

# A Spacing Contribution on the Retention of L2 Word Forms and Meanings

Reham Alkhudiry<sup>1</sup>

<sup>1</sup> Department of English Language and Translation, College of Arabic Language and Social Studies, Qassim University, Saudi Arabia

Correspondence: Reham Alkhudiry, Department of English Language and Translation, College of Arabic Language and Social Studies, Qassim University, Saudi Arabia.

Received: January 5, 2023      Accepted: February 15, 2023      Online Published: April 3, 2023

doi:10.5430/wjel.v13n3p218

URL: <https://doi.org/10.5430/wjel.v13n3p218>

## Abstract

This study examined the contribution of spacing on facilitating learning and retention of L2 word forms and meanings. 38 Saudi Arabian learners of English studied 30 English words (beyond their current language proficiency) using a spaced and massed displays. The former refers to the frequent distribution of repetition across multiple learning sessions, whereas the latter deals with the repetition of words into one single learning session. The 15 lexemes, hence, under the massed condition were classified into three categories of five words, each set was studied three times in one of the three sessions, whereas the other set of words were studied under the spaced condition in which all 15 words were learned once in each of the three sessions. One offline test was conducted to measure the meaning of word knowledge, and one online lexical decision task measured respondents' accuracy and speed in recognizing the form of target words. These two tests were administrated in immediate post-test (IPT) and delayed post-test (DPT), conducted two weeks later. The results show that the meaning and form of spaced L2 words are learned and retained better than those of massed L2 words. The reaction time (RT) results also show that L2 learners who are under the spaced condition are faster in recognizing L2 target word forms than those who are under the massed condition. These findings can have meaningful theoretical and pedagogical implications for developing L2 vocabulary learning and retention.

**Keywords:** L2, English language, vocabulary, lexical, word meaning and form

## 1. Introduction

Vocabulary knowledge has long been recognized as a determining factor in learning a second or foreign language reading (Henriksen et al., 2004), speaking (Hincks, 2003), listening (Stæhr, 2009), and writing (Laufer, 2013; Stæhr, 2008) skills. L2 vocabulary learning is basically based on learning L2 lexical items that are most relevant to L2 learners' needs (i.e., academic, social, business), retain the knowledge so that it will be readily accessible to them once needed, and use the knowledge, receptively and productively, for communicative purposes (Moir & Nation, 2002). Foreign language teachers, obviously, need further support regarding vocabulary instruction since many L2 learners' vocabulary repertoire remains limited even after weeks or months of instruction. This phenomenon might stem from L2 teachers' uncertainty about the best vocabulary teaching practices (Berne & Blachowicz, 2008). Therefore, different approaches and techniques to vocabulary presentation, including glossing (Huang & Lin, 2014; Ko, 2012), focus-on-form(s) (Laufer, 2006), spacing (Lotfolahi & Salehi, 2017; Sobel et al., 2011), massed instruction (Nakata & Suzuki, 2019; Namaziandost et al., 2019; Namaziandost et al., 2020) have been explored in order to understand how they can be learned and retained more efficiently (Nushi & Jenabzadeh, 2016).

One of the most efficient vocabulary techniques, it is essential that L2 learners receive greater exposure to frequent and more common linguistic structures and features (DeKeyser, 2007) and employ strategies that promote deep processing such as memory and cognitive strategies (Moir & Nation, 2002). Researchers have found different inspections of exposure times needed to master vocabulary, as it is recommended 5-16 as the number required of contextual exposures to learn a word (Nation, 1990). Another issue that has been open to debate among vocabulary researchers is how this exposure should be sequenced, whether spaced or massed (Rogers, 2017). While the former refers to the repetition of vocabulary items within a single session, the latter distributes learning episodes over more extended time intervals. Regarding the enhancement of spaced and massed repetition, which is the focus of the study at hand, there is some theoretical evidence to support the supremacy of spaced instruction to massed instruction. According to earlier component-levels theory (Glenberg, 1979), which expands his previous encoding variability hypothesis, maintains that repetition will be possibly more efficient for working memory "because of the differential encoding and storage of their components" (Rose, 1980, pp. 84-85). Findings from previous cognitive psychological studies suggest that spaced repetition may lead to more retention of information than grouped repetition (Goossens et al., 2012; Suzuki & Dekeyser, 2017). However, previously published studies are generally limited to the mastery of grammatical features (e.g., Miles, 2014; Mashhadi et al., 2017) and language skills (e.g., Bui & Ahmadian, 2019). It has not been until recently that L2 vocabulary researchers have investigated of how spaced and massed repetition affects learning and retaining the aspects of L2 word knowledge (form and meaning). As stated by Ellis (2006), further research is required to deal with unresolved issues concerning massed and spaced vocabulary instruction. The current study, therefore, sets to focus on the contribution of multiple exposure on L2 word learning and retention. The main query in this investigation is whether spacing can contribute on facilitating learning and

retention of the form and meaning of L2 words among L1 Arabic learners of English.

## 2. Literature Review

### 2.1 Spaced and Massed L2 Vocabulary Learning Practice

There are two sets of practice in vocabulary learning terminology, namely intentional and incidental, which shape learners' lexical knowledge. These terms differ in how learners devote their attention to the process of learning. The former engages learners in an explicit vocabulary learning activity such as gap-fill or crosswords, hence, the words are delivered intentionally in different word-learning strategies. While incidental learning's primary focus is on another task rather than vocabulary learning. On other words, incidental learning takes place according to Uchihara et al. (2019) when students are not "forewarned of an upcoming vocabulary test" (p. 2). New L2 words should be exposed to the learners in various micro skill contexts without any attention paid to learn these new words. Evidence from previous research indicates that intentional learning may be more conducive to vocabulary learning than incidental (Yanagisawa et al., 2020). Consistent findings have been reached for the benefits of intentional learning in spaced practice studies (Edmonds et al., 2021).

Several published research studies examined the effect of the frequency of encountering a word on later recall. As many research has investigated different estimates of the adequate number of word exposures needed to be successfully retained. For instance, Nation (1990) suggested that the adequate exposure times to learn a word within a text is between five and sixteen. It is shown that six repetitions exposures can result in better learning than two or four (Rott, 1999). Pigada and Schmitt (2006) ascertained that the frequency has no direct impact on new word learning, however, the learning rate was increased after more than ten repetitions. Nevertheless, even after more than 20 exposures may be insufficient for some learners to master the meaning of some words. Therefore, it is important to identify the number of repetitions and the way these repetitions are spread over time. To illustrate this, spaced repetition deals with using repetition within different learning sessions whilst massed repetition refers to words that are repeated in one study session. Much more details regarding the significance of spaced instructions on vocabulary learning would be discussed next.

SLL researchers explored the impact of distributed practice on learning different language skills and sub-skills, including speaking (Kobayashi, 2021), syntax and grammar (Ambridge et al., 2006; Miles, 2014), and especially vocabulary (Edmonds et al., 2021; Nakata & Elgort, 2021; Pavlik & Anderson, 2005), many of which have confirmed the beneficial effects of distributed practice and instruction. According to Kim and Webb (2022), several theories shed light on the effects of spaced practice: a) Desirable difficulty framework shows that spacing intervals between learning sessions can make learning more complicated but more desirable. b) Forgetting that happens during spacing makes retrieval more effortful but leads to robust retention. c) Consolidation learning finds that spaced learning opportunities can improve future repeated learning. d) According to deficient processing, spaced learning may result in more attentional processing, while massed learning may involve less processing of information. e) Accessibility principle points out that additional learning of information is boosted by minimizing the information access in the spacing memory. f) Contextual variability theory based on that spaced learning can create favorable conditions for recalling information learned in different contexts by making it distinctive. g) Study-phase retrieval indicates that spacing between retrievals can be beneficial to long-term retention.

Flawed transmission and encoding instability are two of the central theories showing the significant effect of spread distribution on vocabulary learning and retention. The encoding instability theory illustrates that spaced items can be learned and retained much easier than massed ones. As the spaced distribution may allow learners to use and present the new words in a different contexts, which therefore may result in better retention due to using them more hints (Greene, 1989). Nevertheless, the hypothesis flawed processing (Challis, 1993) argues that massed procedure may not need for deep information processing. When using the massed distribution, all words are repeated into one single learning session; this means that the learner may not being able to engage in deep processing of the words which may lead to some challenges in retaining them later.

Several moderator variables can affect the outcome of spaced instruction. Previous studies have determined that variables such as the age of the participants, the learning goal (i.e., vocabulary, grammar, morphology, pronunciation, or speaking), the number of sessions (single session study or multiple-session study), the type of practice (study trials, test trials, or a combination of both), the type of activity (either verbal, visual, or educational), feedback provision and timing, frequency of practice, and retention interval can yield different results. In the context of Taiwan, Serrano and Huang (2018) investigated the case of 71 high school students assigned to mass and spaced instruction groups. They found the first group outperformed the immediate post-test. Furthermore, the spaced group retained more vocabulary between the immediate and delayed post-test. Yet, neither group gains significantly in the pretest or the delayed post-test though.

Many previous studies on the spacing impact have concerned on younger learners more than adult learners (e.g., Kornell, 2009; Sobel et al., 2011). At university-level L2 research Çekiç and Bakla (2019) studied the impact of three different types of instructions on 77 intermediate Turkish EFL. The participants were grouped into expanding, intensive and long-term fixed spacing groups. Each group read 12 passages that included 20 lexical items. The Vocabulary Knowledge Scale (VKS) was obtained to gather the data via a multiple-choice test consisting of 20-item. They focused on the lexical items under research. It was clear that the productive knowledge of all three groups significantly improved after comparing pre and post-tests. Furthermore, it was found that the group with the most extended amount of spacing interval outperformed other groups in terms of receptive vocabulary gain. Another study was conducted by Kornell (2009) who used 20 words with their synonyms to probe the outperformance of spacing compared to massed distribution procedures. The results indicated that the group of spaced learning had significantly retained word pairs better than that of the massed group.

Nakata and Suzuki (2019) explored the spacing effect in a different context concerning intentional impact of vocabulary learning and the

spacing. They precisely examined the effects of spaced and mass instruction with respect to semantically related words (e.g., coordinates, synonyms, antonyms). To this aim, they presented 133 university students with 48 low-frequency English vocabulary and their equivalents in Japanese. Twenty-four of these words were related semantically, the other 24 were unrelated though. Both groups took part in the pretest, learning phase, gap filler task, and an immediate post-test in the first session. The learning phase for each group differed based on the type of instruction they were supposed to receive. Finally, after one week of the first session, the delayed post-test was held. The analyses did not show any significant difference between learning semantic clustering and unrelated words. Regarding the effect of spacing, it was clear that intervals benefitted both related and unrelated words. Nevertheless, it was assumed that spacing was more conducive to the former group of words, the unrelated words benefitted more from spaced instruction. The existing literature has also found that spaced instruction can be more effective factor than massed practices despite different outcomes from one method to another, for instance on lexis (Çekiç & Bakla, 2019; Goossens et al., 2012; Kornell, 2009; Bahrick et al., 1993; Lotfolahi & Salehi, 2016; Nakata, 2015), learning in particular L2 grammar (Mashhadi et al., 2017; Miles, 2014) and reading comprehension (Namaziandost et al., 2018).

Recently in the Chinese context, Lee et al. (2021) gauged how spaced, and massed instruction impacts 19 low-achievers vocabulary retention. Adopting a 2×3 within-participant replication design, the researchers planned to administer three tests, which included four sets of words, to both massed and spaced classes. The first test was given immediately after the final teaching session, and two delayed tests were held after four weeks of the first test. The study results pointed out that spaced instruction resulted in both short and long-term retention among low-achieving students. Kim and Webb's (2022) meta-analysis on spaced learning shows that the effect size of spacing is small to medium immediate post-test and medium to large for delayed post-tests. In other words, spaced instruction is generally more effective in the long run. In addition, they noted that longer spacing is beneficial to long-term retention. In view of all, the existing literature has shown that spaced has more effect than massed instruction on L2 vocabulary learning and retention at both a high-school level and an undergraduate-student level in an educational settings.

## 2.2 Overview of the Present Study

As can be seen above, all of the studies reviewed here support the fact that spacing effect outperformed the massed effect on vocabulary learning and retention. L2 vocabulary learning researchers have examined the spacing effect in different contexts and conditions, mainly focusing on how to memorise familiar (unrelated) words and there has not been any investigation, to the limited knowledge of the researcher, on the spacing contribution aiming precisely learning and retaining the meaning and form of L2 words. Therefore, the present study sets to examine to what extent L1 Arabic learners of English can learn the form and meaning of 30 English words through spaced and massed instructions. To this end, the current study is addressed the following questions:

**RQ1:** To what extent can spacing and massed conditions facilitate learning and retaining the form of L2 words?

**RQ2:** To what extent can spacing and massed conditions facilitate learning and retaining the meaning of L2 words?

## 3. Methods

### 3.1 Participants and the Target Words

A total of 40 L1 Arabic learners of English enrolled at postgraduate classes at Qassim University participated in this study. Two of them were removed because they didn't complete all the sessions of the experiment, resulting in a final sample size of 38 participants (mean age=19.3). They were all enrolled on the Intensive Course in the English Language and Translation Department. The participants passed courses with 70%. They were expected to master a proficiency level in the CEFR (B1 into B2).

Thirty Target-words were used in the current study for measuring the meaning and form aspects of word knowledge within two sessions (massed and spaced learning sessions). They were randomly selected from the six and seven frequency layers of 1,000 word families in BNC to ensure that they were beyond their current English language proficiency level. As Laufer (2000) pointed out that English second language (L2) learners' vocabulary size often ranges within the limit of 1,000-4,000 word families. This ensures that the target words of this study were totally new to all participants. All the selected target words were singular nouns, for easier classification than adverbs and adjectives (Laufer, 1997).

### 3.2 Lexical Decision Task (LDT)

In LDT (Lexical Decision Task), a participant has to make quick decision about whether combinations of letters compose accurate English words. Reaction times were used to indicate the speed of figuring out the words under learning. In this type of experimental paradigm, in order to ensure that the attention of the learners is not extremely yielded to the target items, so a number of distractors has to be set; three groups of categories were used, namely: target -words, non-words, real English words. In order to avoid test items repetition and to provide a distractors balance; the following number of items were used during the LDT -which has been conducted two times as an immediate (IPT) and a delayed post-test (DPT), and -each time -only the target words were repeated, while the distractors were changed: 50 items: 30 target-words, 10 real English words, and 10 non-words. This procedure was followed in order to avoid repetition of test items across tests, which may lead to potential learning effects for words that were not target items in the study. The used LDT stimuli were displayed individually (one by one) on the middle of the white background screen; all the stimuli are roughly equal in length, showed in Black Times New Roman font, 18-point size.

Instructions for participants:

- Words will appear one by one in the middle of your screen.
- You should make quick decision about whether the target words are accurate English word.
- Press 'D' to confirm “Yes” answer (seen before) and press ‘K’ to confirm “No” answer (not seen before).
- To start, the '\*' will symbol display in the middle of the screen for 20 seconds to make you ready for the first word. Kindly prepare one finger (from left hand) just on top of 'D' key and a finger (from right hand) on top of 'K' key, to start the test immediately while the '\*' symbol disappears.
- You have 6 trials to practice and be familiar with this procedure: six stimuli will appear to ensure that participants became familiarised with the experiment.
- When you are ready to start, press the 'Space Bar'.

Participant error rate higher than 40% will make subject to be removed and will be replaced by a new participant. Participants are scored by awarding one point for each correct answer. All error trials will be excluded to ascertain that extreme reaction time data did not influence the mean RTs for the LDT, an outlier (subject-based outlier procedure) identification was followed. RTs that were more than two standard deviations (SD) above or below the participants’ means across items were trimmed to the cut- off value of two SDs for that participant (as followed by Jegerski, 2014).

3.3 Vocabulary Knowledge Scale (VKS)

Over the years, the VKS was used for testing productive vocabulary knowledge, and the scale test and its modified versions were carried out in various studies (Waring, 2002). The present study uses the VKS simplified updated version of the (Brown, 2008) (see Table 3.1), The original 5-point VKS scale adapted by (Wesche & Paribakht, 1996) was used to develop the students' VKS. This scale was simplified by Brown (2008) and minimize to just include a 4-point scale. Wesche and Paribakht (1996) indicated that VSK scale involved two statements which may not be clearly differentiated: “I think it means” (Scale III) and “I know this word. It means” (Scale IV). Therefore, the following statement: “I have seen this word before and I think it means \_\_\_\_\_” (Scale III) was removed in the VKS modified version, developed by Brown (2008).

Table 3.1. Modified Vocabulary Knowledge Scale

	Self-Report Category
I.	I don't remember having seen this word before.
II.	I've seen this word/phrase before, but I don't know what it means.
III.	I know what this word. It means _____ (Give the meaning in English or Arabic.)
IV.	I can use this word in a sentence _____ (Write a sentence.) (If you do this section, please also complete III.)

3.4 Administering and Scoring the VKS Test

Participants pass the VKS for all 30-target words to evaluate the retained meaning aspect over time. The unknown word, categories I and II receive no points. In the current study, participants award one score in the known word category: for receptive or productive word knowledge when they can use of a target word semantically as well grammatically accurate.

3.5 Procedure

The participants firstly completed a consent form for ethical approval and a brief information sheet about their educational background, age and their language proficiency, as these factors may have an effect on their performance. The study was conducted in a classroom. The students were informed that they were going to learn a series of new words by the researcher. The first session was on presenting all the target words (30 English words) and they were showed via PowerPoint presentation. The participants were requested to provide each word meaning. They, generally, were unable to come up with the correct word meaning demonstrating that the words were totally new to them. Next, the researcher provided the participants with the definition of the word and accompanying phrase.

In the seconds session, the participants practiced in the spaced condition 15 (three thematic sets), and in the massed condition 5 (1 thematic set). One exercise was allocated to each item in spaced condition. The participants had to perform puzzles after a short break time and they were provided with feedback after doing the exercises completely. The right answers were given to the participants on the part of the researcher so that they could assess their own performance in spaced condition. The participants, in massed condition, had to do three different activities in a row on the five items. They had to perform after exercise 1, puzzles and they were provided feedback on their performance. This process took place for the second and third exercises. The same procedure of Session 2 repeated for Sessions 3 and 4 except for the use of different thematic word in the massed condition. In general, the items were practiced in meaning and form sets and three exercises were carried out for each item in both (spaced and massed) conditions. The word sequences within each set was different in each for the three exercises. The researcher did not practice the words after the session; therefore, before Session 5, the students did not practiced them in the classroom. For an overview of the procedure, see Table 3.2

The participants, in the fifth session, were tested on all the target words using as immediate-tests LDT to measure the form recognition of L2 target words and VKS to assess learning of the meaning of the these L2 target words. In the sixth session, the same two tests as post-tests, the LDT to measure L2 word recognition performance and the VKS of all L2 target words to test the meaning retention, were administered after two weeks later.

Table 3.2. Study Procedure

1	2	3	4	5	6
Presentation of all items (1-30)	Items 1-15 Exercises + feedback (spaced condition)	Items 1-15 Exercises + feedback (spaced condition)	Items 1-15 Exercises + feedback (spaced condition)	(1 day later) all items were tested by LDT and VKS (1)	(2 weeks later) all items were tested by LDT and the VKS (2)
	Items 1- 5	Items 6-10	Items 11-15		
	Items 1- 5	Items 6-10	Items 11-15		
	Items 1- 5 Exercises + feedback (massed condition)	Items 6-10 Exercises + feedback (massed condition)	Items 11-15 Exercises + feedback (massed condition)		

4. Results and Discussion

The results of VKS and LDT tests are presented. For normality, the Kolmogorov-Smirnov test was used to measure both tests used in the current study, and since the scores for both these measures, for all participants, were normally distributed, parametric tests were administrated to examine the two condition differences. Because all participants received the target words in spaced condions at the beginning of each learning session and the massed condition at the end, it is important to test firstly whether such a concentrating effect had occurred which may lead to L2 learning advantage of spaced over massed L2 words. Thus, L2 participant performance on the exercises of both spaced and massed conditions were compared. The results showed that all participants obtained high scores on both (spaced:  $M=89.35\%$ ,  $SD=13.23$ ; massed:  $M=87.95\%$ ,  $SD=12.03$ ) and the difference between their performance on the exercises of the spaced and massed conditions was not significant,  $t(30) = -0.298$ ,  $p = .885$ ,  $d = 0.084$ . Moreover, there was no significant difference between the performance of the two classes,  $t(29) = -0.901$ ,  $p = .410$ ,  $d = 0.190$ .

The first RQ raised by the current study was to investigate to what extent can spacing and massed conditions facilitate recognizing the form of L2 words. As mentioned before, the target words used in this study to measure the meaning and form aspects of L2 word knowledge were randomly selected from the six and seven frequency layers of 1,000 word families in the British National Corpus (BNC) to ensure that they were totally unknown to all participants. Descriptive statistics presented in Table 4.1 show that the spaced condition generally obtained higher scores in the LDT accuracy scores in both IPT (98.4 %) and DPT (97.4 %) for the L2 target words than in the massed condition IPT (70.73 %) and DPT (68.27 %). This suggests that L2 participants in the spaced condition were better at recognizing the form of L2 target words than in massed condition (see Table 4.1).

Table 4.1. Target words in LDT (IPT & DPT) both conditions

	Mean	Std. Deviation
Spaced-(IPT)	14.76	.542
Spaced-(DPT)	14.61	.755
Massed-(IPT)	10.61	2.388
Massed-(DPT)	10.24	2.174

Finding out the extent spacing can facilitate recognizing and retaining the form of L2 words better than massed condition, the results of t-test, as shown in Table 4.2, present that there is a significant difference between the total accuracy scores of the LDT (spaced condition) ( $M=14.76$ ;  $SD=.542$ ) and total accuracy scores of the LDT (massed condition) in learning the form of L2 new words (IPT) ( $M=10.61$ ;  $SD=2.388$ ); [ $t(37) = 10.534$ ,  $p = 0.000$ ]. There is also a significant difference between the total accuracy scores of the LDT (spaced condition) ( $M=14.61$ ;  $SD=.755$ ) and the accuracy scores of the LDT (massed condition) in retaining the form of L2 new words two weeks later ( $M=10.24$ ;  $SD=2.174$ ); [ $t(37) = 11.073$ ,  $p = 0.000$ ] (see Table 4.2). These results indicate that using spacing can facilitate learning and retaining the form of L2 words better than massed condition. These findings are confirmed by other previous research which have found that spaced learning has more effect than massed learning on learning L2 grammar (Ambridge et al., 2006; Mashhadi et al., 2017), reading comprehension (Namaziandost et al., 2019; Yanagisawa et al., 2020), and lexis (Çekiç & Bakla, 2019; Goossens et al., 2012; Lotfolahi & Salehi, 2016; Sobel et al., 2011). One of the proposed reason behind that spacing resulted in learning facilitation and retention of L2 new word forms could be accessibility. In other words, the participants had more access to the target forms across separate sessions and as they were exposed to the target forms, it drew their attention to them which led to selective attention as suggested by Brown (2007). It can be also argued that accessibility principle may play a pivotal role in learning and retention of L2 forms because L2 learners may focus on L2 new word forms repeated in different sessions more than on ones encountered many times but in one session. Moreover, as previously mentioned that since spacing takes place across sessions repeatedly which may lead to learn the form of L2 new word deeply, and then may result to be transferred to long-term memory.

Table 4.2. Spaced and Masses variables measuring L2 word form recognition

	Mean	Std. Deviation	t	df	Sig. (2-tailed)
Spaced-LDT (IPT) Massed-LDT (IPT)	4.158	2.433	10.534	37	.000
Spaced-LDT (DPT) Massed-LDT (DPT)	4.368	2.432	11.073	37	.000

Another aim of the first RQ probe the extent in which spacing and massed conditions can facilitate the speed with which respondents recognised the form of L2 target words. Descriptive statistics presented in Table 4.3 show that the respondents in spaced condition generally were shorter in the LDT reaction times (RTs) in both IPT and DPT for the L2 target words than in the massed condition IPT and DPT. This suggests that L2 participants in the spaced condition were faster at recognizing the form of L2 target words than in massed condition (see Table 4.3).

Table 4.3. Target words in LDT- Reaction Time (IPT & DPT) both conditions

	Mean	Std. Deviation
Spaced-IPT	14839.605	4026.9514
Massed-IPT	17019.87	4620.873
Spaced-DPT	13975.526	5103.8079
Massed-DPT	15498.737	5661.9322

Finding out to what extent spacing and massed conditions facilitate the speed with which respondents recognised the form of L2 target words, the t-test results in Table 4.4 below show that there is a significant difference between the LDT (spaced condition) ( $M=14839.605$ ;  $SD=4026.9514$ ) and total accuracy scores of the LDT (massed condition) in the speed of recognizing the form of L2 new words (IPT) ( $M=17019.87$ ;  $SD=4620.873$ ); [ $t(37) = -6.737, p = 0.000$ ]. There is also a significant difference between the LDT (spaced condition) ( $M=13975.526$ ;  $SD=5103.8079$ ) and the (massed condition) ( $M=15498.737$ ;  $SD=5661.9322$ ) in L2 participants' speed in retaining the form of L2 new words two weeks later (DPT); [ $t(37) = -4.084, p = 0.000$ ] (see Table 4.4). These results indicate that L2 participants in the spaced condition were faster at recognizing the form of L2 target words than in massed condition. This occurs because they were constantly at exposure to the forms of the words in subsequent sessions which may result in better retention and recognition since continuous exposure to forms can lead to fast recognition. It can then be argued that encountering L2 new word forms continuously in various contexts across separate sessions can lead to fast recognition.

Table 4.4. Spaced and Masses variables measuring the speed of L2 word form recognition

	Mean	Std. Deviation	t	df	Sig. (2-tailed)
Spaced-LDT (IPT) Massed-LDT (IPT)	-2180.2632	1995.0755	-6.737	37	.000
Spaced-LDT (DPT) Massed-LDT (DPT)	-1523.2105	2298.9165	-4.084	37	.000

The second RQ investigates the extent in which spacing and massed conditions can facilitate learning and retaining the meaning of L2 words. Table 4.5 shows that the spaced condition generally obtained higher scores in the VKS both IPT (97.2%) and DPT (95.6%) for the L2 target words than in the massed condition IPT (55.8%) and DPT (46.33%) (see Table 4.5). This suggests that L2 participants in the spaced condition were better at learning and retaining target words meaning than in massed condition. This can be as a result of contextual variability (Kim & Webb, 2022) since encountering these L2 new words takes place across sessions repeatedly which may lead to process and learn the meaning deeply and, then, lead to better learning and retention of the meaning of L2 new words.

Table 4.5. Target words in VKS (IPT & DPT) both conditions

	Mean	Std. Deviation
Spaced- (IPT)	14.58	.858
Spaced-(DPT)	14.34	1.021
Massed-(IPT)	8.37	1.822
Massed- (DPT)	6.95	1.576

To find out the extent spacing can facilitate learning and retaining the meaning of L2 words better than massed condition, the t-test results in Table 4.6 show that there is a significant difference between the total accuracy scores of the VKS (IPT) spaced ( $M=14.58$ ;  $SD = .858$ ) and massed ( $M =8.37$ ;  $SD = 1.822$ ) condition in learning the meaning of L2 new words [ $t(37) = 19.946, p = 0.000$ ]. There is also a significant difference between the total scores of the VKS delayed-post test (DPT) spaced ( $M=14.34$ ;  $SD = 1.021$ ) and massed ( $M=6.95$ ;  $SD = 1.576$ ) condition in retaining the meaning of L2 new words [ $t(37) = 24.793, p = 0.000$ ] (see Table. 4.6), indicating that using spacing can facilitate learning and retaining the meaning of L2 words better than massed condition, in congruity with the study undertaken by Nakata and Suzuki (2019). One of the suggested reason behind that spaced condition groups outperformed the massed one might be that spacing consolidated learning for the future retention and it gave rise to more attentional processing. It can be argued that spacing may enhance learning and retaining the meaning of L2 new words since it takes place across sessions repeatedly which may result in learning the meaning of L2 new words and, then, may lead to be transferred to long-term memory.

Table 4.6. Spaced and Masses variables measuring the retention of L2 word meanings

	Mean	Std. Deviation	T	df	Sig. (2-tailed)
Spaced-VKS (IPT) - Massed-VKS (IPT)	6.211	1.919	19.946	37	.000
Spaced-VKS (DPT)- Masses-VKS (DPT)	7.395	1.839	24.793	37	.000

**5. Conclusion**

This study sheds light on a meaningful treated aspect of L2 new word learning by comparing two learning procedures viz., spaced and

massed conditions. It shows that L2 learners learned and retained both vocabulary form and meaning using spaced procedures better than massed conditions. It finds that distributing L2 new words across different learning sessions can lead to better L2 vocabulary learning and retention than massing them into one session. Besides, L2 learners in spaced condition were faster in L2 word form recognition in both IPT and DPT. It should be noted that in this study both spaced and massed items were presented and studied initially at the first session, hence, the total number of word presentation was the same in the spaced and massed conditions. Nevertheless, the current results indicate that spacing L2 target words during multiple learning sessions can benefit L2 vocabulary learning and retention in a classroom practices.

However, the current study had some limitations which can be taken into consideration by other future researchers. The target spaced words were always studied first in the current study which may affect the learning process during practices. Therefore, a call to replicate this study is recommended using completely balanced procedure between groups to find out the differences. Moreover, the participants of the study were between (B1) and (B2) levels, other researchers may carry out research in the future taking other language proficiency levels into account to find out the differences. Hence, further studies are required to re-explore other factors which may lead to remarkable improvement of L2 vocabulary learning and retention. It is necessary to administer a longer period post-test over, for instance, 3 weeks to measure how long L2 learners can retain L2 new words in longer term. As reported by Kim and Webb (2022) that the longer the period, the greater the effect size of spaced learning. That is, it might be useful in future research to test the relationship between the effect of spacing and retention interval.

The findings have implications for EFL teachers, and vocabulary course developers concerning the effective role of spaced instruction in enhancing L2 vocabulary learning and retention. It can be suggested, ultimately, that spacing L2 target words during separate vocabulary learning sessions is better than massed them in one learning session.

#### Author Bio

Reham Alkhudiry is an Assistant Professor of Applied Linguistics in the Department of English Language and Translation, Qassim University, SA. Her main areas of interest are: second language acquisition, vocabulary learning and teaching, L2 lexical representation and development, L2 Written Discourse Analysis, assessment of reading comprehension and vocabulary in L2 learners.

#### References

- Allen, V. F. (1983). *Techniques in teaching vocabulary*. Oxford University Press.
- Ambridge, B., Theakston, A. L., Lieven, E. V., & Tomasello, M. (2006). The distributed learning effect for children's acquisition of an abstract syntactic construction. *Cognitive Development, 21*(2), 174-193. <https://doi.org/10.1016/j.cogdev.2005.09.003>
- Bahrack, H. P., Bahrack, L. E., Bahrack, A. S., & Bahrack, P. E. (1993). Maintenance of foreign language vocabulary and the spacing effect. *Psychological Science, 4*(5), 316-321. <https://doi.org/10.1111/j.1467-9280.1993.tb00571.x>
- Barzagar Nazari, K., & Ebersbach, M. (2019). Distributing mathematical practice of third and seventh graders: Applicability of the spacing effect in the classroom. *Applied Cognitive Psychology, 33*(2), 288-298. <https://doi.org/10.1002/acp.3485>
- Berne, J. I., & Blachowicz, C. L. (2008). What reading teachers say about vocabulary instruction: voices from the classroom. *The Reading Teacher, 62*(4), 314-323. <https://doi.org/10.1598/RT.62.4.4>
- Brown, H. D. (2007). *Principles of language learning and teaching* (5<sup>th</sup> ed.). New York: Pearson Education.
- Bui, G., Ahmadian, M. J., & Hunter, A.-M. (2019). Spacing effects on repeated L2 task performance. *System, 81*, 1-13. <https://doi.org/10.1016/j.system.2018.12.006>
- Carpenter, S. K., Pashler, H., & Cepeda, N. J. (2009). Using tests to enhance 8th grade students' retention of U.S. history facts. *Applied Cognitive Psychology, 23*(6), 760-771. <https://doi.org/10.1002/acp.1507>
- Çekiç A., & Bakla, A. (2019). The effects of spacing patterns on incidental L2 vocabulary learning through reading with electronic glosses. *Instructional Science, 47*(3), 353-371. <https://doi.org/10.1007/s11251-019-09483-4>
- Challis, B. H. (1993). Spacing effects on cued-memory tests depend on level of processing. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 19*(2), 389-396. <https://doi.org/10.1037/0278-7393.19.2.389>
- Chukharev-Hudilainen, E., & Klepikova, T. A. (2016). The effectiveness of computer-based spaced repetition in foreign language vocabulary instruction: A double-blind study. *Calico Journal, 33*(3), 334-354. <https://doi.org/10.1558/cj.v33i3.26055>
- DeKeyser, R. (2007). Skill acquisition theory. In B. VanPatten (Ed.), *Theories in second language acquisition: An introduction*. (pp. 97-113). New Jersey: Lawrence Erlbaum Associates.
- Dunnack, H. J., van Hoof, T. J., Banfi, V., & Polifroni, E. C. (2021). Scoping Review of Distributed Practice in Nursing Education. *Nursing Education Perspectives, 42*(6), E22-E25. <https://doi.org/10.1097/01.NEP.0000000000000858>
- Edmonds, A., Gerbier, E., Palasis, K., & Whyte, S. (2021). Understanding the distributed practice effect and its relevance for the teaching and learning of L2 vocabulary. *Lexis*. Advance online publication. <https://doi.org/10.4000/lexis.5652>
- Ellis, R. (2006). Current issues in the teaching of grammar: An SLA perspective. *TESOL Quarterly, 40*(1), 83-107. <https://doi.org/10.2307/40264512>
- Emeny, W. G., Hartwig, M. K., & Rohrer, D. (2021). Spaced mathematics practice improves test scores and reduces overconfidence.

- Applied Cognitive Psychology*, 35(4), 1082-1089. <https://doi.org/10.1002/acp.3814>
- Glenberg, A. M. (1979). Component-levels theory of the effects of spacing of repetitions on recall and recognition. *Memory & Cognition*, 7(2), 95-112. <https://doi.org/10.3758/BF03197590>
- Goossens, N. A. M. C., Camp, G., Verkoeijen, P. P. J. L., Tabbers, H. K., & Zwaan, R. A. (2012). Spreading the words: A spacing effect in vocabulary learning. *Journal of Cognitive Psychology*, 24(8), 965-971. <https://doi.org/10.1080/20445911.2012.722617>
- Greene, R. L. (1989). Spacing effects in memory: Evidence for a two-process account. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, 15(3), 371. <https://doi.org/10.1037/0278-7393.15.3.371>
- Henriksen, B., Albrechtsen, D., & Haastrup, K. (2004). The relationship between vocabulary size and reading comprehension in the L2. In D. Albrechtsen, K. Haastrup, & B. Henriksen (Eds.), *Writing and vocabulary in foreign language acquisition* (pp. 129-140), Museum Tusulanum Press.
- Hincks, R. (2003). Pronouncing the academic word list: Features of L2 student oral presentations. In *Proceedings of the 15th International Congress of Phonetics Sciences* (pp. 1545-1548). Barcelona: Universitat Autònoma de Barcelona. Retrieved March 29, 2006, from [http://www.speech.kth.se/ctt/publications/papers03/icphs03\\_1545.pdf](http://www.speech.kth.se/ctt/publications/papers03/icphs03_1545.pdf)
- Huang, L., & Lin, C. (2014). Three approaches to glossing and their effects on vocabulary learning. *System*, 44, 127-136. <https://doi.org/10.1016/j.system.2014.03.006>
- Jegerski, J. (2014). Self-paced reading. In Jegerski, J., & B. VanPatten (Eds.), *Research methods in second language psycholinguistics*, (pp. 20-49). New York, NY, USA: Routledge. <https://doi.org/10.4324/9780203123430>
- Katz, J. J., Ando, M., & Wiseheart, M. (2021). Optimizing song retention through the spacing effect. *Cognitive Research: Principles and Implications*, 6(1), 79. <https://doi.org/10.1186/s41235-021-00345-7>
- Khan, R., Radzuan, N., Shahbaz, M., Ibrahim, A., & Mustafa, G. (2018). The role of vocabulary knowledge in speaking development of Saudi EFL learners. *Arab World English Journal*, 9(1), 406-418. <https://doi.org/10.24093/awej/vol9no1.28>
- Kim, S. K., & Webb, S. (2022). Effects of spaced practice on second language learning: A meta-analysis. *Language Learning*, 72(1), 269-319. <https://doi.org/10.1111/lang.12479>
- Ko, M. H. (2012). Glossing and second language vocabulary learning. *TESOL Quarterly*, 46(1), 56-79. <https://doi.org/10.1002/tesq.3>
- Kobayashi, M. (2022). The distributed practice effects of speaking task repetition. *International Journal of Applied Linguistics*, 32(1), 142-157. <https://doi.org/10.1111/ijal.12409>
- Kornell, N. (2011). Failing to predict future changes in memory: A stability bias yields long-term overconfidence. In *Successful Remembering and Successful Forgetting: A Festschrift in Honor of Robert A. Bjork*, ed. AS Benjamin, pp. 365-86. New York: Psychol. Press.
- Kornell, N. (2009). Optimising learning using flashcards: Spacing is more effective than cramming. *Applied Cognitive Psychology*, 23(9), 1297-1317. <https://doi.org/10.1002/acp.1537>
- Laufer, B. (1997). What's in a word that makes it hard or easy: Some intralexical factors that affect the learning of words. In N. Schmitt & M. McCarthy (Eds.), *Vocabulary: Description, acquisition and pedagogy* (pp. 140-155). Cambridge, England: Cambridge University Press.
- Laufer, B. (2000). Avoidance of idioms in a second language: The effect of L1-L2 degree of similarity. *Studia linguistica*, 54(2), 186-196. <https://doi.org/10.1111/1467-9582.00059>
- Laufer, B. (2013). Lexical thresholds for reading comprehension: What they are and how they can be used for teaching purposes. *Tesol Quarterly*, 47(4), 867-872. <https://doi.org/10.1002/tesq.140>
- Laufer, B. (2006). Comparing focus on form and focus on forms in second-language vocabulary learning. *The Canadian Modern Language*, 63(1), 149-166. <https://doi.org/10.1353/cml.2006.0047>
- Laufer, B. (2012). Vocabulary and writing. In C. A. Chapelle (Ed.), *The Encyclopedia of Applied Linguistics* (pp. 1-5). Wiley. <https://doi.org/10.1002/9781405198431.wbeal1432>
- Lee, I. H., Maechtle, C., & Hu, C. F. (2021). Enhancing vocabulary retention in low-achieving EFL students: Massed or spaced? *English Teaching & Learning*, 45(4), 415-430. <https://doi.org/10.1007/s42321-020-00074-y>
- Lotfolahi, A. R., & Salehi, H. (2017). Spacing effects in vocabulary learning: Young EFL learners in focus. *Cogent Education*, 4(1), 1287391. <https://doi.org/10.1080/2331186X.2017.1287391>
- Mashhadi, A., Taghi Farvardin, M., & Mozaffari, A. (2017). Effects of spaced and massed distribution instruction on EFL learners' recall and retention of grammatical structures. *Teaching English Language*, 11(2), 57-75. <https://doi.org/10.22132/tel.2017.53183>
- Miles, S. W. (2014). Spaced vs. massed distribution instruction for L2 grammar learning. *System*, 42, 412-428. <https://doi.org/10.1016/j.system.2014.01.014>
- Moir, J., & Nation, I. S. P. (2002). Learners' use of strategies for effective vocabulary learning. *Prospect*, 17(1), 15-35.



<https://search.informit.org/doi/10.3316/aeipt.124135>

- Nakata, T., & Elgort, I. (2021). Effects of spacing on contextual vocabulary learning: Spacing facilitates the acquisition of explicit, but not tacit, vocabulary knowledge. *Second Language Research*, 37(2), 233-260. <https://doi.org/10.1177/0267658320927764>
- Nakata, T., & Suzuki, Y. (2019). Effects of massing and spacing on the learning of semantically related and unrelated words. *Studies in Second Language Acquisition*, 41(2), 287-311. <https://doi.org/10.1017/S0272263118000219>
- Namaziandost, E., Mohammed Sawalmeh, M. H., & Izadpanah Soltanabadi, M. (2020). The effects of spaced versus massed distribution instruction on EFL learners' vocabulary recall and retention. *Cogent Education*, 7(1), 1792261. <https://doi.org/10.1080/2331186X.2020.1792261>
- Namaziandost, E., Nasri, M., Rahimi Esfahani, F., & Keshmirshakan, M. H. (2019). The impacts of spaced and massed distribution instruction on EFL learners' vocabulary learning. *Cogent Education*, 6(1), 1661131. <https://doi.org/10.1080/2331186X.2019.1661131>
- Nation, I. S. P. (1990). *Teaching and learning vocabulary*. New York, NY: Newbury House.
- Nushi, M., & Jenabzadeh, H. (2016). Teaching and learning academic vocabulary. *California Linguistic Notes*, 40(2), 51-70.
- Pavlik, P. I., & Anderson, J. R. (2005). Practice and forgetting effects on vocabulary memory: An activation-based model of the spacing effect. *Cognitive Science*, 29(4), 559-586. [https://doi.org/10.1207/s15516709cog0000\\_14](https://doi.org/10.1207/s15516709cog0000_14)
- Pigada, M., & Schmitt, N. (2006). Vocabulary acquisition from extensive reading: A case study. *Reading in a foreign language*, 18(1), 1-28.
- Rogers, J. (2017). The spacing effect and its relevance to second language acquisition. *Applied Linguistics*, 38(6), 906-911. <https://doi.org/10.1093/applin/amw052>
- Rose, R. J. (1980). Encoding variability, levels of processing, and the effects of spacing of repetitions upon judgments of frequency. *Memory & Cognition*, 8(1), 84-93. <https://doi.org/10.3758/BF03197555>
- Rott, S. (1999). The effect of exposure frequency on intermediate language learners' incidental vocabulary acquisition and retention through reading. *Studies in second language acquisition*, 21(4), 589-619. <https://doi.org/10.1017/S0272263199004039>
- Serrano, R., & Huang, H. Y. (2018). Learning vocabulary through assisted repeated reading: How much time should there be between repetitions of the same text? *TESOL Quarterly*, 52(4), 971-994. <https://doi.org/10.1002/tesq.445>
- Sobel, H. S., Cepeda, N. J., & Kapler, I. V. (2011). Spacing effects in real-world classroom vocabulary learning. *Applied Cognitive Psychology*, 25(5), 763-767. <https://doi.org/10.1002/acp.1747>
- Spruit, E. N., Band, G. P. H., & Hamming, J. F. (2015). Increasing efficiency of surgical training: Effects of spacing practice on skill acquisition and retention in laparoscopy training. *Surgical Endoscopy*, 29(8), 2235-2243. <https://doi.org/10.1007/s00464-014-3931-x>
- Stæhr, L. S. (2008). Vocabulary size and the skills of listening, reading and writing. *The Language Learning Journal*, 36(2), 139-152. <https://doi.org/10.1080/09571730802389975>
- Stæhr, L. S. (2009). Vocabulary knowledge and advanced listening comprehension in English as a foreign language. *Studies in Second Language Acquisition*, 31(04), 577. <https://doi.org/10.1017/S0272263109990039>
- Suzuki, Y., & DeKeyser, R. (2017). Effects of distributed practice on the proceduralization of morphology. *Language Teaching Research*, 21(2), 166-188. <https://doi.org/10.1177/1362168815617334>
- Teninbaum, G. H. (2016). Spaced repetition: A method for learning more law in less time. *Journal of High Technology Law*, 17, 273-312.
- Uchihara, T., Webb, S., & Yanagisawa, A. (2019). The effects of repetition on incidental vocabulary learning: A meta-analysis of correlational studies. *Language Learning*, 69(3), 559-599. <https://doi.org/10.1111/lang.12343>
- Vlach, H. A. (2019). Learning to remember words: Memory constraints as double-edged sword mechanisms of language development. *Child Development Perspectives*, 13(3), 159-165. <https://doi.org/10.1111/cdep.12337>
- Vlach, H. A., & Sandhofer, C. M. (2012). Distributing learning over time: The spacing effect in children's acquisition and generalization of science concepts. *Child Development*, 83(4), 1137-1144. <https://doi.org/10.1111/j.1467-8624.2012.01781.x>
- Wegener, S., Wang, H. C., Beyersmann, E., Nation, K., Colenbrander, D., & Castles, A. (2022). The effects of spacing and massing on children's orthographic learning. *Journal of Experimental Child Psychology*, 214, 105309. <https://doi.org/10.1016/j.jecp.2021.105309>
- Yanagisawa, A., Webb, S., & Uchihara, T. (2020). How do different forms of glossing contribute to L2 vocabulary learning from reading? *Studies in Second Language Acquisition*, 42(2), 411-438. <https://doi.org/10.1017/S02722631190006>

### Copyrights

Copyright for this article is retained by the author(s), with first publication rights granted to the journal.

This is an open-access article distributed under the terms and conditions of the Creative Commons Attribution license (<http://creativecommons.org/licenses/by/4.0/>).