Teaching EFL Vocabulary through Analyzing the Structure of Words Coupled with Using Crossword Puzzles

Yu-Chi Yang[1*]

[1]Department of Foreign Languages, Fooyin University, Kaohsiung City, Taiwan
[*]Corresponding author's email: yuchiyang0813@gmail.com
[*] https://orcid.org/0009-0008-9633-2988
https://doi.org/10.54855/ijte.25523

Received: 05/11/2024 Revision: 04/03/2025 Accepted: 24/03/2025 Online: 23/04/2025

ABSTRACT

In the EFL milieu, plenty of studies have reported the usefulness of some vocabulary-building techniques. Among them, teaching incorporating either the crossword or mnemonics has been widely implemented in various language settings. Empirical evidence supports the value of such a teaching method. Nonetheless, using both the devices in tandem deserves attention and further investigation. In the current research, two groups of EFL majors in a junior college in Taiwan were recruited to receive either traditional lecture-based instruction or teaching aided by both the crossword and mnemonics. Data analysis demonstrates significant inter-group differences in the learning outcome, favorable to the latter group, and the questionnaire responses exhibit the students' approval of this experimental technique. The findings of the research mean more to EFL teaching in Taiwan, as Mandarin Chinese, the medium of instruction in schools, is by far different from English, making it more difficult to learn English as L2.

Keywords: mnemonics, word structure diagram, crossword puzzle, vocabulary acquisition, memory

Introduction

English is a "global lingua franca" used in international politics, entertainment, air traffic control, academia, trade, diplomacy, and social media (Mauranen, 2010, p. 6). In Taiwan, English is the most widely learned foreign language. Public policy wise, the government recognizes the crucial role of English in international and intercultural communication, and English-language teaching is implemented at all levels of education (Ministry of Education, 2018; Rüdiger et al., 2023). In practice, English is a high-stakes subject of study for most students. The outcome of their performance on this subject has a significant impact on their chance of being admitted to a certain major in a certain university. English skills are also a qualification for some appointments in the government and private sectors (104 Corporation,

CITATION | Yang, Y. C. (2025). Teaching EFL Vocabulary through Analyzing the Structure of Words Coupled with Using Crossword Puzzles. *International Journal of TESOL & Education*, *5*(2), 57-74. DOI: https://doi.org/10.54855/ijte.25523

2021; Yam News, 2023).

That being said, opportunities for Taiwanese learners to use the language are limited. There are reasons for and consequences of this awkward situation. Politically, Taiwan is quite isolated in the international community, limiting mass popular access to English as a medium of international communication and thus rendering this language less appreciated (Republic of China (Taiwan), 2018). On a smaller scope, classroom instruction in Taiwan, which is influenced by social expectations and a rigid educational system, prioritizes test-taking skills over proficiency. Young learners' mentality toward learning English is often short-sighted, i.e. striving to fulfill an imminent purpose such as passing an exam through rote memorization (Chen et al., 2020; Huang, 2014; Liao, 2004; Yeh & Wang, 2004), which could explain the omnipresence of private learning centers (Rüdiger et al., 2023). This focus often leads to insufficient effort being directed toward improving learners' ability to comprehend and use the language. For Taiwanese English teachers, as expected, learners' interest and motivation are frequently secondary concerns. Additionally, the popularity of e-learning (Tran & Nguyen, 2022) has enticed many learners to believe that watching videos on social media can allow them to improve their vocabulary and English proficiency. This unstructured approach to learning exacerbates these learners' inability to successfully improve their proficiency levels. This observation of learners' preference for technology as a learning aid is in agreement with the findings of Le and Trinh (2024). And yet, the more concrete and obvious consequence of these scenarios is learners' subpar performance on international English language proficiency exams, such as TOEFL and TOEIC. Recently, Taiwanese TOEFL test takers performed below the average on all four components: Reading, Listening, Speaking and Writing (ETS, 2023). On the Test of English for International Communication (TOEIC®) program, Taiwanese test takers' level of proficiency reveals their inadequate vocabulary competence coupled with marginal written expression and simple conversation skills (Chun, 2024).

The researcher of this study, in his interactions with his students, has noted that young learners often reject thoughtfully designed approaches, even when the less thoughtful methods they adopt fail to produce desired outcomes. Students also often complain about vocabulary being difficult to learn and easy to forget, reflecting their frustration with the learning process.

On the basis of his professional experience, the researcher of this study designed an intervention aimed at promoting learning engagement and, by elucidating alternative learning strategies, enabling learners to access other learning resources. This intervention integrated the Fish-skeleton Vocabulary Learning Diagram (FSVLD) (Appendix 1) and crossword puzzles (Appendix 2). The FSVLD utilizes was used to illustrate word composition and assist with identification of the meanings of word components. After completing lessons focused on the FSVLD, the students applied their knowledge to solve crossword puzzles.

The rationale for this study can be elucidated from three perspectives. First, in EFL settings, the use of the FSVLD is a new practice. Yang and Wang (2006) used this device as an aid for writing essays as well as for quickly grasping the ideas of a writing. Afterwards, Yang and Wang (2014) used it to help students acquire vocabulary knowledge. However, the effectiveness of this device in achieving the goal of vocabulary acquisition and memory has not been validated.

Second, comparative linguistics justifies revisiting crossword puzzles. In contrast to the FSVLD, the crossword puzzles have been widely used in EFL classrooms and their effectiveness in facilitating vocabulary acquisition has been confirmed in previous studies (Alda & Wati, 2021; Keshta & Al-Faleet, 2013; Lestari & Yulia, 2018; Njoroge et al., 2013; Merkel, 2016; Mustika et al., 2022; Orawiwatnakul, 2013). However, the wide use of crossword puzzles is not a reason at all why the researcher of this study jumped on the bandwagon of investigating the potential of this device. Rather, it is comparative linguistics that prompts him to do this study. The process of acquiring L2 vocabulary is complex (Ryan, 1997; Schmitt & McCarthy, 1997). It should be noted that how similar L1 and L2 are decides how easy or difficult it is to pick L2 vocabulary or to learn L2 more generally. More similarity makes this process easier (Schmitt & McCarthy, 1997), and Richards (1976) implies that the level of such similarity is decided by several features of words of a language. Mandarin Chinese is the first language used in Taiwan, and it is the predominant medium of instruction in all levels of education (Rüdiger et al., 2023). There exist immense differences between Mandarin Chinese and English, and the gap must be larger than those between English and other alphabetical languages. These differences permeate various domains of language: orthography, phonology, syntax, and semantics. Mandarin Chinese doesn't belong to the alphabetical system. Rather, a Chinese character is made up of several strokes, for example, "快樂〞, pronounced "kwai lur" and literally meaning "happiness." Each of these two characters is formed by a number of strokes. As to syntax, in Chinese, there is no subject-verb inversion. The verb doesn't have different forms, so it is virtually impractical to compose verbal phrases, and EFL learners often have difficulty using verb tense correctly. Collocations also cause trouble for Taiwanese learners. Take the word 'wait' as an example. A learner may know its meaning. But the phrases 'wait on' and 'wait for' may be confusing or misleading. The effect of the inherent gap existing between Mandarin Chinese and English in relation to their linguistic features could be augmented by cultural differences (Merkel, 2016).

Third, previous studies on the usefulness of the crossword puzzle focused on its impact on vocabulary acquisition; empirical evidence of its impact on memory is scarce and inconsistent. Furthermore, Taiwanese teachers and scholars have not done research on the effectiveness of the crossword puzzle, either in vocabulary acquisition or in vocabulary memory. Therefore, to validate the possible usefulness of the FSVLD, obtain empirical evidence of the applicability of the crossword puzzle in another lingual and cultural context, and validate the effect of the experimental intervention on memory, justify this study.

To test the effectiveness of this intervention, the researcher of this study conducted a quantitative study. One cohort of students received this intervention, and another received traditional lecture-based instruction. The performance of these cohorts was statistically analyzed to address two research questions:

1. Can FSVLD-centered explanations coupled with the use of crossword puzzles help EFL learners improve their ability to acquire vocabulary?
2. Can FSVLD-centered explanations coupled with the use of crossword puzzles help EFL learners remember acquired vocabulary?

Literature Review

A considerable number of scholars have highlighted the crucial role of vocabulary in expressing an individual's meaning. For example, linguist Peter Funk asserted that words are central to cognitive processes (Reader's Digest, 1983). Similarly, a sociolinguist named Wilkins emphasized vocabulary's pivotal role in language, noting, "While without grammar, very little can be conveyed, without vocabulary, nothing can be conveyed" (1985, p. 111). Wilkins (1985) also suggested that vocabulary knowledge profoundly influences an individual. In the same vein, King (2010, p. 5) described vocabulary as a core component of expression, relating it to the "bricks" of a valid piece of writing, and Richards and Renandya (2002, p. 255) referred to vocabulary as "a core component of language proficiency," emphasizing that it provides "much of the basis for how well learners speak, listen, read, and write".

The role of vocabulary in the learning process has been widely studied. Numerous studies have linked vocabulary knowledge to academic success, in addition to the development of other language skills. For example, Nation (1990) asserted that the necessity of vocabulary knowledge for effective learning cannot be overestimated. The logic of this causation is supported by some sources of information. Orawiwatnakul observed that vocabulary is "a key basis on which reading achievement depends" and is crucial to meaning and comprehensible expression (2013, p. 414). According to Karami and Bowles (2019) and Nam (2010), vocabulary can impact an individual's cultural understanding, besides writing, reading, listening, and speaking. Additionally, Keshta and Al-Faleet (2013) discovered that vocabulary determines reading comprehension levels and thereby influences academic performance. The National Institute of Child Health and Human Development [NICHD] summarized the close relationship between vocabulary and academic development as follows: "Vocabulary is important for reading to learn as well as learning to read (NICHD, 2020, p. 22)."

As individuals of diverse backgrounds began learning English (King, 2010) and EFL was recognized as an academic discipline (Faraj, 2015) in the second half of the 20th century, researchers and EFL teachers began developing strategies to enhance vocabulary acquisition and memory (Wei, 2007). One such strategy involves mnemonics (Agnes & Srinivasan, 2024a, 2024b; Amiryousefi & Ketabi, 2011; Farjami, 2007; Hulstijn, 1997; Kurniarahman, 2023; Pillai, 2017). Farjami (2007) claimed that mnemonic devices have value in teaching vocabulary and helping with memory of vocabulary knowledge. Agnes and Srinivasan (2024a, 2024b) and Amiryousefi and Ketabi (2011) emphasized the ability of mnemonic to link new information to existing knowledge and thus help a learner retrieve cues stored in the brains and cited visual imagery as one of the essential mechanisms through which mnemonic devices function. Pillai (2017) observed that mnemonics, which can be presented in visual, physical, or other forms, provide substantive stimulation, create vivid impressions, attract attention, and facilitate memory. Kurniarahman (2023) underscored the positive effect of mnemonic devices on vocabulary memory, possibly owing to their potential to engage students in learning.

Inspired by previous literature on mnemonics (Amiryousefi & Ketabi, 2011; Farjami, 2007; Hulstijn, 1997), Yang and Wang (2014) developed the FSVLD as a teaching aid. This diagram

is shaped like a fish skeleton and comprises three parts: head, trunk, and tail, representing the prefix, root, and suffix of a word, respectively (Yang & Wang, 2014). According to Yang and Wang (2014), when thoughtfully implemented, this diagram can aid learners in developing idiomatic usage, knowledge of antonyms and synonyms, spelling, and the habit of associating concepts. As this diagram demonstrates three parts of a word, it enables the students to quickly form an image of the meaning contained in the word and how it functions that way. As elucidated in literature on mnemonics, in comparison with verbal description, visual imagery is more capable of drawing attention and creating an engaging learning process. From a cognitive perspective, visual information is more easily processed and stored by the human brain, and more capable of creating mental representations and bringing about meaningful connections (Alabi, 2024). In addition, gaining an understanding of the composition of words is an effective method for learning vocabulary (Ellis, 1997; Li, 2009). This benefit can be reasoned as a result of reduced workload. Instead of learning a myriad of words separately, learners only have to remember a lot fewer units of information. With such knowledge, it would be possible for them to guess the meaning of new words or to memorize the learned words more effectively.

Using the crossword puzzle is another strategy that has been validated as effective in enhancing vocabulary acquisition (Alda & Wati, 2021; Keshta & Al-Faleet, 2013; Lestari & Yulia, 2018; Merkel, 2016; Mustika et al., 2022; Njoroge et al., 2013; Orawiwatnakul, 2013) for several reasons. First, solving crossword puzzles is fun and enjoyable. Keshta and Al-Faleet (2013) observed that learners enjoy learning methods that are engaging and that enable "interactive, exciting, and fun learning," highlighting crossword puzzles' potential for diversifying classroom activities and establishing a relaxing learning atmosphere (p. 47). Merkel (2016) noted that solving vocabulary crosswords is fun and renders learning satisfying and stimulating. It is worth noting that when these educators had a favorable experience with crossword-aided teaching, it had already been used in such disciplines as communication, health, psychology, reading, and sociology classes because it is conducive to a more cheering learning experience (Childers, 1996).

Second, crossword puzzles inspire critical thinking. By Ausubel (1963), Mayer (2002), and Yunianta et al. (2012), active thinking is instrumental in achieving meaningful learning. Ayto (1990, p. 422) observed that "arduous reasoning" is essential for solving puzzles. Similarly, Childers (1996) recognized the crossword puzzle's ability to evoke critical thinking and imagination. Additionally, Krashen (1985) suggested that unchallenging learning, that is, learning that is excessively easy or boring, often fails to inspire learners, whereas "i + 1" (input slightly higher than the learner's comprehension level) promotes effective learning.

Third, crossword-assisted teaching encourages engagement and the manipulation of concepts and ideas. Schmitt and McCarthy (1997) described solving crosswords as a cognitive process involving recalling and manipulating words that leads to deep engagement. Moreover, Gairns and Redman (1999) noted that solving a crossword puzzle requires application of a range of information, including grammar and meaning. Finally, studies have demonstrated (Burston, 2005; Merkel, 2016; Schmitt & McCarthy, 1997) that language learners prefer searching for meaning in word clusters to enhance the acquisition of new vocabulary. As solving crossword

puzzles requires the player to read clues, this activity exposes learners to substantive and correct word strings, facilitating thorough learning.

On the strength of the potential impact of the FSVLD and the validated benefits of crossword puzzles, it is not too far-fetched to say that the intervention implemented in this current study can facilitate meaningful learning, an educational concept proposed by Ausubel (1963). Meaningful learning involves active thinking, motivation, problem-solving, practice, and a sense of achievement (Yunianta et al., 2012). Mayer (2002) suggested that meaningful learning has lasting effects and helps learners solve problems beyond those presented in learning tasks.

Learners and teachers are jointly responsible for achieving meaningful learning. Teachers' adjustments to curriculum pedagogy also impact on students' meaningful learning experiences (Vu et al., 2020). Huang (2005), Karami and Bowles (2019), Nemati (2009), and Pillai (2017) have indicated that learners must engage and persist in their efforts, and teachers must create a motivational atmosphere and employ diverse instructional methods to support learners. These views are consistent with that of Wilkins (1985), who observed that recognizing the practical value of learning a second language — using it to influence the environment — increases learners' intent to study.

Commitment, motivation, and guidance are crucial to knowledge acquisition and retention. Therefore, teachers must create and maintain a learning environment that sustains learners' momentum and guides them appropriately. The pedagogical concepts buttressing the effectiveness of the intervention in the present study are the Zone of Proximal Development (ZPD) (Vygotsky, 1978) and instructional scaffolding (Lipscomb et al., 2010; Wood et al., 1976). By these concepts, instruction should progress from easy tasks to more difficult tasks, with teachers providing support on the basis of students' competence levels until the students achieve curriculum objectives.

Methods

This study was conducted over 23 weeks of the 2022-23 academic year. The duration spanned two consecutive semesters (including a four-week winter break in-between). During this period, students taking an English vocabulary enhancement course were divided into experimental and control groups. The experimental group received the experimental intervention, and the control group received traditional lecture-based instruction. The Methods contain five major sections: research design, participants, study instruments, intervention, and data processing. They are enumerated as follows.

Research Design

This study adopted a quasi-experimental design model, shown in Table 1. Initially, a pretest was administered to both groups of students. After the pretest, the larger cohort, designated as the experimental group, received the intervention and completed a questionnaire. Following the intervention, both the experimental and the control groups completed a posttest and a follow-up test. These tests comprised the same set of questions as those on the pretest.

Table 1

Quasi-experimental design model

Group	Pretest	Experimental treatment[1]	Posttest	Follow-up test	Response to questionnaire
Experimental	Yes	Yes	Yes	Yes	Yes
Control	Yes	No	Yes	Yes	No
Experimental	Yes	Yes	Yes	Yes	Yes

Note. [1]Fish-Skeleton Vocabulary Learning Diagram + Crossword Task Activity.

Participants

This study involved 71 third-year students from a 5-year junior college EFL program (equivalent to the senior year in high school) enrolled in the course "English: Vocabulary and Etymology." The participants were divided into two groups: 36 in the experimental group and 35 in the control group. Statistical analyses were conducted using SPSS version 28. A pretest with 60 questions revealed nearly identical vocabulary proficiency between the two groups, with mean scores of 26.22 and 26.37, respectively. Statistical tests (t-test and Levene's test) confirmed no significant difference between the groups ($p = 0.73$). The experimental group was selected due to its larger size for reasons of convenience and practicality. Additionally, the study involved the researcher, three faculty members, and 55 EFL students who were not part of the main groups.

Study Instruments

The study utilized various tools, including a textbook, a learning achievement test, the FSVLD, crossword puzzle worksheets, and a learning attitudes questionnaire. The textbook, Reading Explorer (3rd edition, 2019), published by Cengage Learning, offered a wide range of reading passages aimed at broadening and deepening students' vocabulary. A 60-question learning achievement test embedded in the textbook was administered to both cohorts as a pretest, a posttest, and a follow-up test conducted four weeks after the instruction.

The purpose of FSVLD is to explain word composition, clarify the meanings of word elements, and encourage students to create new words using prefixes, roots, or suffixes, thereby enhancing their understanding of vocabulary. These activities prepared students for subsequent crossword puzzle tasks. The reason for using a fish skeleton diagram for vocabulary teaching is that, in etymology, words are divided into three parts: prefix, root, and suffix, which correspond to the head, trunk, and tail of a fish. Additionally, using a visual representation helps students create a mental image when learning words, enabling them to retain vocabulary for a longer time.

To develop the crossword puzzle worksheets, the researcher collaborated with three faculty members, using a free crossword puzzle generator from The Teacher's Corner website. Target words and their definitions, selected from the textbook, were input into the software to create 12 worksheets, each containing 18 or 19 target words. Of these, one was used for demonstration, nine as quizzes, and two for practice. The accuracy of these worksheets was verified by the faculty members.

A learning attitudes questionnaire (Appendix 3), designed by the researcher, was distributed to the experimental group after the instruction cycle to evaluate the effectiveness of the FSVLD and crossword puzzles in enhancing learning and retention. The questionnaire, comprising 29 items, was scored on a 5-point Likert scale. Exploratory factor analysis using principal component analysis identified three factors—memory, acquisition, and sense of achievement—which explained 64.434% of the variance. The Kaiser–Meyer–Olkin value was 0.807 ($p < .001$), confirming the data's suitability for factor analysis. The questionnaire exhibited excellent reliability, with Cronbach's α at 0.963.

Intervention

After dividing the students into groups, the researcher of this study implemented two distinct teaching approaches. The control group followed a lecture-based method, focusing on word explanations, grammar reviews, and discussions on word origins or related stories. In contrast, the experimental group combined FSVLD instruction with a 20-minute crossword activity during each 50-minute class. Other activities mirrored those of the control group but were delivered in a more concise and faster manner.

To begin, the researcher of this study demonstrated solving a crossword puzzle to familiarize the experimental group with the process and encourage participation. During the intervention, the group completed nine crossword quizzes and collaborated with the researcher of this study in two class sessions to solve puzzles together. As Zitouni et al. (2021) emphasized, repetitive and engaging exercises over time significantly enhance vocabulary retention. After the posttest, the experimental group completed a feedback questionnaire.

Data Processing

The researcher of this study utilized various statistical methods to analyze data from the experimental group's crossword quizzes, as well as both groups' posttest and follow-up test results. First, the experimental group's crossword quiz scores were recorded and standardized as z-scores. Second, t-tests compared pretest and posttest scores of both groups to identify significant differences. Third, follow-up test results were examined to evaluate vocabulary retention. Fourth, Pearson correlation analysis assessed the experimental treatment's impact on posttest outcomes. Lastly, questionnaire responses were analyzed to provide additional insights, complementing the study's findings.

Findings

The data analysis yielded the following insights into the first research question and into the second research questions, and the statistical treatment of the responses to the questionnaire adds credibility to these insights.

Four data sets were analyzed to answer the first research question, with the statistical analysis shown in Table 2, Table 3, and Table 4. The data sets comprise (1) The Experimental Group's Performance on the Crossword Quizzes, (2) Both Groups' Performance on the Pretest and the Posttest, (3) The Groups' Performance on the Posttest, and (4) The Correlation Between the Experimental Group's Performance on the Crossword Quizzes and on the Posttest.

Data Sets Pertinent to the First Research Question

The Experimental Group's Performance on the Crossword Quizzes

The scores of the experimental group on the nine quizzes demonstrate a consistent upward trend throughout the instruction cycle. The group achieved an overall z-score of 55.26, with scores of 38.12 on the first quiz, 53.36 on the fifth quiz, and 77.78 on the ninth quiz. The extent of improvement from the first to the fifth quiz was 39.9%, that from the fifth to the ninth quiz was 45.8%, and that from the first to the ninth quiz was 104%, indicating substantial and sustainable progress in completing the crossword tasks.

Both Groups' Performance on the Pretest and the Posttest

The experimental group had an average of 26.22 correct answers on the pretest and 35.58 on the posttest, and the control group had 26.37 correct answers on the pretest and 24.94 on the posttest. Paired sample *t*-tests were conducted to examine variations in each group's mean scores. The results for the experimental group yielded a t value of −9.194, with $p < .001$, shown in Table 2, indicating a significant difference in their performance between the two tests. By contrast, the results for the control group yielded a t value of 1.274, with a p value of 0.211, shown in Table 3, indicating no significant differences in their performance between the two tests.

The Groups' Performance on the Posttest

The groups' performance on the posttest was also compared. The data were subjected to independent sample *t*-tests, yielding $t = -6.378$ and $p < .001$, shown in Table 4, indicating significant differences in the performance of the experimental and control groups.

The Correlation Between the Experimental Group's Performance on the Crossword Quizzes and on the Posttest

The experimental group scored an average of 10.51 (out of 18 or 19 questions on each quiz) on the nine quizzes. Pearson correlation analyses were subsequently conducted to assess whether the group's performance on the quizzes was correlated with their performance on the posttest. The result, $r = 0.64$ and $p < .001$, indicates a moderate correlation between these data points.

The analysis of the above four data sets highlights that the intervention in this study led to significantly different learning outcomes between the experimental and control groups. Throughout the instructional period, the experimental group consistently outperformed the control group in vocabulary acquisition, demonstrating the intervention's effectiveness and providing a clear benefit to those who received the specialized instruction.

Table 2

Paired sample t-test of the experimental group's performance on the pretest and the posttest

Measuring	Mean	SD	T	df	2-tailed p
Pre-test	26.22	6.109	−9.194	35	<.001
Post-test	35.58				

Note. ***$p < .001$.

Table 3

Paired sample t-test of the control group's performance on the pretest and the posttest

Measuring	Mean	SD	T	Df	2-tailed p
Pre-test Post-test	26.37 24.94	6.635	1.274	34	0.211

Table 4

Independent sample t-test results for the posttests of the control and experimental groups

Group	N	Mean	SD	T	2-tailed p
Control Experimental	35 36	24.94 35.58	6.637 7.389	−6.378	<.001

Note. ***$p < .001$.

To answer the second research question, two data sets were analyzed, with the statistical analysis shown in Table 5, Table 6, and Table 7. The data sets comprise (1) Both Groups' Performance on the Posttest and the Follow-up Test. and (2) The Groups' Performance on the Follow-up vs Their Performance on the Previous Tests.

Data Sets Pertinent to the Second Research Question

Both Groups' Performance on the Posttest and the Follow-up Test

Specifically, the groups were compared in terms of the difference in performance on the posttest and the follow-up test. The experimental group scored an average of 35.58 on the posttest and 34.97 on the follow-up test. These data were subjected to a *t*-test, which yielded $t = 0.828$, with $p = .413 > .05$, indicating no significant differences between the experimental group's performance on the two tests. By contrast, the result for the control group on the posttest was 25.04[2] and that on the follow-up test was 19.87. These data were also subjected to a *t*-test, yielding results of $t = 6.443$ and $p < .001$, indicating significant differences between the control group's performance on these two tests.

The Groups' Performance on the Follow-up vs Their Performance on the Previous Tests

Table 5

Mauchly's spherical test

Within-subject effects	' W	Chi-square test	df	Sig	Epsilon		
					Greenhouse-Geisser	Huynh-Feldt	Lower-bound
Time	.869	4.776	2	.092	.884	.928	.500

The researcher of this study also used a repeated-measure analysis of variance to compare the groups in terms of their performance on the follow-up test versus their performance on the pretest and the posttest. The results revealed that the experimental group earned a mean score of 34.97 (standard deviation [SD] = 6.92) on the follow-up test and 26.22 (SD = 6.30) and 35.58 (SD = 7.39) on the pretest and posttest, respectively. Paired analysis, conducted using generalized linear models and repeated measurements, yielded a Mauchly's W coefficient of .869 ($X^2 = 4.776$, $p = .092$), passing Mauchly's spherical test, shown in Table 5.

Table 6

Test of intraparticipant effects

Source		Type III sum of square	df	mean square	F	Sig.
Time	Finding Sphericity Assumed	1974.796	2	987.398	69.872	<.001
	Greenhouse-Geisser	1974.796	1.768	1116.800	69.872	<.001
	Huynh-Feldt	1974.796	1.855	1064.363	69.872	<.001
	Low-bound	1974.796	1.000	1974.796	69.872	<.001
Error (Time)	Error Sphericity Assumed	989.204	70	14.131		
	Greenhouse-Geisser	989.204	61.889	15.983		
	Huynh-Feldt	989.204	64.938	15.233		
	Low-bound	989.204	35.000	28.263		

A test of intraparticipant effects attained F = 69.872 with $p < .001$, reaching a level of significance, shown in Table 6.

Table 7

Paired comparison results

(I) Time	(J) Time	MD (I-J)	SE	Significance	95% confidence interval for the difference	
					LL	UL
1	2	−9.361*	1.018	<.001	−11.428	−7.294
	3	−8.750*	.880	<.001	−10.536	−6.964
2	1	9.361*	1.018	<.001	7.294	11.428
	3	.611	.738	.413	−.887	2.110
3	1	8.750*	.880	<.001	6.964	10.536
	2	−.611	.738	.413	−2.110	.887

Note. *. The difference in means is significant at the .05 level.

The experimental group scored higher on the posttest than on the pretest, with a significant difference of 9.361 and a standard error (SE) of 1.018 ($p < .001$). This group also performed better on the follow-up test than on the pretest, with a significant difference of 8.750 and SE of 0.88 ($p < .001$). The group's performance on the posttest was superior to that on the follow-up test, with a difference of .611 and SE of .738, but this difference was not significant, with $p = .413$, shown in Table 7. These results indicate that the experimental intervention enhanced vocabulary memory. However, this pattern of changes didn't happen to the control group. As shown in Table 3, the difference in control group's performance on the pretest and the posttest is not significant, but this group performed worse on the follow-up than on the posttest, with the difference reaching a level of significance.

The analysis of the above two data sets demonstrates that the intervention of this current study produced significantly different learning outcomes between the groups, progressing from the inception of the instruction to the administration of the follow-up test, favorable to the experimental group.

Finally, on learning attitudes, the scores given to the questionnaire items were averaged,

attaining 4.2/5.0, and a Pearson Correlation analysis was conducted to examine the correlation between learning attitudes and performance on the follow-up, yielding a Pearson's r of 0.73, with $p < .001$. These statistics speak of the students' high opinion of the experimental intervention and show that the intervention is effective in inspiring active search for clues for executing a task, sustaining engagement, and bringing about a sense of satisfaction. The evidence can be drawn from the responses to some of the questionnaire items: "When completing a crossword task, I approach spelling a complete target word like solving a problem, which gives me a sense of satisfaction.," "Solving crossword puzzles using my knowledge of the affixes and roots of words enables me to form a vivid impression of the words I have learned and remember them later." and "My improved vocabulary, confidence in using English, and grades after taking this course have enhanced my sense of accomplishment in learning English." Furthermore, a Pearson's Coefficient was conducted to examine the relationship of learning interest to success. A Pearson's $r = 0.245$, with $p = .150$, indicates a weak correlation between these two criteria.

Discussion

The effectiveness of the experimental intervention warrants consideration. The results of the current study evidence the potency of this teaching strategy to enhance vocabulary acquisition and memory. Overall speaking, teaching through using the FSVLD and crossword puzzles in sequence effectively holds students' attention, fosters engagement, and provides opportunities for practice, rendering the learning process more enjoyable and more capable of enhancing vocabulary acquisition and memory. These benefits are primarily attributable to the alignment of this teaching strategy with the principles of meaningful learning (Ausubel, 1963; Mayer, 2002; Yunianta et al., 2012), which suggests that active thinking, meaning comprehension, motivation, and practical application facilitate consolidation of learning outcomes and improve an individual's ability to solve real-life problems.

Speaking separately, the impact of the FSVLD can be explained from three perspectives. First, it has the potency to allow students to explore word structures, thus enhancing their understanding of the words. After gaining knowledge of prefixes, roots, and affixes, the students expanded their vocabulary by modifying word components. Second, since a word is divided into three parts, each with an endowed meaning, instead of comprising a larger number of separate alphabetical letters, the students were able to understand the word better and can maintain the momentum for learning owing to the reduced workload. More importantly, as the vocabulary learning diagram visually presents the composition of words, it is more capable of attracting attention and reducing boredom. The diagram presents visual stimulation and facilitates forming concrete imagery of words, thus conducive to enhanced memory. The finding along with the explanations for it is in agreement with the linguistic research of Ellis (1997) and research on mnemonics (Agnes & Srinivasan, 2024a, 2024b; Amiryousefi & Ketabi, 2011; Hulstijn, 1997; Kurniarahman, 2023; Pillai, 2017).

On the positive impact of the crossword puzzle on vocabulary acquisition, it can be attributed to the opportunity to practice and to a sense of purpose as a result of solving a problem. In a

crossword game, the students apply their knowledge and experience how the learned words function in real scenarios. Doing or manipulating not only solidifies learning but leads to satisfaction. In this regard, the outcome of this study agrees with those of a number of previous studies (Alda & Wati, 2021; Keshta & Al-Faleet, 2013; Lestari & Yulia, 2018; Merkel, 2016; Mustika et al., 2022; Njoroge et al., 2013; Orawiwatnakul, 2013). However, it doesn't align with the study outcome of Puspita and Sabiqoh (2017), which failed to prove the positive relationship of crossword puzzles to vocabulary learning.

Why the intervention implemented in this study has made a significantly positive impact on vocabulary memory entails complexity. In some previous research (Keshta & Al-Faleet, 2013). Puspita and Sabiqoh (2017), no significant impact of the crossword puzzle on vocabulary has been confirmed. Therefore, the result of this study may be attributed to the potency of the FSVLD. Or it may be linked to the effect of using two devices in sequence. This teaching activity is captivating, enlightening, pragmatic, and engaging, because the vocabulary learning diagram is capable of effecting visual stimulation and attracting attention and the crossword puzzle inspires thinking and doing. The effectiveness of this sequence of activities is supported by research regarding how the neural system consolidates memory. As pointed out by Hong (2022), conscious learning that has been put into practice has a greater chance of altering the connection of neural circuits, engendering long-term memory.

Conclusions and Suggestions

The findings of this current study contain four major points: (1) The teaching intervention has a significant positive impact on vocabulary acquisition, (2) The teaching intervention has buttressed learning endeavors, motivating learners to remain on track to attain the goal, (3) The teaching intervention has a significant positive impact on memory of vocabulary knowledge, and (4) The students accept the teaching intervention and have benefited from it. Positive answers have been given to both the research questions.

The current study is meaningful in a number of aspects. First, it sheds light on the credibility and validity of the usefulness of the crossword puzzle in EFL vocabulary learning. Second, it provides empirical evidence of the value of the crossword puzzle in achieving memory of vocabulary knowledge if this instructional tool is used in a proper context, such as coupled with another device. Third, it offers an insight into the potential of a vocabulary learning diagram. Finally, and most importantly, the findings of the study are not consistent with previous research on the effect of interest in learning. For example, Isangedighi (1997) reported a strong association between young learners' academic performance and their interest in learning and study habits. However, the current study shows, although the students started with a low initial interest, they adhered to their enthusiasm throughout the learning cycle and performed better than their counterparts in the Control group in the end. This suggests that students' success may be attributable to the instructional intervention.

There is no versatile, or the best, teaching strategy that is universally useful. Rather, numerous conditions must be taken into consideration when designing and implementing teaching strategies (Alabi, 2024; Dang & Tong, 2024; Kurniarahman, 2023; Le & Trinh, 2024; Pillai,

2017). Nonetheless, this study, along with the findings, offers an incentive to think up and implement alternative teaching techniques, especially for a literal and cultural context like Taiwan, where the first language is way different from English and still the educators and young learners are stuck in a mindset, striving to find a shortcut to attaining the imminent goal.

Since the current study investigated the combined effect of two instructional devices, there is a need to explore them separately. Further explorations for additional evidence of the effectiveness of the FSVLD are strongly suggested. Also deserving are investigations of the impact of the crossword puzzle on memory of vocabulary knowledge and of the influence of learning attitudes on outcomes. Whichever action is taken, every effort should be made to get access to a large sample of study. When conditions permit, a sample composed of learners from various disciplines (Le & Trinh, 2024). or involving instructors (Dang & Tong, 2024), should be able to safeguard a reliable outcome and increase the generalizability of the outcome.

Notes

1. Fish-skeleton Vocabulary Learning Diagram + Crossword Task Activity.
2. The size of the Control group was reduced to 23 when the second semester started owing to attrition. This sample size was applied when comparing the group's performances on the posttest and the follow-up test.

References

104 Corporation. (2021). *Global HRM & TOEIC*. 104 Corporation.

Agnes, D., & Srinivasan, R. (2024a). Redefining the association between memory, mnemonics and vocabulary acquisition—Reviewing paradigms in research. *Journal of Language Teaching and Research, 15*(3), 697–706. https://doi.org/10.17507/jltr.1503.02

Agnes, D., & Srinivasan, R. (2024b). Fostering vocabulary memorization: Exploring the impact of AI-generated mnemonic keywords on vocabulary learning through Anki flashcards. *World Journal of English Language*, *14*(2), 433–451.

Alda, J. N., & Wati, S. (2021). Enhancing learners' vocabulary acquisition by crossword puzzle game. *JL3T (Journal of Linguistics, Literature and Language Teaching), 7*(1), 25–40. https://doi.org/10.32505/jl3t.v7i1.2820 2

Amiryousefi, M., & Ketabi, S. (2011). Mnemonic instruction: A way to boost vocabulary learning and recall. *Journal of Language Teaching and Research, 2*(1), 178–182. https://doi.org/10.4304/jltr.2.1.178-182

Ausubel, D. P. (1963). *The psychology of meaningful verbal learning*. Grune & Stratton.

Ayto, J. (1990). *Dictionary of word origins*. Arcade Publishing.

Burston, J. (2005). *Theoretical foundations of crossword puzzle usage in foreign language*

vocabulary acquisition. In Conference paper published at UNTELE, Academia.

Chen, F., Kao, S. M., & Tsou, W. (2020). Toward ELF-informed bilingual education in Taiwan: Addressing incongruity between policy and practice. *English Teaching & Learning*, *44*(2), 175–191. https://doi.org/10.1007/s42321-020-00055-1

Childers, C. D. (1996). Using crossword puzzles as an aid to study sociological concepts. *Teaching Sociology*, *24*(2), 231–235. https://doi.org/10.2307/1318816

Chun, S. (2024). *TOEIC® listening & reading test.* Chun Shin Limited.

Dang, T. M. T., & Tong, T. M. H. (2024). Instruction-giving in EFL classrooms: A case of a university in Viet Nam. *International Journal of TESOL & Education, 4*(2), 46–61. https://doi.org/10.54855/ijte.24423

Davis, T. M., Shepherd, B., & Zwiefelhofer, T. (2009). Reviewing for exams: Do crossword puzzles help in the success of student learning? *The Journal of Effective Teaching*, *9*(3), 4–10.

Derer, Ö. K., & Berkant, H. G. (2019). The effect of puzzle-based learning on secondary school students' attitudes and their self-efficacy beliefs in English lesson. *Journal of Theoretical Educational Science*, *13*(1), 205–231. https://doi.org/10.30831/akukeg.564792

Ellis, N. C. (1997). Vocabulary acquisition: Word structure, collocation, word-class, and meaning. In N. Schmitt & M. McCarthy (Eds.), *Vocabulary: Description, acquisition and pedagogy* (pp. 122–139). Cambridge University Press.

ETS. (2023). *TOEFL iBT® test and score data summary 2022.* https://www.ets.org/pdfs/toefl/toefl-ibt-test-score-data-summary-2022.pdf

Faraj, A. K. A. (2015). Scaffolding EFL students' writing through the writing process approach. *Journal of Education and Practice*, *6*(13), 131–141.

Farjami, H. (2007). Picture production and picture perception: comparing two modes of practicing concrete vocabulary. *Iranian Journal of Applied Linguistics, 10*(1), 1–15. https://www.researchgate.net/publication/340309877_3-1_1_picture_production_and_picture_perception

Gairns, R., & Redman, S. (1999). *Working with words: A guide to teaching and learning vocabulary*. Cambridge University Press.

Hong, L. (2022), *Making a little progress your life will be different*. Global Views – Commonwealth Publishing Group.

Huang, T. J. (2005). A research on learner retention and learning support. *US-China Education Review*, *2*(1), 58–68.

Huang, Y. C. (2014). Formal vocabulary instruction in EFL context. *Journal of National Formosa University*, *32*(2), 37-50. https://doi.org/10.6425/JNHUST.201412_32(2).0004

Hulstijn, J. (1997). Mnemonic methods in foreign language vocabulary learning: Theoretical considerations and pedagogical implications. In J. Coady & T. Huckin (Eds.), *Second*

language vocabulary acquisition (pp. 203–224). Cambridge University Press.

Huyen, N. T. T., & Nga, K. T. T. (2003). The effectiveness of learning vocabulary through games. *Asian EFL Journal*, *5*(4), 90–105.

Isangedighi, A. J. (1997). A comparison of study habits among the underachieving, the achieving and over-achieving junior secondary one students. *West African Journal of Education Research*, *1*, 114–119.

Karami, A., & Bowles, F. A. (2019). Which strategy promotes retention? Intentional vocabulary learning, incidental vocabulary learning, or a mixture of both? *Australian Journal of Teacher Education*, *44*(9), 25–43. https://doi.org/10.14221/ajte.2019v44.n9.2

Keshta, A. S., & Al-Faleet, F. K. (2013). The effectiveness of using puzzles in developing Palestinian tenth graders' vocabulary achievement and retention. *Humanities and Social Sciences*, *1*(1), 46–57. https://doi.org/10.11648/j.hss.20130101.16

King, K. B. (2010). *The writing template book: The Michigan guide to writing well and success on high-stakes tests*. The University of Michigan Press.

Krashen, S. D. (1985). *The input hypothesis: Issues and implications*. Longman.

Kurniarahman, I. (2023). Mnemonics and their effect on students' vocabulary memorization and recall: A quantitative study. *BATARA DIDI: English Language Journal, 2*(1), 10–24. https://doi.org/10.56209/badi.v2i1.51

Le, H. S., & Trinh, M. L. (2024). An Investigation of Vocabulary Learning Strategies of ESP Students. *International Journal of TESOL & Education, 4*(1), 1–17. https://doi.org/10.54855/ijte.24411

Lestari, N., & Yulia, Y. (2018). The use of crossword puzzle to improve vocabulary mastery of the fifth grade students of SD N GOLO. *JELLT*, *2*(2), 71–79. https://doi.org/10.36597/jellt.v2i2.3275

Li, Y. (2009). *L2 learners' attitudes to English vocabulary learning strategies*. Kristianstad University.

Liao, Y. F. (2004). A survey study of Taiwan EFL freshmen's vocabulary learning strategies. *Journal of National Pingtung University, 21*, 271–288.

Lipscomb, A., Swanson, J., & West, A. (2010). Scaffolding (Ch. 21). In M. Orey (Ed.). *Emerging perspectives on learning, teaching, and technology* (pp. 226–236). https://opentextbooks.uregina.ca/teachingdiverselearners/chapter/scaffolding-2/

Mauranen, A. (2010). Features of English as a lingua franca in academia. *Helsinki English Studies*, *6(6)*, 6–28.

Mayer, R. E. (2002). Rote versus meaningful learning. *Theory into Practice*, *41*(4), 226–232. https://doi.org/10.1207/s15430421tip4104_4

Merkel, W. (2016). The potential of crossword puzzles in aiding English language learners. *TESOL Journal*, *7*(4), 898–920. https://doi.org/10.1002/tesj.252

Ministry of Education. (2018). *Curriculum guidelines of 12-year basic education for elementary school, junior high and general senior high schools: Subject of English in the domain of language.* Ministry of Education.

Mustika, V., Yufrizal, H., & Huzairin. (2022). The use of crossword puzzle game to improve students' vocabulary mastery. *U-JET, 11(4),* 306–311.

Nam, J. (2010). Linking research and practice: Effective strategies for teaching vocabulary in the ESL classroom. *TESL Canada Journal*, *28*(1), 127–135. https://doi.org/10.18806/tesl.v28i1.1064

Nation, I. S. P. (1990). *Teaching and learning vocabulary*. Heinle & Heinle Publishers.

Nemati, A. (2009). Memory vocabulary learning strategies and long-term retention. *International Journal of Vocational and Technical Education*, *1*(2), 14–24. https://doi.org/10.4314/marang.v20i1.56821

NICHD. (2000). *A closer look at the five essential components of effective reading instruction: A review of scientifically based reading research for teachers*. Learning Point Associates.

Njoroge, M. C., Ndung'u, R. W., & Gathigia, M. G. (2013). The use of crossword puzzles as a vocabulary learning strategy: A case of English as a Second Language in Kenyan secondary schools. *International Journal of Current Research*, *5*(2), 313–321.

Orawiwatnakul, W. (2013). Crossword puzzles as a learning tool for vocabulary development. *Electronic Journal of Research in Educational Psychology*, *11*(2), 413–428. https://doi.org/10.14204/ejrep.30.12186

Pillai, N. R. (2017). Using mnemonics to improve vocabulary, boost memory and enhance creativity in the ESL classroom. *Melta,* 1–25. https://www.journals.melta.org.my/TET/downloads/tet33_01_05.pdf

Puspita, N., & Sabiqoh, N. (2017). Teaching vocabulary by using crossword puzzle. *English Education: Journal Tadris Bahasa Inggris*, *10*(2), 308–325. https://dx.doi.org/10.24042/ee-jtbi.v10i2.1753

Reader's Digest. (1983). *Super word power*. Berkley Books.

Republic of China (Taiwan). (2018). *Blueprint for developing Taiwan into a bilingual nation by 2030*. Executive Yuan.

Richards, J. C., & Renandya, W. A. (Eds.). (2002). *Methodology in language teaching: An anthology of current practice*. Cambridge University Press.

Rüdiger, S., Leimgruber, J., & Tseng, L. (2023). English in Taiwan. *English Today 153*, *39*(2). Printed in the United Kingdom. https://www.cambridge.org/core/journals/english-today/article/english-in-taiwan/DE7F4A0F324A661509D72C3A4622510B

Schmitt, N., & McCarthy, M. (Eds.). (1997). *Vocabulary: Description, acquisition and pedagogy*. Cambridge University Press.

Tran, Q. H., & Nguyen, T. M. (2022). Students' retention on online learning: Establishing a

predictive model at a private university in Vietnam. *International Journal of TESOL & Education, 2*(4), 149–172. https://doi.org/10.54855/ijte.22249

Vu, T., Winser, W., & Walsh, J. (2020). Teacher attitudes towards the English language curriculum change: The case of Vietnam. *TESOL International Journal*, *15*(6), 38–53.

Vygotsky, L. S. (1978). *Mind in society: The development of higher psychological processes*. Harvard University Press.

Wei, M. (2007). An examination of vocabulary learning of college-level learners of English in China. *Asian EFL Journal*, *9*(2), 91–114.

Wilkins, D. A. (1985). *Linguistics in language teaching*. Edward Arnold.

Wood, D., Bruner, J., & Ross, G. (1976). The role of tutoring in problem solving. *Journal of Child Psychology and Child Psychiatry*, *17*(2), 89–100. https://doi.org/10.1111/j.1469-7610.1976.tb00381.x

Yam News. (2023). *eNews network*. Yam News.

Yang, Y. C., & Wang, C. L. (2014). *TOEIC 900 leisure & social network vocabulary practice*. Bookman Publishers.

Yang, Y. C., & Wang, J. C. (2006). *TOEFL-iBT 120: Reading and writing.* The Jinni Publishing.

Yeh, C. Y., & Wang, Y. H. (2004). An investigation into vocabulary learning strategies used by senior high school students in Taiwan. *Taiwan Journal of TESOL*, *1*(2), 1–44.

Zitouni, M., Zemni, B., Al-Traif, H., & Aljasser, M. (2021). Vocabulary learning strategy use among translation students in Saudi Arabia. *TESOL International Journal*, *16*(4), 67–81.

Yunianta, A., Yusof, N., Othman, M. S., & Octaviani, D. (2012). Analysis and categorization of e-Learning activities based on meaningful learning characteristics. *World Academy of Science, Engineering and Technology International Journal of Educational and Pedagogical Sciences*, *6*(9), 811–816.

Biodata

Yu-Chi Yang holds a master's degree in TESOL and a Ph.D. in Adult Education. He has been teaching vocabulary-related courses at Fooyin University for 22 years. The author has published 20 books related to English proficiency exams, including TOEIC reference books, and shares his personal teaching experiences in this article.