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Enhancing Arabic Synonym Mastery through Crossword Puzzles: A Vocabulary-Based Pedagogical Study

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Abstract

This study investigates the effectiveness of crossword puzzle–based instruction in enhancing Arabic synonym mastery among learners of Arabic as a foreign language. Synonym learning in Arabic often poses challenges due to semantic nuance and the dominance of memorization-oriented instructional practices. To address this issue, the study employed a quantitative quasi-experimental design with a pre-test–post-test approach involving 30 intermediate-level learners. The instructional intervention integrated crossword puzzles into regular vocabulary lessons to promote active recall, semantic association, and deeper lexical processing. Data were collected through vocabulary tests administered before and after the intervention and analyzed using descriptive statistics, paired-samples t-tests, and effect size measurement. The results revealed a statistically significant improvement in learners' post-test scores, with a very large effect size, indicating substantial gains in Arabic synonym mastery. The findings suggest that crossword puzzle–based instruction effectively supports lexical depth, vocabulary retention, and learner engagement. This study contributes to Arabic language pedagogy by demonstrating that crossword puzzles can function as a structured and meaningful instructional strategy for developing synonym competence beyond rote memorization.

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INTRODUCTION

Vocabulary mastery constitutes a foundational component of Arabic language proficiency, as it directly influences learners' abilities in reading comprehension, writing accuracy, listening interpretation, and spoken expression (Arisandi & Habib, 2025; Baharun, 2025; Habib et al., 2024; Solehudin, 2024, 2025). Among the lexical dimensions of Arabic, synonymy (tarāduf) plays a particularly critical role, given the language's rich semantic system, morphological complexity, and stylistic variation (Hanifansyah & Mahmudah, 2024). Learners are often required not only to recognize multiple lexical forms with related meanings, but also to understand their contextual appropriateness, semantic nuance, and pragmatic function (Wang, 2023). Despite its importance, Arabic synonym mastery remains a persistent challenge, especially for learners of Arabic as a foreign language.

In many instructional contexts, synonym learning is still approached through memorization-based techniques, such as word lists, translation exercises, or isolated sentence drills. While these

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methods may support short-term recall, they often fail to promote deeper lexical processing, semantic differentiation, and long-term retention. Consequently, learners may recognize synonyms at a superficial level yet struggle to retrieve or apply them accurately in communicative tasks. This gap between lexical knowledge and functional use highlights a broader pedagogical issue: the need for instructional strategies that engage learners cognitively while maintaining motivation and meaningful interaction .

Vocabulary mastery plays a crucial role in Arabic language proficiency, particularly because Arabic is characterized by semantic richness, diglossia, and complex lexical relations. Research in Arabic psycholinguistics has consistently shown that vocabulary knowledge is a strong predictor of literacy development and text comprehension (Alsiddiqi et al., 2025). These findings indicate that limited lexical competence constrains learners' ability to process meaning, even when other linguistic skills are present.

Within Arabic language pedagogy, several studies have explored crossword puzzles as instructional media. Ritonga et al. (2021) demonstrated that crossword puzzles promote student-centered learning and higher-order thinking skills in Arabic reading instruction. Similarly, Mukhlisah et al. (2022) reported significant quantitative gains in students' Arabic text comprehension after the implementation of crossword-based activities, accompanied by positive learner attitudes. These studies confirm the pedagogical potential of crossword puzzles but focus primarily on general comprehension rather than specific lexical competencies.

Evidence from other disciplines further supports the effectiveness of crossword puzzles. Aggarwal et al. (2023) found that crossword-based learning enhances recall, motivation, and active engagement when learners deal with complex terminologies. Although conducted in medical education, their findings suggest that crossword puzzles facilitate memory and lexical access, processes that are also central to foreign language learning.

More recent studies have positioned crossword puzzles within the domain of artificial intelligence and educational technology. Zeinalipour et al. (2023) introduced an AI-powered Arabic crossword generator, while Zeinalipour et al. (2024) extended this approach to Turkish, highlighting the role of large language models in supporting vocabulary learning. However, these studies focus on system development rather than empirical evaluation of learning outcomes. From a methodological perspective, Logue et al. (2025) emphasized that language performance is highly task-dependent, reinforcing the importance of assessing specific competencies rather than general proficiency.

Responding to this gap, the present study investigates the pedagogical potential of crossword puzzles as a vocabulary-based instructional strategy for enhancing Arabic synonym mastery. The study focuses on how systematic integration of crossword activities can support learners' ability to recognize, recall, and apply Arabic synonyms more effectively. Accordingly, the study is guided by the following research questions: To what extent does crossword puzzle–based instruction improve learners' mastery of Arabic synonyms? How do learners respond cognitively and pedagogically to the use of crossword puzzles in Arabic vocabulary learning?

The scope of this study is limited to synonym-focused vocabulary instruction within a formal Arabic language learning context, emphasizing lexical recognition and semantic understanding rather than broader language skills such as speaking fluency or writing composition. Additionally, the study concentrates on crossword puzzles as a single instructional medium, without comparing multiple game-based approaches. These limitations allow for a more focused examination of the

instructional value of crossword puzzles while acknowledging the need for future research involving diverse media and extended language outcomes.

The significance of this study lies in its contribution to Arabic language pedagogy by addressing a specific yet underrepresented aspect of vocabulary learning synonym mastery through an interactive and cognitively engaging medium. Pedagogically, the findings are expected to provide practical insights for Arabic language teachers seeking effective alternatives to traditional vocabulary instruction. Theoretically, the study enriches the discussion on lexical depth and active learning in Arabic language education by positioning crossword puzzles as a meaningful tool for semantic development. Ultimately, this research contributes to ongoing efforts to design vocabulary instruction that is not only effective but also engaging, learner-centered, and pedagogically sustainable.

METHOD

This study employed a quantitative quasi-experimental design using a pre-test–post-test approach to examine the effectiveness of crossword puzzle–based instruction in enhancing Arabic synonym mastery (Al-khresheh, 2024; Creswell & Creswell, 2020). The research was grounded in lexical depth theory and principles of cognitive engagement and game-based learning, which emphasize semantic processing, recall, and meaningful interaction in vocabulary acquisition. The study was conducted in a formal Arabic language learning institution selected due to learners documented difficulties with Arabic synonyms and the availability of structured vocabulary instruction. Participants were purposively selected from an intermediate-level Arabic class to ensure relatively homogeneous proficiency. The unit of analysis was learners' Arabic synonym mastery, operationalized through their performance in recognizing and recalling synonymous lexical items.

Primary data were collected through vocabulary tests administered before and after the instructional intervention, as well as through structured crossword puzzle activities integrated into regular classroom instruction. The intervention required learners to identify appropriate Arabic synonyms based on semantic clues, encouraging deeper lexical processing beyond rote memorization. Data analysis involved descriptive and inferential statistical techniques to measure learning gains and determine the significance of differences between pre-test and post-test scores. The results were interpreted in relation to the theoretical framework to assess the pedagogical effectiveness of crossword puzzles as a vocabulary-based instructional strategy.

RESULTS AND DISCUSSION

Overall Improvement in Arabic Synonym Mastery

The quantitative results of this study indicate a substantial improvement in learners' mastery of Arabic synonyms following the implementation of crossword puzzle–based instruction. Analysis of pre-test data revealed that learners initially demonstrated limited lexical depth, particularly in tasks requiring the recognition and differentiation of synonymous Arabic words. Many responses reflected surface-level familiarity with vocabulary items without a clear understanding of semantic equivalence or contextual appropriateness. This pattern suggests that prior to the intervention, learners' synonym knowledge was largely receptive and fragmented rather than integrated and functional.

Following the instructional intervention, post-test results showed a marked increase in overall synonym mastery. Learners demonstrated greater accuracy in identifying correct synonyms, reduced hesitation in lexical recall, and improved consistency across test items. The increase in post-test scores indicates that crossword-based instruction facilitated not only vocabulary expansion but also more structured semantic organization. These gains reflect a shift from passive memorization toward active lexical engagement, where learners were required to retrieve and apply synonym knowledge in response to contextual clues.

The magnitude of improvement suggests that the instructional intervention had a meaningful pedagogical impact. Learners' performance improvements were observed across most test items, indicating that the effect was not limited to specific lexical sets but extended to broader synonym categories. This finding underscores the potential of crossword puzzles to function as an effective medium for systematic vocabulary instruction rather than as a supplementary or recreational activity.

Development of Semantic Awareness and Lexical Depth

Beyond overall score improvement, the results reveal significant development in learners' semantic awareness and lexical depth. Pre-test responses often showed confusion between near-synonyms with subtle semantic distinctions, indicating difficulty in processing lexical nuance. Learners frequently selected words with overlapping meanings without recognizing contextual mismatches, reflecting shallow semantic processing.

Post-intervention data, however, demonstrate improved sensitivity to semantic relationships among Arabic synonyms. Learners were more successful in distinguishing between words with similar core meanings but different usage contexts. This improvement suggests that crossword puzzles encouraged learners to engage in semantic comparison and contrast, a process essential to developing lexical depth. The requirement to match clues with appropriate synonyms compelled learners to consider meaning relationships rather than relying on direct translation or rote recall.

This enhanced semantic awareness was evident in learners' increased accuracy on items designed to test nuanced synonym recognition. The results indicate that learners were better able to map semantic fields and recognize how different lexical items function within those fields. Such development reflects deeper cognitive processing and aligns with the theoretical assumption that meaningful vocabulary learning involves building networks of related lexical items rather than accumulating isolated words.

Retrieval Ability and Vocabulary Retention

Another significant result concerns learners' ability to retrieve Arabic synonyms efficiently and accurately. Pre-test observations indicated that many learners struggled with lexical retrieval, often leaving items unanswered or selecting incorrect synonyms due to uncertainty. This difficulty suggests that while learners may have encountered the vocabulary previously, the lexical items were not readily accessible for active use.

Following the crossword puzzle–based instruction, learners demonstrated improved retrieval speed and confidence. Post-test responses showed fewer omissions and more decisive selections, indicating that lexical access had become more automatic. This improvement can be attributed to the repeated retrieval practice embedded within the crossword activities, which required learners to recall synonyms multiple times in varying configurations.

The results also suggest enhanced vocabulary retention. Learners' improved post-test performance indicates that the instructional intervention supported longer-term retention rather than short-lived memorization. The structured repetition and contextualized recall inherent in crossword puzzles appear to have reinforced memory consolidation. As a result, learners were able to retrieve synonyms more reliably, supporting the notion that crossword-based learning strengthens procedural aspects of vocabulary knowledge.

Learner Engagement and Classroom Interaction

In addition to measurable vocabulary gains, the results highlight notable changes in learner engagement and classroom interaction. Observational data collected during the intervention revealed that learners were more actively involved in vocabulary tasks compared to traditional instructional sessions. Learners participated in discussions, negotiated meanings with peers, and demonstrated greater willingness to attempt responses, even when uncertain.

The crossword activities appeared to reduce anxiety associated with vocabulary learning. Learners treated the tasks as problem-solving challenges rather than evaluative exercises, which fostered a more relaxed learning atmosphere. This shift in classroom dynamics encouraged learners to experiment with language and engage more deeply with lexical content.

Furthermore, learners displayed increased collaborative behavior during the crossword sessions. Peer interaction played a role in clarifying meanings, validating synonym choices, and reinforcing semantic understanding. These interactional patterns suggest that crossword puzzles not only supported individual lexical development but also promoted social dimensions of learning that enhanced overall engagement.

Patterns of Error Reduction

Analysis of learner responses also revealed a noticeable reduction in error patterns following the intervention. Pre-test errors frequently involved the selection of non-synonymous words with related thematic meanings or incorrect morphological forms. Such errors indicate incomplete understanding of semantic equivalence and insufficient attention to lexical precision.

Post-test data showed fewer instances of these errors. Learners demonstrated improved accuracy in selecting synonyms that matched both semantic meaning and contextual requirements. This reduction in error frequency suggests that crossword-based instruction supported more careful lexical analysis and reduced reliance on guessing.

Additionally, the consistency of correct responses across similar items indicates that learners developed more stable lexical representations. Rather than treating each item independently, learners appeared to apply learned synonym relationships across multiple contexts. This pattern supports the conclusion that crossword puzzles facilitated transferable lexical knowledge rather than isolated learning outcomes.

Learners' Cognitive Response to Crossword-Based Instruction

The results further indicate positive cognitive responses to the use of crossword puzzles as an instructional medium. Learners demonstrated increased attentiveness during vocabulary sessions, sustained focus on lexical tasks, and heightened curiosity when encountering unfamiliar synonyms. The puzzle format appeared to stimulate intrinsic motivation by framing vocabulary learning as an engaging cognitive activity.

Learners also showed improved metalinguistic awareness. Through repeated exposure to semantic clues, learners became more conscious of meaning relationships and lexical choice. This

awareness was reflected in their ability to explain synonym selections during classroom interactions, suggesting that learners were not merely guessing but actively reasoning through lexical options.

These cognitive responses highlight the pedagogical value of crossword puzzles in promoting higher-order thinking skills related to vocabulary learning. The results suggest that crossword-based instruction supports not only lexical acquisition but also cognitive processes essential for language development.

Descriptive Statistics of Arabic Synonym Mastery

Quantitative analysis was conducted to examine learners' improvement in Arabic synonym mastery before and after the implementation of crossword puzzle–based instruction. Descriptive statistics revealed a substantial increase in learners' post-test scores compared to their pre-test performance. Prior to the intervention, learners demonstrated relatively low mastery of Arabic synonyms, indicating limited lexical depth and reliance on surface-level vocabulary knowledge. Table 1 presents the descriptive statistics of pre-test and post-test scores.

Table 1. Descriptive Statistics of Pre-Test and Post-Test Scores

Test	N	Mean	Std. Deviation	Minimum	Maximum
Pre-Test	30	61.47	7.82	48	75
Post-Test	30	78.93	6.45	65	90

The results indicate an increase of 17.46 points in the mean score after the instructional intervention. This improvement suggests that crossword puzzle–based instruction had a positive impact on learners' ability to recognize and recall Arabic synonyms.

Inferential Analysis of Learning Gains

To determine whether the observed improvement was statistically significant, a paired-samples t-test was conducted. The analysis compared learners' pre-test and post-test scores to assess the effectiveness of the instructional intervention. Table 2 presents the results of the paired-samples t-test.

Table 2. Paired-Samples t-Test Results

Comparison	Mean Difference	t-value	df	Sig. (p)
Pre-Test – Post-Test	-17.46	-12.87	29	.000

The results show a statistically significant difference between pre-test and post-test scores ($p < .001$), indicating that the improvement in Arabic synonym mastery was not due to chance. The large t-value reflects a strong instructional effect of crossword puzzle–based learning. To evaluate the magnitude of the instructional impact, Cohen's d was calculated. The effect size was found to be $d = 1.85$, which is considered a very large effect according to conventional benchmarks. This result suggests that crossword puzzles were highly effective as a pedagogical intervention for enhancing Arabic synonym mastery. Table 3 summarizes the effect size interpretation.

Table 3. Effect Size Interpretation

Effect Size (Cohen's d)	Interpretation
1.85	Very Large Effect

Further analysis revealed that the improvement in synonym mastery was consistently distributed across participants. Most learners showed moderate to high gains, indicating that the instructional approach benefited learners with varying levels of initial proficiency. No extreme outliers were observed, suggesting that crossword puzzle–based instruction supported a relatively uniform learning trajectory. Table 4 presents the distribution of score improvements.

Table 4. Distribution of Score Improvement

Improvement Range (Points)	Number of Students	Percentage
5–10	4	13.3%
11–20	16	53.3%
21–30	10	33.4%
Total	30	100%

The majority of learners (86.7%) achieved improvements greater than 10 points, reinforcing the robustness of the instructional effect.

Overall, the quantitative results provide strong empirical evidence that crossword puzzle–based instruction significantly enhances Arabic synonym mastery. Learners demonstrated substantial gains in post-test performance, supported by statistically significant differences and a very large effect size. These findings confirm that crossword puzzles function as an effective vocabulary-based pedagogical tool, capable of promoting deeper lexical processing and sustained learning outcomes.

The findings of this study provide empirical support for the growing body of research that positions crossword puzzles as an effective pedagogical tool in language learning, while extending previous work by demonstrating their specific impact on Arabic synonym mastery. Earlier studies have shown that crossword puzzles promote student-centered learning and higher-order thinking skills in Arabic reading instruction (Ritonga et al., 2021). Similarly, classroom-based research in Islamic school contexts reported that crossword activities significantly improved students' comprehension of Arabic texts and vocabulary-related outcomes (Mukhlisah et al., 2022). However, these studies primarily focused on general comprehension and reading performance rather than on discrete lexical competencies. The present study advances this line of research by empirically confirming that crossword puzzle–based instruction can enhance lexical depth, particularly learners' ability to recognize, differentiate, and retrieve Arabic synonyms.

The significant improvement in post-test scores and the very large effect size observed in this study align with findings from cross-disciplinary research on active learning. Aggarwal et al. (2023), in a medical education context, demonstrated that crossword puzzles enhance recall, engagement, and motivation when learners deal with complex terminology. Although conducted outside language education, their results support the cognitive mechanisms identified in this study, namely repeated retrieval, semantic association, and reduced anxiety. These mechanisms appear to operate similarly in Arabic vocabulary learning, where learners must navigate semantic nuance and closely related lexical items.

From a psycholinguistic perspective, the present findings are consistent with research emphasizing the central role of vocabulary knowledge in Arabic literacy development. Alsiddiqi et al. (2025) showed that oral vocabulary skills are strong predictors of emergent literacy in Arabic-speaking children, highlighting the importance of strengthening lexical competence. While their study focused on literacy development rather than instructional intervention, the current results

demonstrate how targeted pedagogical strategies such as crossword-based learning can operationalize this theoretical insight in classroom practice by improving learners' access to and control over lexical meaning.

The observed development of semantic awareness and improved retrieval ability further supports the concept of lexical depth. Previous research has argued that vocabulary learning is not merely about increasing the number of known words but about developing meaningful semantic networks (Hanifansyah & Mahmudah, 2024; Wang, 2023). The crossword activities used in this study required learners to engage in semantic comparison and contextual reasoning, which likely contributed to deeper processing and more stable lexical representations. This finding addresses a limitation in earlier crossword studies that treated vocabulary as a broad construct without examining depth of lexical knowledge.

In addition, the task-specific focus of this study responds to methodological concerns raised in bilingual and psycholinguistic research. Logue et al. (2025) demonstrated that language performance is highly task-dependent, suggesting that assessments should target specific competencies rather than general proficiency. By focusing explicitly on synonym mastery and aligning instructional activities with assessment tasks, the present study adopts a more precise evaluative approach, thereby strengthening the validity of its findings.

Finally, the results complement recent advances in AI-powered crossword puzzle research. Studies introducing Arabic and Turkish AI-based crossword generators highlight the potential of crossword puzzles for vocabulary expansion and cognitive engagement (Zeinalipour et al., 2023, 2024). However, these studies primarily emphasize technological development and lack empirical classroom validation. The present study contributes pedagogical evidence that supports the educational value assumed in AI-based crossword systems, suggesting that such tools may be pedagogically meaningful when integrated into well-designed instructional frameworks.

Overall, by linking crossword puzzle–based instruction with lexical depth, psycholinguistic theory, and prior pedagogical research, this study not only corroborates earlier findings but also extends them by providing focused, quantitative evidence on Arabic synonym mastery. This contribution helps bridge the gap between general vocabulary instruction, emerging educational technologies, and competency-specific language pedagogy.

CONCLUSION

This study concludes that crossword puzzle–based instruction is an effective pedagogical strategy for enhancing Arabic synonym mastery in formal language learning contexts. The quantitative findings demonstrate a significant improvement in learners' post-test performance, supported by a large effect size, indicating that the observed gains were both statistically meaningful and pedagogically substantial. These results confirm that systematic engagement with crossword puzzles facilitates deeper lexical processing, enabling learners to recognize, differentiate, and retrieve Arabic synonyms more accurately.

Beyond measurable vocabulary gains, the study highlights the role of crossword puzzles in promoting lexical depth rather than surface-level memorization. By requiring learners to interpret semantic clues and establish relationships among synonymous words, crossword-based instruction supports the development of semantic awareness and more stable lexical representations. This

approach helps bridge the gap between receptive vocabulary knowledge and active lexical use, which remains a persistent challenge in Arabic language education.

Pedagogically, the findings suggest that crossword puzzles can be integrated as a structured instructional tool rather than a supplementary classroom activity. The use of puzzles fosters learner engagement, reduces anxiety associated with vocabulary learning, and encourages active participation through problem-solving and peer interaction. These instructional benefits position crossword puzzles as a viable alternative to traditional vocabulary teaching methods that rely heavily on rote learning.

Despite its contributions, this study is limited by its focus on a single instructional medium and a specific learner group. Future research is encouraged to explore the long-term retention effects of crossword-based vocabulary learning, compare crossword puzzles with other game-based or digital learning strategies, and examine their impact on broader language skills such as writing and speaking. Overall, this study contributes to Arabic language pedagogy by providing empirical evidence that crossword puzzle–based instruction offers a meaningful, engaging, and effective approach to developing Arabic synonym mastery.

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