8.84$, $p < .001$; 95% CI [-27.99, -17.61]; $d = 2.50$), with the experimental group outperforming the control group.

The difference in posttest means, approximately 22.8 points, along with a very large effect size, reflects a substantial improvement in the experimental group. Taken together, these findings indicate that the intervention was highly effective in improving learning outcomes compared to the control condition.

To further evaluate the effectiveness of the intervention, an N-Gain test was conducted to assess the improvement in students' scores from pretest to posttest in both groups. The results are presented in Table 5.

Table 5: Results of the N-Gain Test

N-Gain Results			
N- Gain Percent	Class	Mean	Percent
	Experiment	73.9569	73.96%
	Control	16.7772	16.77%

The N-Gain test was conducted to measure the extent of improvement in students' vocabulary memorization from pretest to posttest. The N-Gain score was calculated using the normalized gain formula, which compares the actual gain with the maximum possible gain. The results indicate that both groups experienced improvement. The experimental group achieved a mean N-Gain of 73.96%, whereas the control group achieved only 16.77%.

Based on the N-Gain classification criteria, the experimental group falls into the high category, while the control group is classified as low. This substantial difference indicates that the mind mapping technique is more effective than traditional learning methods in improving students' vocabulary memorization. In this study, the Independent Sample T-Test was conducted on posttest scores to examine differences between groups after the intervention, while the N-Gain test was used to evaluate the magnitude of improvement within each group.

The findings of this study indicate that the mind mapping technique significantly enhances students' Arabic vocabulary memorization compared to conventional instructional methods. This conclusion is supported by the statistically significant difference in posttest scores, the large effect size, and the substantially higher N-Gain score observed in the experimental group.

Beyond these immediate findings, the study contributes to the existing literature on vocabulary learning, particularly within the context of Arabic instruction in madrasah settings, which remains relatively underexplored. By situating the research in this specific educational environment, the study provides context-sensitive evidence that reflects the instructional practices and learning conditions typical of madrasahs.

The results also highlight mind mapping as a pedagogical strategy whose effectiveness is closely related to contextual suitability rather than methodological novelty alone. Its successful implementation in a resource-limited setting demonstrates that meaningful learning gains can be achieved without reliance on advanced technology. This challenges the assumption that effective learning is primarily dependent on digital tools and instead emphasizes the importance of instructional design that fosters active cognitive engagement. These pedagogical insights can be further understood through established cognitive learning theories.

In order to bridge the theoretical explanation with empirical evidence, the following discussion connects these findings with relevant theoretical frameworks and prior studies. From a theoretical perspective, the effectiveness of mind mapping can be explained through the Depth of Processing Theory, which posits that information processed at a deeper cognitive level is more likely to be retained in long-term memory.²¹ In this study, students in the experimental group actively organized vocabulary into structured mind maps, categorized lexical items, and linked them with visual cues such as colors and symbols.

In order to illustrate the implementation of the mind mapping technique in vocabulary learning, Figure 1 presents an example of students' mind map generated during the instructional process.



Figure 1. Example of Students' Mind Mapping in Arabic Vocabulary Learning

²¹ Fergus I M Craik and Robert S Lockhart, "Levels of Processing: A Framework for Memory Research," *Journal of Verbal Learning and Verbal Behavior* 11, no. 6 (1972): 671-84, [https://doi.org/10.1016/S0022-5371\(72\)80001-X](https://doi.org/10.1016/S0022-5371(72)80001-X).

The figure illustrates an Arabic vocabulary mind map themed “Hobbies”. The map is organized into two main branches: nouns (الأسماء) and verbs (الأفعال). The nouns section includes vocabulary related to various hobbies, such as reading (قراءة), books (كتاب), libraries (مكتبة), sports (رياضة), writing (تدوين), drawing (رسم), cooking (طبخ), and listening to music (استماع إلى الموسيقى), each accompanied by visual illustrations to enhance comprehension. The verbs section presents action words associated with hobbies, including reading (أقرأ), writing (أكتب), learning (أتعلم), playing (ألعب), and cooking (أطبخ), reflecting everyday activities.

At the center of the mind map is the core concept “هواياتي” (My Hobbies), from which all categories branch out hierarchically, illustrating conceptual relationships. Overall, the mind map integrates visual and verbal elements such as color coding and imagery to facilitate vocabulary memorization, promote semantic association, and enhance retention of Arabic vocabulary.

In addition, the findings align with the Dual Coding Theory, which suggests that learning is enhanced when information is encoded through both verbal and visual systems.²² Mind mapping integrates textual information with visual representations, enabling students to process vocabulary through dual channels. This dual representation likely contributed to the superior performance of the experimental group.

The results of this study are consistent with previous empirical research in language learning. Previous studies have consistently reported that visual-based strategies, including mind mapping and concept mapping, can significantly enhance vocabulary acquisition and retention in second language learning contexts.²³ For example, recent studies have demonstrated that mind mapping improves students’ ability to organize and recall vocabulary more effectively than traditional memorization techniques. In the context of Arabic language learning, research also indicates that visual representation strategies help learners understand semantic relationships between words and improve retention.

However, while the present findings are consistent with prior research, the magnitude of improvement observed in this study appears to be substantially higher. The very large effect size and high N-Gain score suggest that the effectiveness of mind mapping in this context exceeds that reported in many previous studies, which typically show moderate to high gains. This difference may be attributed to the specific learning context, where traditional memorization methods were predominantly used prior to the intervention. Consequently, the introduction of a visually structured and cognitively engaging strategy such as

²² Allan Paivio, “Dual Coding Theory: Retrospect and Current Status,” *Canadian Journal of Psychology/Revue Canadienne de Psychologie* 45, no. 3 (1991): 255, <https://doi.org/10.1037/h0084295>.

²³ Rana AlShaikh, Norah Al-Malki, and Maida Almasre, “The Implementation of the Cognitive Theory of Multimedia Learning in the Design and Evaluation of an AI Educational Video Assistant Utilizing Large Language Models,” *Heliyon* 10, no. 3 (2024), <https://doi.org/10.1016/j.heliyon.2024.e25361>.

mind mapping may have produced a more pronounced impact. This indicates that the effectiveness of instructional strategies is closely related to the learning context in which they are implemented.

What distinguishes the present study is its focus on a resource-limited madrasah context, where access to digital tools is constrained. The findings demonstrate that effective learning outcomes do not necessarily depend on advanced technology, but rather on the use of appropriate instructional strategies that promote meaningful learning. In this context, mind mapping functioned as a low technology yet cognitively engaging approach that successfully enhanced vocabulary memorization.

Despite these positive findings, it is important to clarify the scope of the results. This study primarily measured students' learning outcomes based on test scores (pretest and posttest). Therefore, claims related to improvements in students' motivation, confidence, learning independence, or classroom dynamics cannot be considered empirically established findings. While observations during the instructional process suggested increased student engagement and participation in the experimental group, these aspects were not systematically measured using validated instruments.

Accordingly, such outcomes should be interpreted cautiously and framed as pedagogical implications rather than confirmed results. From a constructivist perspective, the interactive and student-centered nature of mind mapping may create a more engaging learning environment, which in turn has the potential to influence affective factors.²⁴ However, further research incorporating qualitative methods or affective measurement tools is needed to validate these assumptions. Therefore, this study contributes to the existing body of knowledge by providing empirical evidence that cognitively engaging, low-technology instructional strategies can produce substantial learning gains, particularly in under-resourced educational settings. It highlights the importance of aligning instructional methods with learners' cognitive processes rather than relying solely on technological advancement. Furthermore, this study offers a context-sensitive pedagogical alternative that can be practically implemented in similar educational environments with limited resources.

In summary, this study provides empirical evidence that mind mapping is an effective instructional strategy for improving Arabic vocabulary memorization in low-resource educational settings. The findings reinforce the importance of meaningful cognitive processing and multimodal learning in vocabulary

²⁴ Roberto Capone, "Blended Learning and Student-Centered Active Learning Environment: A Case Study with STEM Undergraduate Students," *Canadian Journal of Science, Mathematics and Technology Education* 22, no. 1 (2022): 210–36, <https://doi.org/10.1007/s42330-022-00195-5>.

memorization,²⁵ while also highlighting the potential of low-technology approaches as viable alternatives in contexts with limited access to digital resources.

CONCLUSION

This study examined the effectiveness of the mind mapping technique in improving students' Arabic vocabulary memorization at Madrasah Aliyah Al-Amiriyah Blokagung Banyuwangi, a resource-limited educational context. The findings show that students in the experimental group who were taught using mind mapping achieved significantly higher scores than those in the control group who received conventional instruction. This difference was supported by the results of the Independent Samples t-test, which indicated a statistically significant difference between groups, as well as by the large effect size obtained. In addition, the N-Gain analysis revealed that the experimental group reached a high level of improvement, whereas the control group remained in the low category. These results indicate that the use of mind mapping is associated with improved vocabulary memorization outcomes in this context. The structured and visual organization of vocabulary appears to facilitate more effective memorization compared to traditional rote learning techniques.

However, the findings of this study are limited to students' performance on vocabulary tests. This study did not systematically measure affective variables such as motivation, confidence, or learning independence. Therefore, no conclusions can be drawn regarding these aspects. In conclusion, this study provides empirical evidence that mind mapping can function as an effective instructional strategy for improving Arabic vocabulary memorization in classroom settings with limited resources. Further research is recommended to explore its impact on other aspects of learning using more comprehensive measurement approaches.

References

- AlShaikh, Rana, Norah Al-Malki, and Maida Almasre. "The Implementation of the Cognitive Theory of Multimedia Learning in the Design and Evaluation of an AI Educational Video Assistant Utilizing Large Language Models." *Heliyon* 10, no. 3 (2024). <https://doi.org/10.1016/j.heliyon.2024.e25361>.
- Amrulloh, Muhammad Afif, and Essam Mustafa Ahmed. "Improving Arabic Vocabulary Mastery with a Constructivist Approach through Mind Map: Meningkatkan Penguasaan Kosakata Bahasa Arab Dengan Pendekatan Konstruktivis Melalui Mind Map." *Al Mahāra: Jurnal Pendidikan Bahasa Arab* 11, no. 1 (2025): 83–102. <https://doi.org/10.14421/almahara.2025.0111-05>.

²⁵ Olsafrian Ihsanu Matswa and Muhammad Gatan Arda Saputra, "Mastering Arabic Vocabulary through Drill Technique: A Study on Primary Learners," *Al-Muhawaroh: Jurnal Pendidikan Bahasa Arab* 1, no. 1 (2025): 47–58, <https://doi.org/10.38073/almuhawaroh.v1i1.2644>.

- Basith, Abdul, and Ana Masruroh. "Meningkatkan Minat Belajar Bahasa Arab Dengan Metode Ice Breaking Di Madrasah Aliyah Al-Amiriyyah Banyuwangi." *TADRIS AL-ARABIYAT: Jurnal Kajian Ilmu Pendidikan Bahasa Arab* 3, no. 2 (2023): 214–27. <https://doi.org/10.30739/arabiyat.v3i2.2364>.
- Belver, Marcos, Ángeles Manjarrés, Alejandra Barbarelli, and Simon Pickin. "Requirements Elicitation Based on Psycho-Pedagogical Theatre for Context-Sensitive Affective Educational Recommender Systems." *IEEE Access* 11 (2023): 76284–99. <https://doi.org/10.1109/ACCESS.2023.3297509>.
- Capone, Roberto. "Blended Learning and Student-Centered Active Learning Environment: A Case Study with STEM Undergraduate Students." *Canadian Journal of Science, Mathematics and Technology Education* 22, no. 1 (2022): 210–36. <https://doi.org/10.1007/s42330-022-00195-5>.
- Craik, Fergus I M, and Robert S Lockhart. "Levels of Processing: A Framework for Memory Research." *Journal of Verbal Learning and Verbal Behavior* 11, no. 6 (1972): 671–84. [https://doi.org/10.1016/S0022-5371\(72\)80001-X](https://doi.org/10.1016/S0022-5371(72)80001-X).
- Dee, Thomas S, and Elizabeth Huffaker. "Accelerating Opportunity: The Effects of Instructionally Supported Detracking." *American Educational Research Journal* 63, no. 2 (2026): 307–50. <https://doi.org/10.3102/00028312251408539>.
- Feng, Rui, Haroon N Alsager, Zeinab Azizi, and Leeda Sarabani. "Impact of Mind-Mapping Technique on EFL Learners' Vocabulary Recall and Retention, Learning Motivation, and Willingness to Communicate." *Heliyon* 9, no. 6 (2023). <https://doi.org/10.1016/j.heliyon.2023.e16560>.
- Higdon, Kate F, Ian Neath, Aimée M Surprenant, and Tyler M Ensor. "Distinctiveness, Not Dual Coding, Explains the Picture-Superiority Effect." *Quarterly Journal of Experimental Psychology* 78, no. 1 (2025): 180–91. <https://doi.org/10.1177/17470218241235520>.
- Ihwan, Muhamad Bisri, Ro'fat Hizmetul Himmah, Abdul Wahab Rasyidi, and Muhamad Fai Al Fatih. "Intensive Arabic Language Teaching to Acquire the Four Linguistic Skills | Tadris Al-Lugah Al-'Arabiyyah Al-Mukassaf Li Iktisab Al-Maharat Al-Lugawiyah Al-Arba.'" *Jurnal Al Bayan: Jurnal Jurusan Pendidikan Bahasa Arab* 12, no. 2 (2020): 281–300. <https://doi.org/10.24042/albayan.v12i2.6329>.
- Insaniyah, Anyes Lathifatul, Ro'fat Hizmetul Himmah, and Aryn Nia Agustin. "Efektifitas Teknik Pembelajaran Chain Reaction Untuk Meningkatkan Penguasaan Mufradat." *Kilmatus: Journal Of Arabic Education* 3, no. 2 (2023): 157–64. <https://doi.org/10.55352/pba.v3i2.673>.
- Jamroh, Nur Maya Badriyatul, and Khoiratun Nisa. "Implementasi Metode Drill Dalam Meningkatkan Hafalan Kosakata Bahasa Arab Di Madrasah Aliyah Al Amiriyyah Blokagung Banyuwangi." *TADRIS AL-ARABIYAT: Jurnal Kajian Ilmu Pendidikan Bahasa Arab* 1, no. 02 (2021): 317–33. <https://doi.org/10.30739/arabiyat.v1i02.1405>.
- Khaerah, Miftahul, Muassomah Muassomah, Afifah Afifah, Muh Fitra, Nur Maidah, and Muhammad Irham Sya'rawi. "The Impact of Mind Map as Project-Based Learning on Arabic Vocabulary Learning Outcomes at Ma'had Babul Khairat." *Langkawi* 10, no. 2 (2024): 178–94. <https://doi.org/10.31332/lkw.v0i0.8495>.
- Mahmudah, Menik, Lailil Maghfiroh, Nur Hanifansyah, and Sultan Abdus Syakur. "Enhancing Arabic Rhetoric Education through Mind Mapping: A Focus on Bayan & Badi'." *Lughawiyat: Jurnal Pendidikan Bahasa Dan Sastra Arab* 8, no. 1 (2025): 32–55.

<https://doi.org/10.38073/lughawiyat.v8i1.2208>.

- Matswa, Olsafrian Ihsanu, and Muhammad Gatan Arda Saputra. "Mastering Arabic Vocabulary through Drill Technique: A Study on Primary Learners." *Al-Muhawaroh: Jurnal Pendidikan Bahasa Arab* 1, no. 1 (2025): 47–58. <https://doi.org/10.38073/almuhawaroh.v1i1.2644>.
- Ovalle-Fresa, Rebecca, Arif Sinan Uslu, and Nicolas Rothen. "Levels of Processing Affect Perceptual Features in Visual Associative Memory." *Psychological Science* 32, no. 2 (2021): 267–79. <https://doi.org/10.1177/0956797620965519>.
- Paivio, Allan. "Dual Coding Theory: Retrospect and Current Status." *Canadian Journal of Psychology/Revue Canadienne de Psychologie* 45, no. 3 (1991): 255. <https://doi.org/10.1037/h0084295>.
- Rabie-Ahmed, Amr, and Ayman Mohamed. "Collaborative and Individual Vocabulary Learning in the Arabic Classroom: The Role of Engagement and Task Demands." *Foreign Language Annals* 55, no. 4 (2022): 1006–24. <https://doi.org/10.1111/flan.12636>.
- Rahmah, Hasifatur, and Imam Fauji. "Enhancing Arabic Vocabulary Mastery in Primary Students through Powtoon-Based Web Media: Meningkatkan Penguasaan Kosakata Bahasa Arab Pada Siswa Sekolah Dasar Melalui Media Web Berbasis Powtoon." *Indonesian Journal of Islamic Studies* 12, no. 2 (2024). <https://doi.org/10.21070/ijis.v12i2.1692>.
- Rosbina, Atania, Sri Wardani, and Haryono Haryono. "Development of Web-Based Learning Media with an Inquiry Model to Enhance Learning Outcomes and Student Independence in Elementary Schools." *Journal of Innovation and Research in Primary Education* 4, no. 3 (2025): 673–83. <https://doi.org/10.56916/jirpe.v4i3.1354>.
- Said, Nidal Al, and Khaleel M Al-Said. "The Effect of Visual and Informational Complexity of News Website Designs on Comprehension and Memorization among Undergraduate Students." *AI & Society* 37, no. 1 (2022): 401–9. <https://doi.org/10.1007/s00146-021-01164-6>.
- Strielkowski, Wadim, Veronika Grebennikova, Alexander Lisovski, Guzalbegim Rakhimova, and Tatiana Vasileva. "AI-driven Adaptive Learning for Sustainable Educational Transformation." *Sustainable Development* 33, no. 2 (2025): 1921–47. <https://doi.org/10.1002/sd.3221>.
- Wong, Evelyn, Alvaro Bermudez-Cañete, Matthew J Campbell, and David C Rhew. "Bridging the Digital Divide: A Practical Roadmap for Deploying Medical Artificial Intelligence Technologies in Low-Resource Settings." *Population Health Management* 28, no. 2 (2025): 105–14. <https://doi.org/10.1089/pop.2024.0222>.
- Wu, Sifan, Haipeng Chen, Yingda Lyu, Shaojing Fan, Zhigang Wang, Zhenguang Liu, and Yingying Jiao. "Dual Coding Theory in Action: Language-Assisted Human Pose Estimation in Videos." In *Proceedings of the AAAI Conference on Artificial Intelligence*, 40:10745–53, 2026. <https://doi.org/10.1609/aaai.v40i13.38049>.
- Zhou, Yonghong, and Mingming Zhou. "A Meta-Analysis on Mobile-Assisted Vocabulary Learning: Do Mobile Applications Help?" *ReCALL* 38, no. 1 (2026): 75–93. <https://doi.org/10.1017/S0958344025100335>.