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Research Paper

Beyond Memorization: Unpacking Decontextualized, Semi-Contextualized, and Dual-Code Methods in Vocabulary Recall and Retention among EFL Learners

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Abstract
Mastering vocabulary remains a major challenge for language learners, prompting a continuous exploration of the most effective long-term retention strategies. This study aimed to investigate the efficiency of single- and dual-coding representation of L2 vocabulary items in the recall and retention of concrete words in two successive and distinct phases. In phase one, four distinct groups of female and male Iranian EFL language learners (n=80) received target concrete word instruction within the framework of verbal- (i.e., decontextualized L2-L1 flashcards) and visual-coding channels (i.e., semi-contextualized picture-supported L2 flashcards). In phase two, three distinct groups of participants (n=60) were exposed to verbal-, visual-, and dual-coding (i.e., verbal representations paired with pictures and L1

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equivalents) methods for learning target concrete words. Afterwards, Kruskal-Wallis tests and Repeated Measures ANOVA were run to assess the differences in participants' vocabulary retention across different teaching methods. A comparative analysis of pretest and posttest scores across both phases underscored the importance of integrating verbal coding of L2 vocabulary with visual imagery and dual-coding techniques for effective teaching of concrete word items. Moreover, the findings suggest that an exclusive focus on verbal encoding may impede language learners' ability to efficiently and progressively expand their L2 lexicon. Ultimately, this multimodal approach promotes deeper cognitive engagement, enhances long-term retention, and highlights potential benefits of gender-responsive teaching strategies.

Keywords: Concrete Word, Dual-Coding, Single-Coding, Visual Imagery

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1. Introduction

Recent research demonstrates that the effective acquisition and expansion of an L2 lexicon is a critical factor influencing language learners' self-perceived communicative competence (Aljasir, 2025; Bakhshi & Mohebbati, 2024; Karatas et al., 2025; Schmitt et al., 2011; Teng, 2023). As with its remarkable contribution to high levels of language proficiency and despite the vacillating history of its actual representation as a key linguistic element in language classrooms over the last 100 years (Nagy & Scott, 2000), learning and retaining the elusive L2 lexicon has always been a daunting and tenuous experience for language learners (Alahmadi & Foltz, 2020; Dessalew & Mohammed, 2024; Farkhodovna, 2025; Liu, 2024; Sarani & Ghollasi-Moud, 2022). It has been argued that a successful engagement in a simple conversation requires L2 learners to possess a command of 2000 to 3000 words in English and to expand their lexicon to 5000 words for an average of 95% text coverage for academic texts and further to 8000 words for 98% text coverage for a variety of authentic texts (Nation & Webb, 2011). In this vein,

several studies have corroborated the contribution of developing lexical knowledge in facilitating speakers' language processing (e.g., Banks et al., 2015; Dorterler & Tavil, 2024; Hu & Luo, 2024; Rodriguez-Aranda & Jakobsen, 2011). Hence, identifying the most optimal path to bolstering and expanding L2 vocabulary knowledge appears to be a serious concern for researchers and practitioners interested in the field (Ghaedi & Shahrokhi, 2016; Mayer, 2014; Namaziandost et al., 2023).

To respond to these challenges and to pave the way for L2 learners' lexical knowledge development, there has been a hot controversy over the supremacy of each of the dual and single-coding channels for processing vocabulary. In this regard, dual-coding theory (Paivio, 2010) assumes a dual representation of L2 input through verbal and nonverbal channels (i.e., imagens) as well as other effective stimuli that can be conducive to longer-term word retention compared to a single-coding channel. Correspondingly and in line with single-coding theory (Pylyshyn, 2007), proponents of L2 vocabulary learning through decontextualized channels (i.e., logogens) contend that there is no need for two distinct verbal and nonverbal stimuli representations as both are processed in the working memory, transformed to semantic elements, and stored in memory. Thus, a dual representation of L2 input is assumed to impose on language learners an extra burden of information processing in cognitive terms (Alahmadi & Foltz, 2020).

As each of the above channels has been argued to potentially engage individuals in distinct mental processing in L2 vocabulary learning, the present research attempted to examine if L2 vocabulary teaching with either of these frameworks can bring into play (any) differences in language learners' status and quality of L2 vocabulary acquisition and retention in both immediate and delayed terms. In so doing and as males and females have manifested different performances at various cognitive tasks (Halpern, 2013),

gaining insight into if gender could have any impact on the contribution of different vocabulary teaching techniques was an issue of concern in phase one of this study. Following this and in phase two, the study aimed at investigating which of verbal- (i.e., decontextualized single-coding), visual- (i.e., semi-contextualized single-coding), and dual-coding of L2 vocabulary input would function as a more efficient measure for improving language learners' recall of target concrete words in the long run.

2. Literature Review

2.1 Dual-Coding Theory

In theoretical terms, the present research primarily ties in with Paivio's (2010) Dual-Coding Theory (DCT), a general cognition theory, which propounds a marked supremacy of mental imagery over other working memory tasks in activating the mind and conjuring up newly acquired knowledge in the long run. The theory explains that individuals have a potential to process input through both verbal and nonverbal (i.e., visual imagery) associations and proceeds that as each of the verbal and nonverbal mental systems operates independently, the interconnection between verbal and nonverbal input processing in the brain will be conducive to more favorable outcomes in learning (Paivio, 2010). Following the proposition, the verbal system accumulates and processes such linguistic input as texts, sounds, and meaningful sensory-motor gestures (e.g., sign language) in sequential units called 'logogens' while the nonverbal system deals with such visual information like symbols, pictures, and videos, which keeps them in units called 'imagens' (Paivio, 2010). The two systems distinctly process their receiving input at representational (i.e., direct activation of logogens and imagens from stimulus patterns), referential (i.e., cross-section activation of

logogens by activated images and the reverse, which establishes an interconnection between the two units to represent one another and extend the world knowledge), and associative levels (i.e., amalgamation and activation of extra detailed and peripheral information in representational and referential systems) (Paivio, 2010). While being functionally autonomous, both verbal and nonverbal codes can be used interchangeably and simultaneously for organizing, retaining, and retrieving the linguistic input for subsequent use and thus can be conducive to easier, better, and longer recalls of the target items (Paivio, 2010).

2.2 Bilingual Dual-Coding Theory

With regard to SLA research, Paivio (2010) specifically proposed bilingual DCT, debating over a functional interconnection between two independent verbal systems (i.e., L1 and L2) and an independent imagery one. The imagery system was identical to the one already proposed in the original monolingual DCT and suggested to be associated with both verbal systems at referential level (Soh, 2010). That is, the imagery system could be implied to be a means of indirect access from one language to another, as processing and encoding of a lexical item in an L2, which had already been acquired in an L1 verbal system, would be conducive to upgrading the item as a result of adjoining its L2 equivalent while both would have in common forging a link with the mental imagery. Advocates of DCT have further proceeded to suggest that applying discrete and direct tools like L2-L1 flashcards (i.e., verbal) together with visual imagery (i.e., nonverbal) as two distinct tools for intentional teaching of target words may facilitate language learners' L2 lexical knowledge development. That is, a joint verbal representation of L2 linguistic pieces of information (i.e., decontextualized) together with relevant objects, events, or kinesthetic perceptions (i.e., semi-contextualized) may

imply the brain's more active involvement in encoding, storing, and retrieving of new words (Ithriyah, 2024; Liu, 2024; Maroney, 2024).

2.3 Dual-Coding Theory in Empirical Research

Over the last three decades, several empirical studies have been conducted to examine the efficacy of utilizing DCT for L2 vocabulary representation through applying bilingual flashcards with or without pictures (i.e., visual imagery). In the same vein and similar to the theoretical proposition, a myriad of internationally empirical research has corroborated the supremacy of accompanying pictures in L2 lexicon representation over solely resorting to verbal channels (Farely et al., 2012; Jared et al., 2013; Kagan, 2018; Paivio, 2010). For instance, Paivio's (2007) early review of 60 independent empirical studies together with his subsequent review (2010) demonstrated dual-coding representation of linguistic input was predominant over several other approaches and strategies in evoking items encoded as linguistic notions in the long-term memory, especially with the addition of brain correlates of DCT representational units, structures, and adaptive functions. Likewise, Kagan (2018) explored the effect of using picture-supported versus word-only sight word flashcards on L2 learners' ability to learn sight words and indicated accompanying L2 vocabulary learning process with pictures contributed to L2 learners' lexical knowledge development in a statistically significant manner.

Along the same lines, the studies in the Iranian context corroborated the fact that accompanying teaching new words with corresponding pictures led to a statistically significant outperformance of language learners in that group (Fathi & Sarkhosh, 2019; Ghader & Bahlooli Niri, 2016; Kasmaienezhadfard et al., 2015; Khodashenas et al., 2014; Pishghadam et al., 2010; Sadeghi et al., 2016).

2.4 Single-Coding Theory

Despite its impressive empirical success, however, bilingual DCT could by no means gain universal acceptance, typically because, compared to its origin, it is taken into account as a fairly young cognition theory and more research is warranted to test its validity (Kanellopoulou et al., 2019; Slakk, 2024; Wang-Kildegaard & Ji, 2024). In particular, it came in for criticism following Pylyshyn's (2007) proposition of Single-Coding Theory, which blurred the distinction between the impressions of creating a mental picture similar to perceptual experience as just an epiphenomenon and a mere accompanying event of a representational process, which is inherently propositional. He further argued that each of the verbal and imagery stimuli, together with all of their characteristics, is being coded and consolidated in the long-term memory in a unique manner and with quite distinct propositions, and the spatial mechanisms of mental imagery were language-related propositional mechanisms, which processed spatial information encoded in the form of discrete propositions (Pylyshyn, 2007). Several comparative studies have investigated the efficacy of imagery-based versus verbal mnemonic devices for facilitating L2 vocabulary acquisition (e.g., Emirmustafaoglu & Gokmen, 2015; Shen, 2010). However, a review of the related literature reveals inconsistencies regarding the effectiveness of both verbal- and picture-supported word flashcards. These conflicting findings underscore the necessity for further research to delineate the conditions under which these mnemonic strategies may be most effective.

2.5 Gender

This study is also an attempt to examine gender differences in L2 learners' recall of vocabulary items over both short- and long-term intervals. Although several empirical investigations have explored the influence of gender on L2

vocabulary acquisition (Catalan, 2003; Pahom et al., 2015), their findings remain inconclusive. For example, Catalan (2003) demonstrated that gender significantly influences the selection and use of learning strategies, with female learners tending to rely on verbal mnemonic approaches while male learners appear to favor visual methods in acquiring Spanish vocabulary. In contrast, Pahom et al. (2015) reported that male participants outperformed their female counterparts in recalling vocabulary items following an instructional treatment based on L1-L2 translations, as evidenced by both immediate and delayed assessments. These discrepancies underscore the need for further investigation into the role of gender in the development of L2 literacy and lexical competence. Accordingly, to address the above conflicting findings and with the aim of contributing to the existing literature, the researchers propounded the following research questions:

1. Is there any difference between decontextualized (flashcards) and semi-contextualized (visual imagery) vocabulary teaching techniques in terms of their immediate effect on vocabulary learning and retention of male and female Iranian EFL learners? (Phase One)

2. Is there any difference between decontextualized (flashcards) and semi-contextualized (visual imagery) vocabulary teaching techniques in terms of their delayed effect on vocabulary learning and retention of male and female Iranian EFL learners? (Phase One)

3. Is dual-code teaching of vocabulary more effective than decontextualized and semi-contextualized techniques in terms of its immediate and delayed effect on vocabulary learning and retention of male and female Iranian EFL learners? (Phase Two)

3. Method

3.1 Design and Participants

The current quantitative study employed a quasi-experimental pretest, immediate and delayed post-test design. The vocabulary teaching was the independent variable, which took place at three levels of decontextualized, semi-contextualized, and dual-code techniques. Gender was another independent variable of the study. The dependent variables were the participants' test scores at pre- and posttests. Participants consisted of 80 homogenous intact basic-level L2 learners at Iran Language Institute (ILI) in Urmia, Iran. They included 40 males and 40 females, whose age ranged from 11 to 14 (mean=12.5). The homogeneity of the learners was also taken into account in that the learners who had been placed in each class had to pass through the ILI placement test. Besides, a pretest was also given in order to make sure the participants were homogeneous at the outset of the study. At the first phase of the study, the participants were divided into four respective male and female groups for verbal- and visual-coding L2 vocabulary instruction. However, in the second phase of the study, based on the results obtained in the first phase, females comprised the subjects of the study.

3.2 Instruments and Procedure

3.2.1 Phase One

Phase one explored the effect of de-contextualized and semi-contextualized teaching techniques on learners' vocabulary retention across genders. Before the treatment, the pretest was administered to the research participants, who had been divided into four distinct groups (two male and two female groups). The pretest comprised multiple-choice and matching items, which tested the participants' L2 lexical knowledge in terms of 20 target words. A total of 30

vocabulary items were introduced to the participants. Of these, 20 words were designated as target items and were systematically assessed during both the immediate posttest and the second posttest. The remaining 10 words served as fillers and were deliberately incorporated to reduce predictability and mitigate repetition effects. By substituting these filler words with alternative vocabulary items in subsequent assessments while keeping the 20 target words unchanged, the researchers ensured that the statistical analyses were based exclusively on the target items. This approach not only maintains consistency across test administrations but also minimizes any potential bias that could arise from repeated exposure to the same fillers. The focused words were selected from the books they were supposed to study later in the proceeding terms. Subsequently, the treatment was put into practice through administering both verbal (i.e., decontextualized single-coding) and visual (i.e., semi-contextualized single-coding) L2 vocabulary teaching techniques across the groups. In this phase, bilingual word-only and picture-supported L2 flashcards represented two distinct techniques for decontextualized and semi-contextualized L2 vocabulary learning, respectively. Conventionally, word-only flashcards embrace studying out-of-context words through mechanical strategies and typically encompass a glorified L2-L1 wordlist broken into units (Nation & Webb, 2011). Hence, in the pretest-posttest intervention phase of the research, target concrete words were initially written on the board together with their L1 equivalents. Successively, the language learners in both of the male and female groups were engaged in repeating the vocabulary items both chorally and individually and memorizing their meaning in L1. Then, they were asked to make sentences using the already practiced target concrete words and to subsequently make flashcards by writing a target word on one side of the card and its L1 equivalent on the other side of it. The same test given in the pretest phase

served to assess the participants' L2 lexical knowledge development subsequent to the treatment as the posttest, as well. Correspondingly, the two other groups of male and female participants were taught the same 30 vocabulary items, using picture-supported L2 flashcards. Of these, 20 words were designated as target items. The remaining 10 words served as fillers and were deliberately incorporated to reduce predictability and mitigate repetition effects. Throughout the treatment, the pictures were presented on pieces of paper (by the size of 16 cm. * 20 cm. with a white background) with the target words printed on the back side of the pictures. Initially, the target words were aurally presented and the corresponding pictures were successively represented. Following this, the participants were engaged in choral and individual repetition of the given vocabulary items and were sequentially asked to spell the words and make a sentence with each of them. Right after teaching the whole words, the immediate posttest was given to all the participants. After two sessions, the delayed posttest was also administered to them all. The tests consisted of 20 questions and the top score was considered 20 if all items were answered correctly (one point for each question).

3.2.2 Phase Two

Phase two examined the effectiveness of dual-code vocabulary teaching techniques versus decontextualized and contextualized techniques. Sixty participants from the same institute were selected for the second phase of the study. The language learners were assigned into three groups (20 individuals in each one) and received the instruction of L2 vocabulary items with three distinct techniques, that is, L2-L1 flashcards (i.e., decontextualized single-coding), pictured-supported L2 flashcards (i.e., semi-contextualized single-coding), and L2-L1 flashcards paired with the corresponding pictures (i.e.,

dual-coding). For the decontextualized and semi-contextualized teaching groups, the procedure was a facsimile of the steps taken in phase one. The third group (dual-code teaching) received the treatment in a different way, whereby the images were presented in slides one by one and the target words and their L1 equivalents were contemporaneously presented in the slides. Right after teaching the words, an immediate posttest was administered in all groups, which was a meaning recall test, in a way that the subjects were to write the meaning of focused words in L1. Two sessions later, the delayed posttest was administered. The relatively short interval was deliberately chosen to investigate its effects on vocabulary retention. Vocabulary acquisition is a process filled with challenges due to its nature and the forgetfulness that learners often experience. This understanding motivated the researchers' decision to explore whether the proximity of testing sessions might influence the stabilization and long-term retention of newly acquired vocabulary.

4. Results

4.1 Phase One

Table 1 represents the descriptive statistics for the four groups at pretest, immediate, and delayed posttests. However, before further analysis, normality of the distribution was examined across all four groups of test scores using Kolmogrov-Smirnov test of normality.

Table 1

Descriptive Statistics for the Four Groups at Pretest, Immediate, and Delayed Posttests

	Pretest	**Immediate Posttest**	**Delayed Posttest**

		N	Mean	SD	Mean	SD	Mean	SD
Visual Imagery	**Males**	20	1.85	1.46	4.10	4.10	13.65	5.56
	Females	20	4.80	2.35	12.20	4.54	14.75	2.95
Flashcards	**Males**	20	3.00	1.41	11.10	4.74	5.25	4.78
	Females	20	4.80	2.35	12.20	4.19	6.15	2.70

As the overall strength of the assumptions of normality was not confirmed for running parametric tests, the equivalent nonparametric tests were conducted, with ANOVA being surrogated by Kruskal-Wallis test (see Table 2).

Table 2

Mean Ranks for the Four Groups at Pretest, Immediate, and Delayed Posttests

Groups	**Pretest**	**Immediate Posttest**	**Delayed Posttest**
	Mean Rank	**Mean Rank**	**Mean Rank**
Visual Imagery (males)	26.83	56.08	59.98
Flashcards (males)	38.38	37.03	31.03
Visual Imagery (females)	40.45	41.55	42.65

Flashcards (females)	38.35	27.35	28.35

The Kruskal-Wallis test revealed that the participants' performance was not significantly different in the pretest, $X^2(3, n=80) = 27.51$, $p = .07$, as the calculated p value was higher than the confidence level ($p > .05$), and thus the research participants were all homogenous before the interventional procedures began. However, the immediate, $X^2(3, n=80) = 15.96$, $p = .00$, as well as delayed posttest results, $X^2(3, n=80) = 23.17$, $p = .00$, demonstrated a statistically significant difference in the participants' test performance both in the short run and in the long run. Successively, a careful inspection of mean ranks (see Table 3) revealed that both male and female groups of the participants who had received instruction with picture-supported L2 flashcards outperformed their peers who were taught the new words through L2-L1 word-only flashcards.

Table 3

Kruskal-Wallis Test for the Four Groups at Pretest, Immediate and Delayed Posttests

	Pretest	**Immediate Posttest**	**Delayed Posttest**
Chi-Square	27.51	15.96	23.17
df	3	3	3
Asymp. Sig.	.07	.00	.00

Subsequently, a Repeated Measures ANOVA (see Table 5) was conducted to calculate the amount of gained scores from pretest to immediate and delayed posttest, as there was more than one posttest and the participants had been tested more than once (Larson-Hall, 2010). The independent variable, that is, the time of testing (pretest as well as immediate and delayed posttests), was a within-group factor, which is a must in Repeated Measures ANOVA design (see Table 4). The dependent variable was the performance of the participants on the L2 vocabulary test.

Table 4

Time of Testing as a Within-Group Independent Variable in a Repeated Measures ANOVA Design

Time	**Within Group Independent Variable**
1	pretest
2	Immediate posttest
3	Delayed posttest

Table 5 represents the results of the Repeated Measures ANOVA, reporting the *F* value for the **time** factor as well as its associated significance level and effect size (i.e., **Partial Eta Squared**). For interpreting these findings, Mauchly's test of sphericity must be examined to see if the scores meet the assumption of sphericity. As the *p* value was smaller than the interval confidence level ($p<.05$), the scores did not meet the assumption of sphericity, and thus the values in the **Greenhouse-Geisser** row were examined instead, and it was revealed that the scores for three times of testing were statistically and significantly different ($p<.00$).

Table 5

Tests of Within Subjects Effects

		Type II Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Visual Imagery (female)	**Sphericity Assumed**	477.10	2	238.55	45.88	.00	.70
	Greenhouse-Geisser	477.10	1.16	409.82	45.88	.00	.70
Flash card (female)	**Sphericity Assumed**	438.35	2	219.17	46.87	.00	.72
	Greenhouse-Geisser	438.35	1.58	276.97	46.87	.00	.72
Visual Imagery (male)	**Sphericity Assumed**	2163.26	2	1081.63	157.81	.00	.89
	Greenhouse-Geisser	2163.26	1.67	1290.82	157.81	.00	.89
Flash card (male)	**Sphericity Assumed**	775.82	2	387.91	53.81	.00	.74
	Greenhouse-Geisser	775.82	1.92	403.66	53.81	.00	.74

Table 6 is the pairwise comparison for each group, from pretest to immediate and delayed posttest scores. With regard to L2-L1 word-only flashcard instruction, the delayed posttest scores of both male and female groups of the participants represented a decline in their L2 vocabulary test performance than the immediate posttest phase of the study, meaning that the reported significant difference in the participants' test performance

represented inefficiency of the word-only flashcard instruction for long-term retention of L2 words. Meanwhile, as the participants' performance consistently improved from pretest to immediate to delayed posttests, the implication was that employing picture-supported flashcards was an effective vocabulary teaching technique of L2 words for male and female language learners in both the short and the long run.

Table 6

Pairwise Comparisons

							95% Confidence Interval	
		Time (I)	**Time (J)**	**Mean Difference (I-J)**	**Std. Error**	**Sig.[a]**	**Lower Bound**	**Upper Bound**
Females	**Visual Imagery**	1	2	-6.40*	.83	.00	-8.60	-4.20
			3	-.95*	.28	.01	-1.69	-.20
		2	1	6.40*	.83	.00	4.20	8.60
			3	5.45*	.88	.00	3.13	7.76
		3	1	.95*	.28	.01	.20	1.69
			2	-5.45*	.88	.00	-7.76	-3.13
	Flashcards	1	2	-6.78*	.83	.00	-8.98	-4.59
			3	-3.57*	.50	.00	-4.92	-2.23
		2	1	6.78*	.83	.00	4.59	8.98
			3	3.21*	.72	.00	1.30	5.12

		3	1	3.57*	.50	.00	2.23	4.92
			2	-3.21*	.72	.00	-5.12	-1.30
Males	**Visual Imagery**	1	2	-13.63*	.86	.00	-15.90	-11.35
			3	-12.42*	.99	.00	15.03	-9.80
		2	1	13.63*	.86	.00	11.35	15.90
			3	1.21*	.66	.25	-.53	2.95
		3	1	12.42*	.99	.00	9.80	15.03
			2	-1.21*	.66	.25	-2.95	.53
	Flash card	1	2	-8.73*	.80	.00	-10.87	-6.60
			3	-6.36*	.95	.00	-8.88	-3.85
		2	1	8.73*	.80	.00	6.60	10.87
			3	2.36*	.84	.03	.13	4.60
		3	1	6.36*	.95	.00	3.85	8.88
			2	-2.36*	.84	.03	-4.60	-.13

Based on estimated marginal means

*. The mean difference is significant at the .05 level.

a. Adjustment for multiple comparisons: Bonferroni.

4.2 Phase Two

In order to get a general portrayal of the participants' performance in the second phase of the study, descriptive statistics were run for pretest, immediate, and delayed posttest scores of the participants who were

subjected to three distinct L2 vocabulary teaching approaches in each group (see Table 7).

Table 7

Descriptive Statistics for the Three Groups at Pretest, Immediate and Delayed Posttests

		Pretest		Immediate posttest		Delayed posttest	
	N	**Mean**	**SD**	**Mean**	**SD**	**Mean**	**SD**
Dual-code	20	3.00	.57	12.15	2.25	15.40	3.36
Semi-contextulized	20	2.00	.41	4.95	2.35	3.40	2.32
Decontextualized	20	1.50	.36	9.00	3.71	5.40	3.48

Further, the normality of the distribution and the homogeneity of variances were examined for each of the three groups at pretest, immediate, and delayed posttests. Although Levene's test showed that the groups enjoyed equal variances (p>.05), the Kolmogorov-Smirnov test revealed that the scores were not normally distributed in either group (p<.05). Hence, to make inferences about the larger population from which the sample was taken, Kruskal-Wallis test was conducted as the non-parametric equivalent of ANOVA. The Kruskal-Wallis test results (see Table 8) revealed that as the mean differences of pretest scores among the three groups were not statistically significant, $X^2(2,n=60)=.72$, $p=.69$, as the estimated p value was higher than the confidence level (p>.05), the groups were equal at the outset. However, the mean score differences on the immediate, $X^2(2,n=60)=34.27$,

p=.00, and delayed posttests, $X^2(2,n=60)=23.61$, p=.00, were statistically significant, meaning that the participants represented a distinct test performance across the three groups both immediately and in the long-run.

Table 8

Mean Ranks for the Three Groups at Pretest, Immediate and Delayed Posttests

	Pretest	**Immediate Posttest**	**Delayed Posttest**
	Mean Rank	**Mean Rank**	**Mean Rank**
Dual-code	32.18	46.10	54.85
Semi-contexualized	30.40	13.92	18.40
Decontexualized	28.92	31.48	28.25

Consecutively, a careful inspection of mean ranks (see Table 9) manifested that the dual-coding group had a higher mean rank at both the immediate and delayed posttests. Therefore, it could be inferred that the dual-code approach to teaching vocabulary was more effective than employing L2-L1 word-only and picture-supported L2 flashcards.

Table 9

Kruskal-Wallis Test for the Three Groups at Pretest, Immediate and Delayed Posttests

	Pretest	**Immediate Posttest**	**Delayed Posttest**

Chi-Square	.72	34.27	23.61
Df	2	2	2
Asymp. Sig.	.69	.00	.00

Following this, a Repeated Measures ANOVA was conducted for each of the three groups to calculate the amount of gained score from pretest to immediate to delayed posttest.

Table 10

Within-Subjects Factors for the Three Groups at Pretest, Immediate and Delayed Posttests

Time	**Independent Variable**
1	pretest
2	immediate_posttest
3	delayed_posttest

As Table 10 indicates, the scores did not meet the assumption of sphericity as an assumption of Repeated Measures ANOVA, and thus, the values in the **Greenhouse-Geisser** row were examined, which revealed that the scores for three times of testing were statistically and significantly different (p<.00). The results of ANOVA with Repeated Measures with a Greenhouse-Geisser correction show that the scores for three times of testing were statistically significantly different for the three groups (p<.00).

Table 11

Tests of Within-Subjects Effects

Source	Group		Type II Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
time	**Dual-code**	**Sphericity Assumed**	1538.63	2	769.31	215.96	.00	.91
		Greenhouse-Geisser	1538.63	1.24	1233.13	215.96	.00	.91
time	**Semi-contexualized**	**Sphericity Assumed**	234.70	2	117.35	56.23	.00	.74
		Greenhouse-Geisser	234.70	1.39	168.49	56.23	.00	.74
time	**Decontexualized**	**Sphericity Assumed**	792.30	2	396.15	60.12	.00	.76
		Greenhouse-Geisser	792.30	1.94	406.58	60.12	.00	.76

As Table 10 indicated, there was an overall significant difference in the test mean scores. Hence, a Bonferroni post-hoc test was run for further clarification of mean differences across the three groups (see Table 11).

Table 12

Pairwise Comparisons

					95% Confidence

						95% Confidence Interval	
	(I) time	(J) time	Mean Difference (I-J)	Std. Error	Sig.	Lower Bound	Upper Bound
Dual-code	1	2	-11.85*	.52	.00	-13.22	-10.47
		3	-9.10*	.79	.00	-11.17	-7.02
	2	1	11.85*	.52	.00	10.47	13.22
		3	2.75*	.41	.00	1.67	3.82
	3	1	9.10*	.79	.00	7.02	11.17
		2	-2.75*	.41	.00	-3.82	-1.67
Semi-contexualized	1	2	-4.75*	.52	.00	-6.13	-3.36
		3	-3.20*	.52	.00	-4.58	-1.81
	2	1	4.75*	.52	.00	3.36	6.13
		3	1.55*	.26	.00	.85	2.24
	3	1	3.20*	.52	.00	1.81	4.58
		2	-1.55*	.26	.00	-2.24	-.85
Decontexualized	1	2	-8.85*	.86	.00	-11.11	-6.58
		3	-5.25*	.82	.00	-7.40	-3.09
	2	1	8.85*	.86	.00	6.58	11.11
		3	3.60*	.74	.00	1.63	5.56
	3	1	5.25*	.82	.00	3.09	7.40
		2	-3.60*	.74	.00	-5.56	-1.63

Table 12 indicates that the mean differences in the three groups were significantly different from pretest (time 1) to the immediate posttest (time 2) (p<.05) and from the immediate (time 2) to the delayed posttest (time 3) (p<.05) and from pretest to delayed posttest (p<.05). Although the differences from pretest to immediate and delayed posttests were significant for three groups, a closer look at table 7 reveals that the performance of the semi-contextualized and de-contextualized groups declined significantly at the delayed posttests, and this decline is significant. Therefore, these two techniques of vocabulary instruction proved ineffective in the long-run, and the only technique that proved effective at both the immediate and delayed posttests was the dual-code technique.

5. Discussion

This study was primarily an attempt to explore if teaching target concrete words through each of verbal- (i.e., decontextualized L2-L1 flashcards) and visual-coding techniques (i.e., semi-contextualized picture-supported L2 flashcards) had any effects on the extent to which male and female language learners developed and further expanded their L2 lexicon both immediately and in the long run. Subsequently, the study proceeded through examining the differential effects of applying single- and dual-coding theories on building language learners' L2 lexical knowledge of the concrete word items. In so doing, the main focus of concern was over inspecting the immediate and delayed outcomes of the above teaching techniques as well as those of pairing the target linguistic input with both image representations and L1 translation equivalents (i.e., dual-coding) on supplementing language

learners' L2 vocabulary knowledge. Overall, the research results provided support for the significant contribution of applying visual- and dual-coding techniques to promoting the language learners' L2 vocabulary knowledge both immediately and in the long run.

In phase one, in particular, the statistically significant supremacy of visual over verbal representation of the target concrete words may in part be attributable to the appealing nature of visualization to learners. Compared to the tedious instruction of L2 vocabulary through word-only flashcards, integrating verbal and corresponding visual representation of the target word items safeguarded a favorable and stimulating learning environment for the learners, deepened their understanding of the new vocabularies, and contributed to their building L2 lexicon in both the short and long run. From this perspective, the findings were in line with Ghaedi and Shahrokhi's (2016) empirical research, which indicated visualization resulted in better vocabulary learning than verbalization.

Another explanation for the contrasting distinction observed between the impacts of the above teaching techniques on building the language learners' L2 lexical knowledge can be discussed from a cognitive learning perspective. Drawing on Paivio's (2010) DCT, it can also be argued that pairing pictures with word-only flashcards led to a simultaneous cognitive processing of visual and verbal channels and further developing mental pictorial representations of graphic input and mental verbal representations of linguistic input. As the synchronized pictorial and verbal cues can facilitate learning, in particular when the corresponding visual and verbal representations are continuously present in working memory (Mayer, 2014), supplying the language learners with picture-supported flashcards significantly contributes to developing their L2 lexical knowledge. In

contrast, using word-only flashcards as a verbal channel can be argued to impede information transfer from short- to long-term memory, as decontextualized teaching techniques and tools overlook comprehension in favor of memorization (Alahmadi & Foltz, 2020). In this regard, advocates of meaningful learning also discuss that such semi-contextualized techniques as picture-supported flashcards chiefly foster the pictorial-verbal combination in learning target words, involve many parts of the brain in input processing, provide greater cognitive power, and package information more efficiently than they could if using just decontextualized vocabulary learning tools (Schmitt et al., 2011). As implementing picture-supported flashcards instantiates a semi-contextualized vocabulary instruction technique, which underscores representing new vocabulary items through visualization, it builds and strengthens meaningful links in L2 learners' memory and, in turn, increases the retention and recall of more lexical items (Shen, 2010). Some scholars have already contended that, due to the concrete nature of target word items, the mental imagery evoked from verbal descriptions and visual materials have similar properties and appeal to the same brain areas, and thus, teaching the words through either word-only or picture-supported flashcards makes no significant difference in this regard (e.g., Ithriyah, 2024; Maroney, 2024; Mazoyer et al., 2002). However, Nagy and Scott (2000) discuss that vocabulary learning is a multi-faceted process and encompasses various types of knowledge; therefore, it is possible that considering verbal and decontextualized representation of target words as a sole focus of concern in L2 classrooms brings about a difficulty in understanding the new vocabulary.

With regard to gender sensitivity, the research findings indicated that there was a statistically significant difference on the participants' test performance within each treatment group, as both male and female groups of

the language learners whose treatment had been based on visual representation through picture-supported flashcards outperformed their peers who had received L2 vocabulary instruction through word-only flashcards in both immediate and delayed terms. That is, teaching the target concrete words through the semi-contextualized teaching technique was significantly more effective than the decontextualized one for both male and female groups of the participants in this context. Meanwhile, a closer inspection of the mean ranks across the four gender groups revealed that the test scores of the male participants surged from pretest to posttest phases of the study after they had gone through a visual representation of the target concrete word items through picture-supported flashcards. Besides, they had a relatively better performance than their female counterparts in both immediate and delayed posttests of the verbal representation of the content words in word-only flashcard treatment groups. These findings were not along the same wave lengths as those of some previous empirical studies, which demonstrated that the linguistic ability of males was weaker than that of females for biological reasons (e.g., Fontecha 2010), as well as the studies that found that gender difference was non-significant in L2 vocabulary learning (e.g., Jimenez and Terrazas 2008; Llach and Gallego 2012). Nevertheless, there were several other studies, which, akin to the present study, identified male language learners had a relatively better performance than their female counterparts in L2 vocabulary learning and L2 lexicon development (e.g., Lynn, Fergusson, and Horwood 2005).

The results in phase two implied a statistically significant difference on the participants' test performance across the given three groups, as the participants who simultaneously received L2 vocabulary instruction through dual channels (i.e., L1 equivalent and visual imagery) outperformed their

peers in the other groups who were taught target concrete words through either L2-L1 word-only or picture-supported L2 flashcards. The results of the delayed posttests failed to endorse the positive impact of using the word-only and picture-supported teaching techniques on language learners' long-term recalling and retaining of target concrete words. Meanwhile, dual-coding of L2 vocabulary items provided a ground for the research participants to represent a statistically significant test performance in the immediate and, in particular, the long run after the treatment. In this vein, the superior performance of the language learners in the dual-coding group can be attributed to a contemporaneous representation of target concrete words in verbal terms in tandem with relevant pictures and their L1 equivalents as distinct L2 input instruction channels for target language processing. Similar to the previous phase of the study, these findings, in turn, lend support to Paivio's (2010) DCT proposition, propounding that double coding of information can function as a complement and provide a ground for language learners to process the information twice through distinct channels, which, subsequently, culminate in longer retention of the newly learned target words. Thus, dual encoding of L2 input can be construed as a significantly efficient teaching technique for developing and further expanding language learners' L2 vocabulary knowledge in the long run.

6. Conclusion

Semi-contextualized instruction of vocabulary items and dual channels was found to be more fruitful than the decontextualized ones for teaching L2 lexicon in the long run. Inasmuch as building L2 lexicon may confront language learners with daunting experiences and thwart the rapid development of their major communication skills in the target language,

identifying and putting the efficient vocabulary teaching techniques into practice are of particular significance in L2 pedagogical studies (Cheng & Matthews, 2018; Matthews, 2018; Uchihara & Saito, 2019). In lay terms, it can also be implied that intentionally overlooking L2 vocabulary input representation in language classrooms in favor of major communication skills can make language learners encounter formidable challenges concerning target language achievements in communicative terms. Hence, pedagogical scholars and stakeholders involved in L2 material and curriculum development are warranted to seriously take the necessity of explicit target vocabulary input representation into consideration.

Although the male participants did not significantly show a better performance than their female counterparts in either of the immediate and long-term retention and recall of concrete word items, it should be noted that, besides biological and cognitive reasons, there are several other extraneous variables (e.g., motivation, attitudes towards language learning, proficiency level, task type, and information gap) that may contribute to each gender group's performance in empirical terms. This may be the main reason behind the point that male-female comparative studies do not always yield identical results in every context (Pahom et al., 2015); therefore, future research may still be needed to bring into play the above variables in inspecting the differential effect of gender on the process of developing language learners' L2 lexical knowledge.

The study highlights the effectiveness of dual-coding techniques in vocabulary instruction, showing that combining verbal and visual representations significantly improves both short-term and long-term retention of vocabulary. This suggests that language teachers should integrate visual aids, such as picture-supported flashcards, alongside traditional verbal

methods to enhance learners' engagement and retention. Additionally, the findings suggest that gender may influence how learners respond to different teaching techniques, encouraging educators to consider more tailored, gender-sensitive approaches in their instruction. Overall, focusing on semi-contextualized, multimodal learning environments can foster deeper cognitive processing and better vocabulary retention among students.

This study faced the following limitations throughout its conduction, and these limitations should be taken into account in interpreting the findings. The participants of the current research were the beginner-level English language learners in Urmia, and thus the results cannot be generalized to the efficiency of employing visual and dual-coding channels of target word representations for promoting and expanding immediate- and advanced-level language learners' L2 lexical knowledge in terms of concrete word items. In addition, in the present study, a total of 30 vocabulary items were used, consisting of 20 target words and 10 fillers, to reduce predictability and repetition effects. Although substituting the filler words in subsequent assessments helped maintain consistency across tests and minimized potential bias, the relatively small set of items may limit the generalizability of the findings. Future research could benefit from employing a broader range of vocabulary to determine whether the observed effects persist with a larger, more varied item pool. Further, the researchers intentionally used a relatively short interval between the immediate posttest and the second posttest to investigate its effects on vocabulary retention. However, this may not fully capture the long-term durability of lexical acquisition. Vocabulary learning is inherently challenging due to the natural forgetfulness common among learners. It remains unclear whether the initial stabilization observed will translate into long-term retention. Therefore, extending the interval between

assessments in future studies might offer deeper insights into the processes of consolidation and long-term vocabulary stabilization. Besides, the nature of task types administered to the participants for eliciting their performance in the pretest and posttest phases of the study may have impacted the test results. Further research could explore the impact of dual-coding techniques on more advanced language learners, as this study focused on beginners. Additionally, future studies should investigate the efficacy of these techniques on abstract vocabulary items, expanding beyond concrete words. Researchers could also examine the role of learner motivation and attitudes in determining the success of dual-coding approaches. Finally, it would be valuable to assess how different task types in vocabulary assessments influence retention, providing deeper insights into the most effective instructional practices.

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