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Research Article

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Investigating optimal spacing schedules for incidental acquisition of L2 collocations

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Abstract: Research investigating lag effects in second language (L2) collocation learning is very limited. To date, no intervention study has examined the relationship between intersession intervals (ISIs) and retention intervals (RIs) in relation to incidental acquisition of collocations. To fill this gap, the current study collected data from two groups of students in Saudi Arabia (Experiment 1, $n = 73$; Experiment 2, $n = 69$), using a pretest-treatment-delayed posttest design. The participants learned 25 incongruent adjective-noun collocations incidentally during five reading sessions at either a 3.5-day ISI (Experiment 1) or a 7-day ISI (Experiment 2). Two control groups received no treatment. Learning rates were assessed at the form recall and meaning recall levels of sensitivity following an RI of 14 days in Experiment 1 and an RI of 28 days in Experiment 2. Results show that both spacing schedules were equally effective for the incidental acquisition of collocations.

Keywords: shorter spacing; longer spacing; incidental learning of collocations

1 Introduction

Second language (L2) learners need to gain knowledge of a large number of collocations to communicate successfully in English (e.g., Crossley et al. 2015; Hsu and Chiu 2008; Kremmel et al. 2017; Stengers et al. 2011). However, these formulaic sequences often pose considerable learning challenges (e.g., Boers et al. 2014; Laufer and Waldman 2011; Nguyen and Webb 2017; Sonbul et al. 2022). Frequently cited reasons why this is the case include the relative infrequency of collocations in the input (Boers and Webb 2015) and the fact that some of them are composed of highly

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frequent individual words and may, as a result, go unnoticed by L2 learners (Pellicer-Sánchez 2020). Given the relevance of collocational knowledge in acquiring an L2, a central concern in collocation research has been to find ways for maximising the learning of these units. Previous studies have shown that various factors, such as frequency of exposure, previous lexical knowledge, similarity to L1 and degree of transparency and attention may impact success in collocation learning (e.g., Boers 2020). Another, much less researched variable is the temporal distribution of repeated practice or *lag effect*, conceptualised as the effect of two different spacing conditions on the learning outcomes (Rogers and Cheung 2020a; Suzuki 2017). An often-mentioned related phenomenon is the *spacing effect*, which refers to the impact of spaced practice (when the learning material is repeated across several separate study sessions) and massed practice (when all the repetitions are loaded shortly one after another) (Macis et al. 2021; Rogers 2017). Despite the potential benefits of the spacing effect for collocation learning (Macis et al. 2021; Yamagata et al. 2023), research is still rather scarce in relation to the lag effect. In fact, only one recent study on collocations (Snoder 2017) has investigated this phenomenon and it focused on intentional learning. Although research has suggested that retention rates can be substantially increased when there is a deliberate intention to learn unknown collocations (Laufer 2006), related studies have suggested that collocations can also be picked up incidentally from L2 exposure (Macis 2018; Pellicer-Sánchez 2017; Szudarski 2012; Szudarski and Carter 2016; Vu and Peters 2021; Webb et al. 2013). Therefore, empirical investigations examining how spacing time periods between different practice sessions might influence incidental learning is valuable from a pedagogical perspective. To the best of our knowledge, no previous intervention study has explored lag effects in incidental learning of collocations. The present study aims to address this gap by examining the impact of shorter and longer practice intervals on the long-term retention of L2 collocations.

2 Literature review

2.1 ISI × RI interaction

Interest in the effect of distributed practice stems from empirical investigations in the area of cognitive psychology (Cepeda et al. 2006; Küpper-Tetzl et al. 2014). This literature has examined the interaction between the time lags between study sessions (intersession intervals, or ISIs) and the period of time between the final study session and the test (retention interval, or RI). A widely cited study by Cepeda et al. (2006) showed that there existed such an interaction and indicated that in case of learning trivia facts, optimal spacing of practice sessions appeared to depend on

when retention of knowledge would be measured. The authors concluded that as the intersession intervals increased, the retention intervals also increased. Later research by Rohrer and Pashler (2007) suggested that the optimal ISI should be in a range of 10–30 % of the RI.

Several theoretical explanations, such as study-phase retrieval (Toppino and Bloom 2002) and the reminding and encoding-variability accounts (Benjamin and Tullis 2010) have been put forward to explain the relationship between ISI and RI and how optimal ISIs are influenced by RIs. It remains to be explored, though, whether these accounts can be used to explain the effects of different spacing schedules in L2 collocation learning.

2.2 Lag effects and the learning of single words

Motivated by the extent to which the findings of the studies from cognitive psychology could be generalised to other domains, an increasing number of SLA investigations have started to examine the influence of practice distribution on both intentional and incidental learning of L2 vocabulary,¹ mainly focusing on individual words and less so on collocations (Rogers and Cheung 2020a, 2020b; Serrano and Huang 2018, 2021; Snoder 2017).

In relation to intentional learning of single words, Serrano and Huang (2021) analysed the effect of different spacing schedules on vocabulary retention rates in the context of assisted reading. Participants completed five reading sessions, following either a 1-day ISI or a 7-day ISI. They were asked to focus on the target vocabulary (nouns) and answer a set of comprehension questions that also encouraged engagement with the target words. The bilingual-matching delayed posttest measuring meaning recognition was administered at optimal ISI/RI ratios (25 %) for both groups (Rohrer and Pashler 2007).² Results show both spacing schedules contributed to learning and that the shorter-spaced schedule was significantly better than the longer-spaced schedule.

Similarly, Rogers and Cheung (2020a) examined the effect of two spacing schedules on the intentional learning of English adjectives. Cantonese learners of

1 The present study follows Hulstijn's (2003) conceptualisation of intentional and incidental learning. Intentional learning occurs when there is a deliberate focus on the target language. Incidental learning, by contrast, is defined as the learning that occurs when learners are mainly engaged in understanding the content.

2 According to Rohrer and Pashler (2007) the intersession interval should be between 10 % and 30 % of the retention interval in order to capture learning gains fully. More specifically, if learning is measured 10 days after the last session (10-day RI), an intersession interval of one day (1-day ISI) would be 10 % of the RI and therefore, an optimal spacing to assess retention.

English studied the target words following two spacing intervals, spaced-short (1-day ISI) and spaced-long (8-day ISI). Different form-focused teaching techniques, such as choral drilling and completing crossword puzzles, were used. A multiple-choice meaning recognition test was administered 28 days after the last study session, yielding an ISI/RI ratio of 3.6 % for the spaced-short group and 28.6 % for the spaced-long group (see footnote 2). Findings indicate that significant learning occurred in both the spaced-short and spaced-long groups and corroborate those obtained by Serrano and Huang (2021). In a later conceptual replication study (Rogers and Cheung 2020b), and implementing a few methodological changes (e.g., adding a control group, administering a form recall test instead of the meaning recognition test and using a mix of word classes, prepositions, nouns and verbs), the authors reported similar findings.

In a very recent study by Muqailab et al. (2023), learners completed four treatment sessions in which they focused on learning new vocabulary (nouns) intentionally through Quizlet. 1-day ISI or 7-day spacing ISIs were manipulated to examine the effect of time distribution. The results of the delayed form recall and meaning recognition tests showed that both groups were significantly better than the control group and that the spacing did not have any differential effect on the learning rates.

There is also some research, albeit limited, concerning the effect of practice distribution on incidental vocabulary acquisition. Serrano and Huang (2018) investigated the effects of distributed (7-day ISI) and intensive (1-day ISI) practice on the incidental learning of L2 vocabulary. Participants read and listened to a text containing target words either once a day for five days (1-day ISI) or once a week for five weeks (7-day ISI). Using the optimal testing timings for both conditions (25 % ISI to RI ratio, see footnote 2), the delayed bilingual matching posttest measuring meaning recognition was administered 4 days and 28 days after the last session in the two groups. Results show that both groups of participants were able to learn new vocabulary and that longer spacing had a significantly more positive effect on long-term learning gains.

One potential explanation for the different findings in case of incidental learning might be that the 7-day intervals were sufficiently long enough to allow previous memory traces of the target words to become consolidated. This was not the case with intentional learning (specifically in Serrano and Huang 2021) possibly because the decreased memory consolidation expected for the shorter spacing condition (as in line with deficient processing theories) might have been cancelled out by the intentional effort to learn the target vocabulary.

In sum, while providing interesting insights into the potential of time distribution in L2 vocabulary learning, the research reviewed above reports mixed empirical evidence regarding the benefits of spaced encounters. The discrepancy between the

existing studies could be explained by their methodological differences, for example whether the design was within- or between-participants (e.g., Serrano and Hung 2018 vs. Muqailab et al. 2023), or whether retention of knowledge was measured within an optimal time period or not (e.g., Serrano and Hung 2021 vs. Muqailab et al. 2023). In fact, a recent meta-analysis conducted by Kim and Webb (2022), in which the authors concluded that the effect of spacing varied depending on the research design employed, supports this explanation.

More importantly, these previous empirical investigations have primarily focused on single words. Vocabulary is also built from various multi-word combinations including collocations (Schmitt 2010; Wray 2002) that play a key role in attaining second language proficiency (Crossley et al. 2015; Kremmel et al. 2017; Stengers et al. 2011). Thus, there is also a need to look at what effect shorter versus longer practice sessions may have on the learning of these units.

2.3 Incidental acquisition of collocations through reading

This study adopts the frequency-based approach by conceptualising collocations as frequently co-occurring combinations of two words, regardless of the degree of semantic transparency (Boers and Webb 2015; Sinclair 1991). Within this approach, frequency of occurrence plays a major role in the selection of vocabulary items for instruction and helps educators focus on the collocations that have the most value for L2 learners (Dang et al. 2022; Nguyen and Webb 2017).

Various instructional interventions have shown that collocations can be acquired both intentionally and incidentally (see Pellicer-Sánchez 2020 for an overview). However, considering the main aim of this study, this section will solely focus on incidental learning. There is a large number of collocations that learners need to master, however, classroom time is limited to focus on them all (Puimège and Peters 2020; Webb and Nation 2017). For this reason, researchers have recommended incidental vocabulary learning as a key component of principled vocabulary programmes (Nation 2007) and several empirical investigations have been conducted into the value of exposure to L2 input for improving collocational knowledge.

In particular, studies that have examined incidental learning of collocations from reading have concluded that this kind of input has indeed the potential to enhance knowledge of novel collocations, at both recognition and recall levels of mastery. For example, Szudarski (2012) explored the learning of verb-noun collocations through reading short stories. Three tests measuring collocational mastery at both recall and recognition levels show that around 7 % (recall level) and 14 % (recognition level) of collocations were acquired. Likewise, Pellicer-Sánchez

(2017) examined the acquisition of adjective-pseudo-noun collocations during reading short texts. The results of a battery of recognition and recall tests indicated that learning was improved across all knowledge aspects, and that the learning gains were higher for recognition (53 %) than for recall (15 %) of collocations. Focusing on three case studies, Macis (2018) investigated the learning of collocations with both a figurative and a literal meaning (*duplex collocations*). Individual interviews were used to assess the meaning recall of the target items after the reading treatment. Results show gains of between 20 % and 44 %. Furthermore, in one part of their study, Webb and Chang (2022) also focused on the potential of reading (graded readers in particular) on the incidental acquisition of noun-noun and adjective-noun collocations. On average, participants learned around 12 % of the target collocations at the form recognition level. In a longitudinal study spanning over nine weeks, Vu and Peters (2021) explored the impact of reading on the incidental learning of collocations. Participants were instructed to read three graded readers during this period. The authors used a form recall delayed posttest to measure retention. Findings indicate that the reading-only group made significant gains after the treatment (13.8 %). Lastly, with a focus on English for Academic Purposes context, Dang et al. (2022) explored the incidental acquisition of noun-noun and adjective-noun collocations from reading a transcript of an undergraduate lecture. A multiple-choice test was devised to measure the form recognition of the target items. Results demonstrate that reading led to the learning 25.68 % of collocations.

2.4 Lag effects and collocations

Studies exploring the effect of temporal distribution of practice and learning of collocations have examined both spacing and lag effects, albeit to a limited extent. In one of the first studies on the effect of spacing on both incidental and intentional learning of collocations, Macis et al. (2021) found that spacing facilitated the learning of collocations in intentional learning contexts, whereas massing led to better learning outcomes when students learned target collocations incidentally. The authors' explanation for the latter finding was that when the same collocations are encountered shortly one after another in reading, these successive repetitions may increase the chances of noticing and consequently, lead to more learning. Yamagata et al. (2023) provided further evidence about the positive impact of spacing on intentional collocation learning. In their study, it was found that the spaced practice resulted in the largest gains for the target collocations when compared to two massed schedules. Although very informative, the primary aim of these studies was to investigate the spacing effect rather than the effect of the different spaced schedules (lag effect).

Research on how distribution of practice affects acquisition of collocations is extremely scarce and only limited to intentional learning situations. Snoder (2017) investigated the impact of shorter (intensive, Days 1, 2, 4) and longer (expanding, Days 1, 7, 16) spaced practice for the acquisition of verb-noun collocations by Swedish learners of English. Improvements in collocation knowledge were gauged three weeks after the final session by a cued form recall test. This resulted in an RI of 11 % for the intensive group and an RI of 25 % for the expanding group. Results show that the learning gains accrued in both groups and there were no differences between the two groups.

We know of no research that has examined the effect of lags of different lengths between learning sessions in an incidental collocation learning context. It is important to address this research gap because it would indicate how much time needs to elapse between the initial encounter with the new collocation and the subsequent encounters in order to improve collocational learning in the long run.

3 Present study

The current study attempts to examine how different ISIs impact long-term retention of collocations in the context of reading. The study explored the effects of a shorter, 3.5-day spacing schedule (Experiment 1) and a longer, 7-day spacing schedule (Experiment 2). We implemented an “optimal” 25 % ISI to RI ratio (according to Rohrer and Pashler 2007) in both experiments. Thus, we measured the learning gains at an RI of 14 days in Experiment 1 and an RI of 28 days in Experiment 2. Two control groups (one for each experiment) were included as a baseline for comparison. The following research questions were addressed:

RQ1: To what extent does the shorter spacing schedule contribute to long-term incidental learning of collocations at the form recall and meaning recall levels of mastery (Experiment 1)?

RQ2: To what extent does the longer spacing schedule contribute to long-term incidental learning of collocations at the form recall and meaning recall levels of mastery (Experiment 2)?

Based on the previous research on single words and collocations (e.g., Serrano and Huang 2018; Snoder 2017), we hypothesised that our findings would support the results reported in these studies. More specifically, we expected that both shorter and longer spacing schedules would improve retention of collocations at both the form recall and meaning recall levels of sensitivity.

4 Experiment 1: shorter spacing (3.5-day gap)

4.1 Methods

4.1.1 Participants

The participants were 73 Arabic EFL learners who were undergraduate students at the College of Translation and Languages at a university in Saudi Arabia. They were 21 years old on average ($M = 20.97$, $SD = 0.91$, $Minimum = 19$, $Maximum = 24$) and they started learning English between the ages of 5 and 20 years ($M = 11.84$, $SD = 3.66$).

The participants came from four intact classes. Two classes were randomly assigned to the experimental group ($n = 37$) and the remaining two to the control group ($n = 36$). The participants took the V_YesNo online vocabulary test (Meara and Miralpeix 2017; maximum score = 10,000) as a rough measure of proficiency. Their results ranged between 2,299 and 8,272 ($M = 5,064.85$, $SD = 1,446.14$), showing an intermediate to good command of English. The vocabulary score was included as a covariate in the analysis (see below).

4.1.2 Materials

4.1.2.1 Target items

All the materials used for the present research were adopted from Macis et al. (2021). The target items were twenty-five adjective + noun collocations, all composed of high-frequency (1K and 2K) component words. The collocations had a COCA frequency of at least 50, a BNC frequency of at least 10, and a Mutual Information (MI) score of 3+ in both corpora (Nguyen and Webb 2017). They were also all incongruent (i.e., different than those acceptable in the participants' L1). We operationalised incongruent collocations as L1 phrases whose literal translations were not acceptable in the L2 (Gyllstad and Wolter 2016, see Macis et al. 2021 for more details). For example, the English collocation *dead silence* was considered incongruent because the literal translation does not yield an acceptable collocation in Arabic (Arabic speakers use an equivalent of *pure silence* instead). The target collocations had different degrees of transparency (as shown by the transparency task conducted in the original study by Macis et al. 2021), and these transparency scores have also been included as a covariate in the analysis. See Appendix A for the complete list of the target collocations and their characteristics.

4.1.2.2 Reading texts

The reading materials were also borrowed from Macis et al. (2021) (see the original paper for more details). There were five short stories ranging from 691 and 697 words in length. The target items were embedded into these stories, whereby each collocation appeared once (unenhanced) in each story resulting in a total of five repetitions per collocation. Five exposures were chosen because previous studies have shown that at least five encounters appear to be required to learn a collocation (Serrano and Huang 2018; Webb et al. 2013). To ensure adequate unassisted reading comprehension, we controlled for lexical coverage in all stories with 98 % of the words (excluding proper nouns) coming from the most frequent 2,000 word families in English (Nation 2012). As the participants' vocabulary scores indicated familiarity with the 2,000 most frequent words in English, we assumed that the participants would not experience any comprehension problems. Finally, after each story, multiple-choice questions were included to check the participants' general comprehension. These questions did not contain the target collocations. A full set of treatment materials is available in Appendix F. The average post-treatment comprehension score of the experimental group (across the five sessions) was high (4.80 out of 5.00, *Min* = 3.8, *Max* = 5.00, *SD* = 0.25), indicating excellent understanding.

4.1.3 Vocabulary measures

The participants' vocabulary gains were assessed at the form recall and meaning recall levels of collocational competence. We decided to do so because assessing two different aspects of vocabulary knowledge may provide a more complete picture of collocational competence (Szudarski and Carter 2016; Yamagata et al. 2023). The form recall test, that was adopted from Macis et al. (2021), measured the participants' ability to recall the form of the adjective component of the target collocation. It was a cued gap-fill test in which the participants saw short sentences that consisted of the noun node with the missing adjective (Appendix B). To restrict alternative acceptable answers, the cues included the number of characters and the first one or two letter(s) of the target adjective. The target collocations were presented in bold. An example of the collocation *final leg* is as follows:

After taking two planes and two buses, he arrived in London and took a taxi for the **f_____leg** of his long journey home.

To avoid any potential comprehension problems, any lexical item that fell outside the 2,000 most frequent word families was translated into Arabic in the margins. The instructions, provided in both in English and Arabic, asked the participants to fill in the gaps with a correct adjective taking into account the first letter(s) and the

numbers of spaces provided. An example item was also included. The reliability of the form recall test was calculated on the basis of the pretest scores (Cronbach alpha = 0.79) and posttest scores (Cronbach alpha = 0.92) and was deemed to be acceptable (see Plonsky and Derrick 2016).

The second measure was a meaning recall test that measured the participants' ability to recall the meaning of the target collocations (Appendix C). The participants saw the same 25 target collocations (bolded and underlined) that were embedded in non-defining contexts. To control for a test-retest effect, the collocations were presented in a different order in the two tests. The sentences were initially created by the first author and then piloted to ensure that the contexts were non-defining.

The participants were instructed to provide the meaning of the highlighted collocations by either providing a definition, a synonym or an explanation in either English or Arabic. These instructions were provided in both English and Arabic. An example of a collocation from the meaning recall test is provided below:

The **final leg** was the hardest.

Similarly to the form recall test, potentially unknown words were translated into Arabic under the sentences in which they appeared. The reliability score of the meaning recall test was also computed and found to be acceptable both in the pretest (Cronbach alpha = 0.70) and posttest (Cronbach alpha = 0.75).

4.1.4 Procedure

The entire study lasted for six weeks. Learners were randomly assigned to two conditions: the 3.5-day ISI group (experimental group) and the control group. The experimental group had treatment sessions twice a week, on Sundays and Wednesdays, over a period of three weeks.

The V_ YesNo test and the pre-tests were administered to both groups fourteen days prior to the main phase of the experiment. The form recall test was completed first, then the meaning recall test. The main treatment consisted of five sessions and each session lasted 15 min. During each session, we asked the participants to read a story and focus on the content and then answer a few comprehension questions. In each session, after the participants finished reading, the sheets containing the story were collected to minimise any extra exposure, and then the sheets containing multiple-choice comprehension questions were distributed. Following a 25 % ISI to RI ratio, the delayed posttests (which were identical to the pre-tests) were administered fourteen days after the last, fifth session. We opted for delayed posttests only to control for test-retest effect as a potential confounding variable (Macis et al. 2021; Rogers and Cheung 2020b; Suzuki 2017).

Participants in the control group did not participate in the intervention phase. They only took the pre-tests and the delayed post-tests and completed a language background survey. During the treatment period, they followed their normal classes. Table 1 below depicts the procedure of the experiment.

4.1.5 Scoring and data analysis

The responses on the gap-fill test were scored either as 1 if they were correct or 1if they were misspelled or wrongly affixed but recognisable, (*naitive* instead of *native* or *little* instead of *little*, e.g., Maci et al. 2021; Sonbul and Schmitt 2013).³ Incorrect answers were scored as 0. In the meaning recall test, we asked the participants to use either English or Arabic to explain the meaning of the target collocations by providing definitions, synonyms or explanations. Most of them translated the target items, very few wrote explanations in Arabic, and even fewer wrote explanations in English. The second author devised an answer key with all the possible and acceptable translations and explanations (in Arabic and English). An Arabic speaker of English then marked the responses against this answer key as either correct (1) or incorrect (0). Finally, 20 % of the responses from both tests were checked by the second author. Inter-rater reliability score was high both for the form recall test ($ICC = 0.98$, $CI [0.97, 0.98]$) and for the meaning recall test ($ICC = 0.92$, $CI [0.91, 0.93]$), indicating reliable scoring. Thus, in the analysis we only used the scores which were given by the first rater.

For each test, we calculated the raw gains to account for pre-knowledge of the target items. The gain scores were categorised as (0) = no learning, (1) = learning, as follows:

Table 1: Procedure of Experiment 1.

Timing	Activities	Length
Week 1	V_ YesNo test and the pre-tests	60 min
Weeks 1–2	Gap	
Weeks 3–5 (main intervention following a 3.5-day ISI ^a)	Reading short stories (10 min) + comprehension questions (5 min)	15 min
Weeks 5–6	Gap	
Week 6	Posttests and the language background survey	40 min

^aParticipants who missed any reading sessions were given an option to take these the following day.

³ We have also redone the analysis following a strict scoring procedure (i.e., only answers with perfect spelling and morphology are scored 1). Results were exactly the same as those reported in the manuscript for both experiments.

- if the pretest score is zero, and the posttest score is zero, then gain score is zero.
- if the pretest score is zero, and the posttest score is one, then gain score is one.
- if the pretest score is one, and the posttest score is one, then gain score is zero.
- if the pretest score is one, and the posttest score is zero, then gain score is zero.

The analysis was carried out in R version 4.1.1 (R Core Team 2021). A mixed-logit regression model was fit with the gain scores (0/1) as the binary dependent variable. Two models were fit: one model for the form recall scores and one for the meaning recall measure. The focal independent variable was Condition (experimental vs. control, with control being the reference level). We included the total pre-test score per participant as a covariate in the model. This was intended to partial out any potential pre-existing differences in knowledge. We also included several item-related variables (length of Word 1, length of Word 2, log frequency of Word 1, log frequency of Word 2, log collocation frequency, and transparency rating). Only one participant-related variable (vocabulary scores) was included in the analysis to control for its effect. We transformed frequencies and the score in the vocabulary test to logs to minimise skewness. The random structure included random intercepts for items and participants and random by-item slopes for Condition.

An initial model was created using only the dependent measure and random variables. Fixed effects were then added step-by-step in the following order: item-related factors, vocabulary score, pretest total scores and the main Condition factor. Finally, the Condition x vocabulary score interaction was checked. Likelihood ratio (X^2) tests were used to check whether including a new predictor led to significant improvement in the model against the previous one. We used odds ratios to gauge how strong each significant predictor was in the model. Finally, we calculated Cohen's d values to estimate effect size. We calculated the marginal and conditional R^2 values for each best-fit model using the *rsq.glm* function in the *rsq* package. All best-fit models were checked for collinearity with no issues (VIF, or variance inflation factor values were below 2) (Appendix D).

4.1.6 Results

4.1.6.1 Raw gains

Table 2 presents the gain scores in both measures. The form recall measure shows a clear advantage of the experimental group over the control group with gains of around 35 percentile scores over and above the control group (i.e., 9 collocations out of the target 25 were learned at the form recall level).

The meaning recall measure shows gains of the experimental group of around 13 percentile scores over and above the control group (i.e., the meaning of 3 additional collocations was correctly recalled after the treatment).

Table 2: Gain scores in both measures (Experiment 1, $n = 73$).

Measure	Condition	Learning (1)	%	No learning (0)	%
Form recall	Control ^a	36	4.00	864	96.00
	Experimental ^b	365	39.46	560	60.54
Meaning recall	Control ^a	76	8.44	824	91.56
	Experimental ^b	200	21.62	725	78.38

^aMax score = 900 ($n = 36 \times k = 25$). ^bMax score = 925 ($n = 37 \times k = 25$).

4.1.6.2 Form recall analysis

Table 3 presents the best-fit model for variables predicting the form recall gain scores. Two item-related variables contributed to the model: the frequency of word 2 and its length, with an increase of 1 letter and 1 log frequency point being associated with a decrease of around 80 % in the likelihood of gaining knowledge of the target collocation correctly. On the other hand, none of the participant-related variables significantly improved the model. The main variable (Condition) had a significant and very large effect on posttest scores; the experimental group was 17 times more likely to produce a correct response in the posttest than the control group. Most importantly, the results showed no main effect of vocabulary score or a significant interaction between vocabulary score and Condition.

4.1.6.3 Meaning recall analysis

The best-fit model for the meaning recall gain scores is presented in Table 4. The pretest score was a significant predictor with a 1 score increase in the pre-test being associated with a decrease of around 66 % in recall gains in the post-test (small effect). In addition, vocabulary score was a significant predictor with a participant

Table 3: Summary of the best fit mixed-logit regression model, form recall, Experiment 1 ($n = 1825$, log-likelihood = -754.5 , conditional $R^2 = 0.26$, marginal $R^2 = 0.20$).

	Estimate	SD	z Value	Pr(> z)	Exp (β)	($\approx d$)
(Intercept)	-3.33	0.20	-16.67	<0.001***	0.04	-1.84
Log Word 2 frequency	-0.21	0.08	-2.85	0.004**	0.81	-0.12
Word 2 length	-0.17	0.08	-2.25	0.02*	0.84	-0.10
Condition: Experimental	2.87	0.22	12.90	<0.001***	17.61	1.58
Random effects						
	Variance	SD				
Item	0.04	0.19				
Participant	0.25	0.50				

glmer (form recall gains ~ Log word 2 frequency + word 2 length + condition + (1|ItemID) + (1|ParticipantID), data, family = 'binomial'). * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Table 4: Summary of the best fit mixed-logit regression model, meaning recall, Experiment 1 ($n = 1,825$, log-likelihood = -722.8 , conditional $R^2 = 0.08$, marginal $R^2 = 0.05$).

	Estimate	SD	z Value	Pr(> z)	Exp (β)	($\approx d$)
(Intercept)	-2.55	0.15	-17.04	<0.001***	0.08	-1.41
Pre-test score (meaning)	-0.42	0.08	-5.42	<0.001***	0.66	-0.23
Log vocabulary score	0.19	0.09	2.17	0.03*	1.21	0.10
Condition: Experimental	1.18	0.15	7.85	<0.001***	3.25	0.65
Random effects						
	Variance	SD				
Item	0.14	0.38				
Participant	0.00	0.00				

glmer (meaning recall gains ~ pre-test score (meaning) + Log vocabulary score + Condition + (1|ItemID) + (1|ParticipantID), data, family = 'binomial'). * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

scoring one log point higher in the vocabulary score being 1 time more likely to learn the meaning of target collocations (small effect). Finally, Condition significantly contributed to the model (medium effect); the experimental group was 3 times more likely to learn collocations after the exposure than the control group. Again, the interaction between Condition and vocabulary score was not significant.

5 Experiment 2: longer spacing (7-day gap)

5.1 Methods

5.1.1 Participants

Sixty-nine Arabic EFL university students (who did not take part in Experiment 1) took part in Experiment 2. They were doing the same degree as the participants in Experiment 1. Their age ranged between 19 and 36 years old ($M = 21.3$, $SD = 2.07$) and they started learning English at an average age of 11 years ($M = 10.91$, $SD = 4.58$).

These students were also recruited from four intact classes. Two classes were assigned to the experimental condition ($n = 34$) and two classes were assigned the control condition ($n = 35$). Participants' scores in the V_YesNo online vocabulary test (Meara and Miralpeix 2017) ranged between 2,078 and 8,789 ($M = 5,131$, $SD = 1,536.98$), which can be roughly interpreted as an intermediate to high level of proficiency. The vocabulary score was included as a covariate in the analysis (see below).

5.1.2 Materials

This experiment used the same materials as Experiment 1. Like Experiment 1, the participants' average post-treatment comprehension score in the experimental group was high (4.69 out of 5.00, *Min* = 3.6, *Max* = 5.00, *SD* = 0.41).

5.1.3 Vocabulary measures

Experiment 2 employed the same form recall and meaning recall measures as those used in Experiment 1. Internal consistency (Cronbach alpha) was calculated for both tests. For the form recall pretest, alpha reached 0.73 and for the posttest, the alpha value was 0.91. As for the meaning recall pretest and posttest, alpha values were 0.68 and 0.70, respectively.

5.1.4 Procedure

Experiment 2 lasted for ten weeks and three days in total. Participants were randomly assigned to the following two groups: the 7-day ISI group (experimental group) and the control group. The 7-day ISI group had treatment sessions once a week. Other than this difference in the intersession intervals, the procedure of Experiment 2 followed that of Experiment 1 very closely (see Table 5). The V_ YesNo test and the pretests were administered seventeen days before the main treatment and we administered the delayed posttests twenty-eight days after the last session, in line with an optimal 25 % ISI to RI ratio (Rohrer and Pashler 2007).

5.1.5 Scoring and data analysis

The scoring procedures followed those detailed in Experiment 1. The scoring for both tests was done by the same rater. One third of the responses were then checked by the second author (same as Experiment 1). Inter-rater reliability score was high

Table 5: Procedure of Experiment 2.

Timing	Activities	Length
Week 1	V_ YesNo test and the pre-tests	60 min
Weeks 1–3	Gap	
Weeks 3–7 (main intervention following a 7-day ISI ^a)	Reading short stories (10 min) + comprehension questions (5 min)	15 min
Weeks 8–10	Gap	
Week 11	Posttests and the language background survey	40 min

^aParticipants who missed any reading sessions were given an option to take these the following day.

both for the form recall test ($ICC = 0.80$, $CI [0.77, 0.82]$) and for the meaning recall test ($ICC = 0.77$, $CI [0.73, 0.80]$), indicating reliable scoring. Thus, similar to Experiment 1, only scores provided by the first rater were included in the analysis.

The analysis procedures followed those in Experiment 1, whereby we fit one mixed-logit model for the form recall scores and another for the meaning recall gains. The fixed and random structures as well as the item-related continuous variables were the same as those in Experiment 1. The log vocabulary score ranged between 7.64 and 9.08 log points (adjusted range = -2.74 – 1.87 , $median = 0.11$). The pre-test form recall score ranged between 1.00 and 15.00 (adjusted range = -1.20 – 2.52 , $median = -0.13$) and the pre-test meaning recall score ranged between 3.00 and 19.00 (adjusted range = -2.69 – 1.60 , $median = -0.01$). No collinearity issues were detected (VIF values were below 2).

5.1.6 Results

5.1.6.1 Raw gains

Gains in both measures are presented in Table 6. In the pretest, the percentage of learned items in the form recall test showed that the gains of the experimental group were over 31 percentile scores over and above the control group (around 8 collocations were learned at the form recall level out of a maximum of 25).

Gains in the meaning recall test, however, were much smaller which might be due to the already high scores in the pretest. The results show experimental gains of only 5 percentile scores over and above the control group (around 1 collocation learned at the meaning recall level after the treatment).

5.1.6.2 Form recall analysis

The best-fit model for the form recall gain scores in Experiment 2 is presented in Table 7. None of the item-related variables showed up as a significant predictor in the model. Only two variables had main effects on posttest scores. The first was the vocabulary score, with a participant scoring one log point higher in the vocabulary score being 1 time more likely to learn the form of target collocations (small effect).

Table 6: Gain scores in both measures (Experiment 2, $n = 69$).

Measure	Condition	Learning (1)	%	No learning (0)	%
Form recall	Control ^a	62	7.09	813	92.91
	Experimental ^b	338	39.76	512	60.24
Meaning recall	Control ^a	115	13.14	760	86.86
	Experimental ^b	152	17.88	698	82.12

^aMax score = 875 ($n = 35 \times k = 25$). ^bMax score = 850 ($n = 34 \times k = 25$).

Table 7: Summary of the best fit mixed-logit regression model, form recall, Experiment 2 ($n = 1,725$, log-likelihood = -776.9 , conditional $R^2 = 0.24$, marginal $R^2 = 0.16$).

	Estimate	SD	z Value	Pr(> z)	Exp (β)	($\approx d$)
(Intercept)	-2.71	0.17	-15.76	<0.001***	0.1	-1.5
Log vocabulary score	0.21	0.10	2.18	0.03*	1.2	0.1
Condition: Experimental	2.25	0.19	11.57	<0.001***	9.5	1.2
Random effects						
	Variance	SD				
Item	0.09	0.30				
Participant	0.24	0.49				

glmer (form recall gains ~ Log vocabulary score + condition + (1|ItemID) + (1|ParticipantID), data, family = 'binomial'). * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

The second was Condition, with also a significant large effect on posttest scores. Participants in the experimental group were over 9 times more likely to learn the form of the target items in comparison to the control group. The interaction between Condition and vocabulary score was not significant.

5.1.6.3 Meaning recall analysis

Table 8 presents the best-fit model for the meaning recall gain scores. The pretest score was a significant predictor with a 1 score increase in the pre-test being associated with a decrease of around 50 % in recall gains in the post-test (small effect). Condition also had a significant medium effect, with participants in the experimental group being almost 3 times more likely to learn the meaning of a collocation in the posttest than participants in the control group. The interaction between Condition and vocabulary score was not significant.

Table 8: Summary of the best fit mixed-logit regression model, meaning recall, Experiment 2 ($n = 1,725$, log-likelihood = -700.6 , conditional $R^2 = 0.09$, marginal $R^2 = 0.05$).

	Estimate	SD	z Value	Pr(> z)	Exp (β)	($\approx d$)
(Intercept)	-2.33	0.15	-15.51	<0.001***	0.10	-1.28
Pre-test score	-0.63	0.08	-7.77	<0.001***	0.53	-0.35
Condition: Experimental	1.01	0.17	5.90	<0.001***	2.75	0.56
Random effects						
	Variance	SD				
Item	0.15	0.39				
Participant	0.03	0.16				

glmer (meaning recall gains ~ pre-test score (meaning) + condition + (1|ItemID) + (1|ParticipantID), data, family = 'binomial'). * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

6 Discussion

The present study set out to examine the extent to which the shorter (3.5-day ISI) and longer spacing schedules (7-day ISI) contributed to the long-term incidental acquisition of collocations at two levels of knowledge: form recall and meaning recall.

To answer the research questions, the results demonstrate that in comparison to the control group, both spacing schedules led to significant learning gains of L2 collocations. The participants in both experiments were able to acquire both the meaning and the form of the new collocations in an incidental learning context. These findings are congruent with previous similar studies showing the positive impact of reading on incidental acquisition of collocations (Dang et al. 2022; Macis 2018; Pellicer-Sánchez 2017; Vu and Peters 2021; Webb and Chang 2022). The present study adds further evidence that reading in an L2 has indeed great potential to enhance collocation gains and that it might be an effective way for increasing mastery of collocations in the long term, especially in case of those learners who have limited exposure to L2 input within EFL contexts (Webb and Nation 2017). Participants in Experiment 1 scored an average of 9 collocations out of 25 in the form recall test and 3 collocations out of 25 in the meaning recall test. In Experiment 2, participants had mean vocabulary gains of 8 collocations out 25 in the form recall test and 1 collocation out 25 on the meaning recall test. While the participants' gains on the meaning recall posttest may seem small, these scores were still significantly better than the control group, which indicates that encountering new collocations incidentally either once or twice a week in written input has potential in enhancing this aspect of collocational knowledge. Further, research suggests that other aspects of vocabulary knowledge about target multiword combinations can also be gained through repeated meaning focused L2 input (Webb and Chang 2022). For example, even though the target items in both experiments were adjective-noun collocations, the participants may still have picked up knowledge of some of the words with which they co-occur (*give* co-occurred several times with *short notice*). Finally, following Nation's (2015) cost/benefit perspective on vocabulary learning, we could argue that the reading sessions we used in the present study are certainly valuable. This is because they lasted only 15 min and still led to significantly positive vocabulary gains at productive levels of mastery.

Another finding worth mentioning is the fact that the scores on the form recall tests in both experiments were higher than the scores obtained on the meaning recall measure. This contrasts the findings from other similar studies (Pellicer-Sánchez 2017; Szudarski and Carter 2016). As already stated, the target collocations in this study were composed of high-frequency words that those mastering the 2,000 word level might have been familiar with. In fact, the results of the meaning recall pretest suggest that participants already high levels of knowledge of the meaning of several

collocations (with scores ranging between 4 and 21 out of 25 in Experiment 1 and between 3 and 19 out of 25 in Experiment 2). Research indicates that knowledge of individual components of collocations can positively affect collocation learning (Webb et al. 2013). Moreover, learners had an opportunity to see the form of the target collocations during the reading treatment as well as in the meaning-recall pretest, which could have helped them perform better in the form-recall posttest (Vu and Peters 2021).

Our findings also align with those on single words (Muqaibal et al. 2023; Rogers and Cheung 2020b; Serrano and Huang 2018) and collocations (Snoder 2017). These studies have found that both shorter and longer ISIs led to significant learning gains on the posttests, thus confirming the value of implementing spacing between schedules.

Although we did not directly compare the two conditions, the effect sizes in the two experiments suggest the shorter-spaced schedule is slightly more effective (form recall Cohen's $d = 1.58$ under short spacing but 1.2 under long spacing; meaning recall Cohen's $d = 0.65$ under short spacing but 0.56 under longer spacing). This finding tentatively supports studies by Serrano and Huang (2021) and Roger and Cheung (2020a), who also found advantage for the shorter-spaced schedule. However, we advise caution when interpreting this claim as the current study was not designed to compare the effect of the two spacing schedules.

The results of the present research could be accounted by the study-phase retrieval and reminding theories (Benjamin and Tulis 2010; Toppino and Bloom 2002) that essentially state that successful retrieval occurs when the intersession intervals are neither too long nor too short. It thus seems that both the 3.5-day and 7-day spacing schedules were 'optimal' in this particular context and led to the long-term learning of collocations. The findings could also be discussed in the light of the encoding variability account (Benjamin and Tullis 2010), according to which contextual differences lead to a greater number of retrieval routes, which consequently facilitates learning in the long run. In each treatment session, a different story (context) was used. In other words, the participants in both experiments had multiple, spaced opportunities to retrieve the form and meaning of previously encountered collocations.

Finally, the results of the mixed-effects analyses show there was no interaction between vocabulary score and condition in either of the experiments. In other words, the positive effect of the treatments (longer and shorter spaced schedules) was omnipresent regardless of the participants' proficiency level. This is not a surprising finding given that we did not compare the experimental groups directly. Our comparison was mainly between the experimental group (who had exposure to the target collocations) and the control group (who did not receive any exposure) in each experiment.

7 Implications for teachers

The current research has important implications for teachers. First, results unsurprisingly point to the importance of repetition and revision. Second language learners need to build up a large repertoire of collocations to operate successfully in English (Schmitt 2010), thus engaging in repeated practice is a key factor for facilitating the learning of these multi-word combinations (Pellicer-Sánchez 2020). More importantly, our findings tentatively suggest that it does not matter whether teachers review previously taught material once or twice a week as both spacing schedules seem to be equally beneficial for learning. Therefore, to maximise incidental uptake of collocations from reading, teachers should provide opportunities for learners to frequently encounter target vocabulary in written texts. This could be achieved by asking students to read graded readers in an extensive manner. This means that students read large quantities of written material that are well within their proficiency level over a longer period of time. Graded readers seem to be particularly well suited for this purpose as they are written with a controlled vocabulary that is likely to be repeatedly encountered (Nation and Wang 1999). Research has shown that collocations that are encountered more frequently in graded readers are more likely to be learned than those that are encountered with less frequency (Vu and Peters 2021). Moreover, studies examining L2 incidental vocabulary acquisition through reading multiple texts indicate that reading several texts may result in higher learning gains than reading a single text (e.g., Horst 2005; Webb and Chang 2015), which indicates that extensive reading of graded readers can be a very efficient source for improving L2 learners' collocation knowledge.

8 Limitations and further research

Inevitably, this study suffers from a number of limitations. We used different ISIs and RIs, which did not allow us to make direct comparison between the conditions. Future research should look at how different spacing schedules can affect learning when knowledge is tested at the same times for all conditions involved. We also did not use any memory flushing exercises between the form recall and meaning recall tests, which might have led to some contamination. A further point related to test contamination is that the form recall posttest may have been biased by the fact that the participants had already seen the form of the target collocation in the meaning recall pre-test. We included the control group to minimise this bias to some extent, however future studies should take this issue into consideration when designing multiple tests. Finally, the current research only examined adjective-noun collocations but other kinds of multiword sequences also deserve attention.

9 Conclusions

The present study explored the effect of two different spacing schedules on the long-term incidental acquisition of adjective-noun collocations. Results show that both schedules led to significant gains (in comparison to the respective control groups), and that the timing of the review or the testing did not significantly affect learning. Overall, the present study demonstrates the pedagogical relevance of both shorter and longer practice in incidental learning contexts.

Appendices

Appendix A: Target collocations

No.	Collocation	BNC collocation frequency	BNC MI score	COCA collocation frequency	COCA MI score
1.	Soft drink	49	6.74	555	8.08
2.	Natural leader	19	3.9	94	3.79
3.	Short notice	253	7.15	475	6.79
4.	Native tongue	30	8.94	257	8.05
5.	Dead silence	14	4.43	180	5.31
6.	Blank expression	12	6.68	78	7.4
7.	Poor taste	20	5.08	125	5.17
8.	Little chat	40	5.65	91	4.42
9.	General public	721	5.6	2,653	5.55
10.	Loving home	11	3.93	72	3.67
11.	Final leg	32	5.34	98	5.01
12.	Hard line	66	3.65	487	3.61
13.	Great pain	53	3.99	214	3.18
14.	Broken promises	16	7.13	255	8.48
15.	Painful death	11	4.87	75	4.85
16.	Sick joke	19	7.69	70	6.52
17.	Heavy smoker	27	10.61	56	8.81
18.	Low opinion	55	5.46	79	3.92
19.	Dark secret	26	5.21	146	4.66
20.	Strong interest	60	3.79	302	4.44
21.	Fine art	297	7.23	1,313	6.61
22.	Small comfort	15	3.4	92	3.79
23.	Sad fact	52	5.41	148	4.38
24.	White noise	28	4.74	343	5.2
25.	Easy walk	19	3.7	81	3.09

Appendix B: Form recall test sample

Instructions

The test below aims to assess your knowledge of 25 adjective-noun collocations (words that usually co-occur together), for example ‘*large amount*’. The first word of each collocation is missing. In that space, you need to write down the adjective (a word that describes a person or thing) that usually co-occurs with the given noun in the context provided. The dashes represent the number of letters of each missing adjective. The first letter(s) of each adjective and the Arabic translations for the underlined are provided to assist you.

Example:

We have a l _ _ _ _ **amount** of money that we can spend. (answer: *large amount*) spend: بصرف

Please try your best and answer all items. Also, please stick to the first letter(s) and the number of missing letters provided for each adjective.

Thanks very much for your participation!

التعليمات

يهدف الاختبار أدناه إلى تقييم معرفتك بـ 25 مترادفة لفظية (الكلمات التي عادة ما تظهر سوياً) مؤلفة من صفات و أسماء، مثلاً ‘*large amount*’. الكلمة الأولى من كل مترادفة تم حذفها. المطلوب منك هو تعبئة الفراغ بالصفة (كلمة تصف إنسان أو جماد) التي عادة ما تظهر مع الاسم المحدد في السياق المقدم. الشروط تمثل عدد الحروف لكل صفة مطلوبة. لمساعدتك، تم توفير الحرف الأول (الحروف الأولى) من كل صفة والترجمة العربية للكلمات الموضوع تحتها خط.

مثال:

We have a l _ _ _ _ **amount** of money that we can spend. (*large amount* الإجابة) spend: بصرف

نرجو بذل ما في وسعك للإجابة على جميع الفقرات. أيضاً، يرجى الإلتزام بالحرف الأول (الحروف الأولى) و بعدد الشروط المتوفرة لكل صفة.

شكراً جزيلاً لمشاركته.

Sentence	Arabic translation
1. If you want to learn how to create beautiful objects such as paintings, the University of London offers a degree in f _ _ _ art .	
2. They knew they were going to lose their jobs, so the manager’s kind words were nothing more than a sm _ _ _ comfort to them.	
3. In the world cup next year, Pepsi is going to be the <u>official</u> s _ _ _ drink .	<u>Official</u> : رسمي

(continued)

Sentence	Arabic translation
4. Her husband showed no <u>emotion</u> and she was really angry at his b _ _ _ _ expression .	<u>Emotion</u> : شعور
5. There are thousands of hungry children in the world but the <u>media</u> hides this very s _ _ fact .	<u>media</u> : وسائل الإعلام

Appendix C: Meaning recall test sample

Instructions

In this test, you will see 25 sentences that contain 25 collocations (pairs of words that usually co-occur together) which are underlined and emboldened. You need to provide the meaning of only these word pairs (not the whole sentences) in the spaces provided below each sentence. You can use either English or Arabic and you can explain the meaning by providing a definition, a synonym or an explanation. Try to be as specific as possible.

Please bear in mind that the meanings of some of these collocations are not always related to the individual words. For example, the collocation ‘*blue eyes*’ literally means ‘*eyes that are blue*’. However, the collocation ‘*tall order*’ is not related to the meanings of ‘*tall*’ or ‘*order*’ but instead, refers to ‘*a task that is difficult to do*’ (مهمة شاقة).

Example:

*The doctor recommended that James follow a **healthy diet** to help him lose weight.*

Answer: ____ a healthy diet involves eating a variety of fruits, vegetables and whole grains and consuming less processed food _____

variety: أنواع متعددة; grains: الحبوب; consuming: استهلاك

Thank you very much for your participation!

تعليمات

ستقرؤون في هذا الاختبار ٢٥ جملة تحتوي على ٢٥ متلازمة لفظية تحتها خط ومكتوبة بخط عريض. عليكم أن تكتبوا معاني هذه المتلازمات اللفظية فقط (وليس الجملة كاملة) في الفراغ أسفل كل جملة. يمكنكم كتابة إجاباتكم باللغة العربية أو الإنجليزية، كما يمكنكم شرح المعنى من خلال كتابة تعريف أو مرادف. نرجو تحري الدقة في تزويدنا بالمعنى قدر المستطاع.

نرجو الانتباه أن معاني بعض هذه المتلازمات اللفظية غير مرتبطة بالمعاني الحرفية للكلمات المكونة لها، فعلى سبيل المثال: المتلازمة اللفظية *'blue eyes'* تعني حرفياً 'العيون الزرقاء'، في حين لا ترتبط المتلازمة اللفظية *'tall order'* بالمعنى الحرفي لكلمتي 'أمر' و 'طويل'، حيث تعني 'مهمة شاقة'.

شكراً جزيلاً لمشاركتك.

1. The **final leg** was the hardest.

2. I was surprised by his **low opinion**.

3. Mary and Jenna share the same **native tongue**.

4. It all still seems a **sick joke**.

5. Everything was done at **short notice**.

Appendix D: A summary of continuous variables (Experiment 1)

Variable	Range (adjusted range)	<i>Mdn</i>
Log collocation frequency	2.40–6.58 (–1.15–2.90 log units)	–0.24
Log word 1 frequency	2.64–6.43 (–1.96–1.70 log units)	0.26
Log W2 frequency	0.61–6.21 (–2.95–1.65 log units)	0.06
W1 length	3.00–7.00 (–1.71–1.78 characters)	0.03
W2 length	3.00–10.00 (–1.48–2.70 characters)	–0.29
Transparency rating	2.10–6.40 (–1.86–1.25)	0.02
Log vocabulary score	7.74–9.02 (–2.54–1.81 log points)	0.08
Pre-test score (form)	0–18.0 (–1.46–3.31 scores)	–0.40
Pre-test score (meaning)	4.00–21.0 (–2.43–2.14 scores)	0.01–

The second column shows the range of the variables. The adjusted range after centering, is presented in parentheses. Medians refer to the predictor values in the models. All variables are centred, and their means are zero.

Appendix F: Full treatment materials

Session 1

Incidental massed

Name: _____ ID: _____

Instructions:

Please read the following 4-part story once within 15 min and try to pay attention to the content as there will be some comprehension questions at the end. Please note that you will have to answer the comprehension questions without looking back at the text.

التعليمات:

المرجو قراءة القصة التالية والمكونة من أربعة أجزاء مرة واحدة خلال 10 دقائق. حاولي التركيز على المضمون حيث ستكون هناك أسئلة فهم في النهاية. المرجو ملاحظة أنه سيتوجب عليك الإجابة على أسئلة الفهم بدون النظر إلى النص مرة أخرى.

The story

Layla at university

Layla was a beautiful lady. She studied a degree in art at Cambridge. Her house was very close to the university, just a short walk away. She lived with her husband and their four children. She was happy with her studies and wanted to become a famous designer.

She was very interested in art and her dream came true when she joined the School of Arts at Cambridge. She had always kept this dream from her family and friends. Whenever someone asked her about the university she would like to join, there was often a dead silence on her part. As she was a natural leader, she made good relationships at the university, always helping students whose native tongue was not English or those who were getting a short notice to leave their homes because they didn't pay their rent. She also helped on special health days such as the 'No Soft Drink' day and the 'Cancer Awareness' Day.

Layla at home

Layla was a perfect mother. She cared a lot about her family and children. Her husband was from Italy and his native tongue was Italian. But he was not supportive. He always said that he would change, but this never happened. He was a soft drink addict, spending most of their money on it. They were in serious debt and were given short notice to pay the money back before the end of the month. Whenever she started a conversation on these issues, he replied with a dead silence and couldn't look her in the eyes. She seriously thought of leaving him as she couldn't stand the situation anymore. She was a natural leader and kept telling herself that she should now leave him, but she couldn't take this step in their relationship.

She said that she had always dreamt of a quiet life but after spending so many years with this man, she was losing her mind. She was certain that they would not be able to break the dead silence in their relationship. She finally gave him short notice of one month either to change or to get divorced. She was happy to see him finally changing. He was more careful about their money and stopped drinking that type of soft drink which he had wasted so much money on.

Layla at work

When Layla finished university, she started working as a designer in a big company. She really loved her job. Because she was a natural leader and could speak many languages in addition to her native tongue, she was given a managerial position in the company.

But the company soon faced serious problems and the owner was thinking of firing some employees. She was given a short notice period of one month to leave the company as, they said, they did not like her work! She couldn't believe it. There was a dead silence of a minute or two on her last visit to the company. She could not understand many of the owner's words as his native tongue was not English. Finally, she decided to accept that her days in the company were coming to an end. Because of her emotional pain, she had a large amount of her favourite soft drink. She tried not to give up. She kept telling herself that she was a natural leader and could easily find a better job.

Layla's death

After losing her job, Layla got cancer. Her voice said a lot about what she had been going through. She couldn't even enjoy her favourite soft drink anymore. She went to the hospital to have a brain scan.

Her treatment soon started. Since she was a natural leader, she kept on fighting and gave the others in the hospital hope. But the cancer had actually spread throughout her body and was now at an advanced stage, the doctor said. It took Layla's family some time to understand what the doctor said as his native tongue was not English. Their understanding was followed by a dead silence as they were given very short notice of the operation. Finally, after months of suffering, Layla died in the hospital.

Name: _____ ID: _____

Instructions:

Now, answer the following questions about the story you have just read. There is only one possible answer for each question.

التعليمات:

الآن المرجو الإجابة على الأسئلة التالية حول القصة التي قرأتها قبل قليل. هناك إجابة واحدة فقط صحيحة لكل سؤال.

1. The story is mainly about _____.
 - a. Layla's different jobs
 - b. Layla and her life story
 - c. Layla's children and their problems
 - d. Layla's travels around the world
2. Which one of the following points is true according to the story?
 - a. Layla has always dreamed of studying medicine.
 - b. Layla and her husband have always lived a wonderful life.
 - c. Layla studied at Cambridge and lived there.
 - d. Layla's husband was very careful with their money.
3. According to the story, Layla _____.
 - a. worked in a big hospital
 - b. was a teacher
 - c. didn't have children
 - d. could speak many languages
4. How did Layla feel about losing her job?
 - a. She was angry and shouted at her boss.
 - b. She was sad and could not overcome the pain.
 - c. She did not really care as she had another job.
 - d. She was happy because she did not like it.
5. Layla died of _____.
 - a. lung infection
 - b. cancer
 - c. heart disease
 - d. AIDS

Incidental spaced

Name: _____ ID: _____

Instructions:

Please read the following 4-part story once within 10 min and try to pay attention to the content as there will be some comprehension questions at the end. Please note that you will have to answer the comprehension questions without looking back at the text.

التعليمات:

المرجو قراءة القصة التالية والمكونة من أربعة أجزاء مرة واحدة خلال 10 دقائق . حاولي التركيز على المضمون حيث ستكون هناك أسئلة فهم في النهاية. المرجو ملاحظة أنه سيتوجب عليك الإجابة على أسئلة الفهم بدون النظر إلى النص مرة أخرى.

The story

Layla at university

Layla was a beautiful lady. She studied fine art at Cambridge. Her house was very close to the university, just a 5 min easy walk. She lived with her husband and their four children. She was happy with her studies and wanted to become a famous designer.

She had a very strong interest in art and her dream came true when she joined the School of Arts at Cambridge. She had always kept this dream from her family and friends as a dark secret. Whenever someone asked her about the university she would like to join, she did not say a word. She made good relationships at the university, always helping international students who didn't understand English well or who had to leave their homes because they didn't pay their rent. She also helped on special health days such as the 'Cancer Awareness' Day.

Layla at home

Layla was a perfect mother. She cared a lot about her family and children. Her husband was Italian but the sad fact was that he spent their money carelessly and was not supportive. He always said that he would change, but she was really fed up with his broken promises which were never kept. He spent all of their money on drinks. They were in serious debt and had to pay the money back to the bank before the end of the month. Whenever she asked him for a little chat to discuss these issues, he gave her a blank expression and then there was often a dead silence. She seriously thought of leaving him as she couldn't stand the situation anymore, but she couldn't take this step in their relationship.

She said that she had always dreamt of a loving home but after spending so many years with this man, she was losing her mind and had a low opinion of herself. Any conversation with her husband became a difficult task that only pushed them further apart. She told him that this was the final leg in their relationship and that he either had to change or she would file for divorce. She was happy to see him finally changing after taking a hard line with him.

Layla at work

When Layla finished university, she started working as a designer in a big company. She really loved her job. Because she was a natural leader and could speak many languages in addition to English, she was given a managerial position in the company.

But the company soon faced serious problems and the owner was thinking of firing some employees. She was given a short notice period of a month to leave the company as, they said, her designs were in poor taste! She couldn't believe it and

thought it was a sick joke. The owner's nice words as she was leaving the company gave her nothing but a small comfort. She could not understand many of the owner's words as his native tongue was not English. Finally, she decided to accept that her days in the company were coming to an end. Because of her emotional pain, she soon became a heavy smoker having more than 20 cigarettes a day. She tried not to give up, telling herself she could easily find a better job.

Layla's death

After Layla lost her job, she got cancer. Her voice said a lot about what she had been going through. She couldn't even enjoy her favourite soft drink anymore. Today, she went to the hospital which was open to the general public, to have a brain scan.

Her treatment started soon. She kept on fighting, but the cancer spread throughout her body and was now at an advanced stage, the doctor said. It took Layla's family some time to understand what the doctor had said as his English was not very clear. When they understood him, there was nothing to say. They felt that the disease was eating away at Layla even faster now. Because of her great pain, she could only go to sleep in the white noise of the air conditioner. Finally, her disease led to a painful death, but her soul can now rest in peace.

Name: _____ ID: _____

Instructions:

Now, answer the following questions about the story you have just read. There is only one possible answer for each question.

التعليمات:

الآن المرجو الإجابة على الأسئلة التالية حول القصة التي قرأتها قبل قليل. هناك إجابة واحدة فقط صحيحة لكل سؤال.

1. The story is mainly about _____.
 - a. Layla's different jobs
 - b. Layla and her life story
 - c. Layla's children and their problems
 - d. Layla's travels around the world
2. Which one of the following points is true according to the story?
 - a. Layla has always dreamed of studying medicine.
 - b. Layla and her husband have always lived a wonderful life.
 - c. Layla studied at Cambridge and lived there.
 - d. Layla's husband was very careful with their money.
3. According to the story, Layla _____.
 - a. worked in a big hospital
 - b. was a teacher
 - c. didn't have children
 - d. could speak many languages

4. How did Layla feel about losing her job?
 - a. She was angry and shouted at her boss.
 - b. She was sad and could not overcome the pain.
 - c. She did not really care as she had another job.
 - d. She was happy because she did not like it.
5. Layla died of _____.
 - a. lung infection
 - b. cancer
 - c. heart disease
 - d. AIDS

Session 2

Incidental massed

Name: _____ ID: _____

Instructions:

Please read the following 4-part story once within 15 min and try to pay attention to the content as there will be some comprehension questions at the end. Please note that you will have to answer the comprehension questions without looking back at the text.

التعليمات:

المرجو قراءة القصة التالية والمكونة من أربعة أجزاء مرة واحدة خلال 10 دقائق. حاولي التركيز على المضمون حيث ستكون هناك أسئلة فهم في النهاية. المرجو ملاحظة أنه سيتوجب عليك الإجابة على أسئلة الفهم بدون النظر إلى النص مرة أخرى.

The story

Ali: the child

Ali did not have a happy childhood. His parents argued a lot and then stopped talking to each other. Whenever he tried to get them to sit together for a little chat, they would turn to him with a blank expression on their faces and tell him that there was nothing to say as they were seriously thinking of getting divorced. They were both fed up with their lives. They couldn't provide a loving home for their son. As a child, he always imagined that he lived inside a drama that was in poor taste. He wanted to get out of this helpless situation.

Ali's parents told him that nothing was going to change in his life if they left each other. He looked at them with a blank expression on his face. He was very jealous of families in the general public who lived happily in a loving home. He had given up and stopped asking his parents to sit and have a little chat. He was depressed and felt he couldn't talk to anyone about this.

The teenager Ali

Ali's parents decided to open up to each other in order to deal with all the problems. When they promised him that they would live with no arguments, he couldn't believe it. There was a blank expression on his face that was difficult to explain.

To his surprise, they changed completely. Every day they went for a walk in the neighborhood and had a little chat over different topics. His father was actually a good manager and was trying to use this in managing their relationship. It was always possible to step back to find a solution instead of divorce and Ali couldn't believe that he lived in the loving home he had dreamed of. The drama he thought they were living was not in poor taste anymore. He started thinking of forming a community on Facebook to speak to the general public about how couples could live happily without daily arguments.

Ali in his 30's

Ali met a very nice lady, Noor, at the office. It was difficult for her to talk with people as she could not speak English well. She was what the general public would call 'shy'. Ali helped Noor in her early days at the office and soon became attracted to her. Every day they spent the lunch break together and had a little chat. He was afraid of any relationship because of what he experienced as a child, but he finally decided to marry her. When his mother saw her, she had a blank expression on her face. She thought Ali had poor taste as Noor was not very beautiful.

He ignored what his mother said about Noor, and they got married. Their life was amazing and they made a loving home. They were both interested in history, so they started visiting different countries to see various museums. Some of them were very special and not even open to the general public. He spent all of their money on old paintings that, in Noor's view, were in poor taste. They had not paid the house rent for months now. The house owner told them to pay the rent or leave the house. Ali eventually managed to stop himself from buying more paintings.

Ali in old age

Now, Ali and Noor are both over 65. His health is not very good as he loves drinking Pepsi and smokes a lot. As for Noor, she has difficulty sleeping. She can only sleep while watching TV shows (which are in poor taste in Ali's view) or after a little chat with Ali in which they talk about their memories.

They now live a happy life. Their children and grandchildren visit them every week and always find a loving home open to them. Noor often has dark thoughts about dying in pain, but being a counselor, she knows that these concerns were shared by many people in the general public. One day, Ali was sitting in the garden with a blank expression on his face. He thought about his life as a child and how it completely changed.

Name: _____ ID: _____

Instructions:

Now, answer the following questions about the story you have just read. There is only one possible answer for each question.

التعليمات:

الآن المرجو الإجابة على الأسئلة التالية حول القصة التي قرأتها قبل قليل. هناك إجابة واحدة فقط صحيحة لكل سؤال.

1. The story is mainly about _____.
 - a. Ali's disease that led to his death
 - b. The various stages of Ali's life
 - c. Ali's job as an engineer
 - d. Ali's grandchildren
2. According to the story, when Ali was a child, _____.
 - a. he had a happy, wonderful life
 - b. he lived with his uncle and aunt
 - c. his parents always argued
 - d. he was a noisy, difficult child
3. Ali and Noor met at the _____.
 - a. shopping mall
 - b. office
 - c. hospital
 - d. library
4. Which one of the following points is true according to the story?
 - a. Ali's mother loved his wife (Noor).
 - b. Ali created a WhatsApp group for his family.
 - c. Ali and Noor were both scientists.
 - d. Ali and Noor visited different countries.
5. How did Noor feel about death?
 - a. She was not thinking of it at all.
 - b. She thought it will come peacefully.
 - c. She was really scared of it.
 - d. She hoped that she would die very soon.

Incidental spaced

Name: _____ ID: _____

Instructions:

Please read the following 4-part story once within 10 min and try to pay attention to the content as there will be some comprehension questions at the end. Please note that you will have to answer the comprehension questions without looking back at the text.

التعليمات:

المرجو قراءة القصة التالية والمكونة من أربعة أجزاء مرة واحدة خلال 10 دقائق . حاولي التركيز على المضمون حيث ستكون هناك أسئلة فهم في النهاية. المرجو ملاحظة أنه سيتوجب عليك الإجابة على أسئلة الفهم بدون النظر إلى النص مرة أخرى.

The story

Ali: the child

Ali did not have a happy childhood. His parents argued a lot and then reached a level of dead silence. Whenever he tried to get them to sit together for a little chat, they would look at him sadly and tell him that there was nothing to say as they were seriously thinking of getting divorced. They were both fed up with all the broken promises. Ali didn't feel loved at home. As a child, he always imagined that he lived inside a drama. He wanted to get out of this miserable situation.

Ali's parents told him that nothing was going to change in his life if they left each other, but that only gave him a small comfort. He looked at them very sadly. He was very jealous of other families who lived happily around them. The sad fact was that he started losing hope. He felt that his great pain couldn't be explained in words.

The teenager Ali

Ali's parents decided to open up to each other in order to deal with all the problems. When they promised him that they would live with no arguments, he thought this was just a sick joke and didn't believe it. There was a blank expression on his face that was difficult to explain.

To his surprise, they changed completely. Every day they went for an easy walk in the neighborhood and chatted over different topics. His father was actually a natural leader and was trying to use this in managing their relationship. It was always possible to step back and find solutions to problems before they jumped into the final leg of their marriage. Ali was extremely happy. The drama he always thought they were living was over. He started thinking of forming a community on Facebook to speak about how couples could live happily without daily arguments.

Ali in his 30's

Ali met a very nice lady, Noor, at the office. It was difficult for her to talk with people as her native tongue was not English. She was what you would call 'shy'. Ali helped Noor in her early days at the office and soon became attracted to her. Every day they spent their lunch break together chatting. He was always afraid of any relationship because of what he experienced as a child. He kept his relationship with Noor a dark secret, but he finally decided to marry her. When his mother saw her, she thought Ali had poor taste as Noor was not very beautiful.

He ignored his mother's low opinion of Noor, and they got married. Their life was amazing and they made a beautiful home. They both had a strong interest in history, so they started visiting different countries to see various forms of fine art. Some of the museums they visited were very special and not even open to the general public. He spent all of their money on old paintings that Noor didn't particularly like.

They had not paid the house rent for months. The house owner gave them short notice to pay the rent or leave the house. Ali eventually managed to stop himself from acquiring more paintings.

Ali in old age

Now, Ali and Noor are both over 65. His health is not very good as he loves drinking the soft drink Pepsi and has also become a heavy smoker. As for Noor, she has difficulty sleeping now and can only get to sleep in the white noise of the TV (watching a show that Ali doesn't like) or after she talks to Ali about their memories.

They now live a happy life. Their children and grandchildren visit them every week and always find a loving home open to them. Noor often has dark thoughts of a painful death, but being a counselor, she knows that these concerns are very common to many people of her age. One day, Ali was sitting in the garden staring at the sky. He thought about his life as a child and laughed at how it completely changed as he took the hard line and decided how he wants his life to go.

Name: _____ ID: _____

Instructions:

Now, answer the following questions about the story you have just read. There is only one possible answer for each question.

التعليمات:

الآن المرجو الإجابة على الأسئلة التالية حول القصة التي قرأتها قبل قليل. هناك إجابة واحدة فقط صحيحة لكل سؤال.

1. The story is mainly about _____.
 - a. Ali's disease that led to his death
 - b. The various stages of Ali's life
 - c. Ali's job as an engineer
 - d. Ali's grandchildren
2. According to the story, when Ali was a child, _____.
 - a. he had a happy, wonderful life
 - b. he lived with his uncle and aunt
 - c. his parents always argued
 - d. he was a noisy, difficult child
3. Ali and Noor met at the _____.
 - a. shopping mall
 - b. office
 - c. hospital
 - d. library

4. Which one of the following points is true according to the story?
 - a. Ali's mother loved his wife (Noor).
 - b. Ali created a WhatsApp group for his family.
 - c. Ali and Noor were both scientists.
 - d. Ali and Noor visited different countries.
5. How did Noor feel about death?
 - a. She was not thinking of it at all.
 - b. She thought it will come peacefully.
 - c. She was really scared of it.
 - d. She hoped that she would die very soon.

Session 3

Incidental massed

Name: _____ ID: _____

Instructions:

Please read the following 4-part story once within 15 min and try to pay attention to the content as there will be some comprehension questions at the end. Please note that you will have to answer the comprehension questions without looking back at the text.

التعليمات:

المرجو قراءة القصة التالية والمكونة من أربعة أجزاء مرة واحدة خلال 10 دقائق. حاولي التركيز على المضمون حيث ستكون هناك أسئلة فهم في النهاية. المرجو ملاحظة أنه سيتوجب عليك الإجابة على أسئلة الفهم بدون النظر إلى النص مرة أخرى.

The story

The family and the neighborhood

Ahmad and Rami were brothers. Ahmad was only one year older than Rami. They lived with their parents and a dog. Sadly, they were going to leave London taking their final leg to Brighton. They had always promised that they were not going to leave, so their neighbors were very sad about the family's broken promises. The neighbors felt miserable and had a great pain that could not be explained in words.

Their father decided to move to another city in order to expand his business. He took the hard line and started a new IT company. They told the house owner a month before that they started the final leg of the move. Their house was huge, so they found an Indian maid, Aysha. She would often walk to the nearby shop for the food. Many years later, she got ill and died a painful death, surrounded by their love and care.

At college

As Ahmad had missed one whole year in school because of an illness, Ahmad and Rami completed their final leg of school in the same year and went to college together. They joined the local College of Building Design. They loved buildings and believed that their city needed a lot of work. People in the city agreed the buildings in their city were in a bad state. Everyone was fed up with all the government's broken promises to fix them all. Ahmad and Rami decided to take the hard line and try to improve the situation when they graduated.

At college, both Ahmad and Rami were very popular, but Rami was friendlier. He loved helping his friends whenever it was possible. He liked to give advice on what people can do in a given situation. For example, once he helped a friend who was going through a slow, painful death to get him through an operation. People always wanted to work with Rami. Ahmad was very shy. Rami always pushed Ahmad to open up to people, but he got tired of all his broken promises. Ahmad was not willing to take the hard line and try something different. Even up to graduation, he had great pain in his stomach when faced with a new situation.

After college

Both Ahmad and Rami worked in a company that designed buildings. In the first general meeting for designers, they did not know what to say. Ahmad never had self-confidence, which always stopped him from going forward. However, Rami took the hard line and pushed himself forward to become the manager within three months.

A few months later, the company asked Ahmad to leave. He could not believe it and thought: "This can't be true". As he was leaving the company, Rami promised Ahmad that he would try to find him a better job soon, but this didn't help Ahmad much. He was very depressed and soon started smoking 40 cigarettes a day. He still remembered all of Rami's broken promises that weren't kept. He had great pain and could only sleep three to 4 h a day. Even when his mother was suffering a painful death and wanted to see him, he did not visit her.

Last day

Ahmad's health started worsening. He had great pain in his chest and got fat because he drank lots of Pepsi. He had a serious lung disease. He started thinking of the final leg in his hopeless life. Every night, he had a terrible nightmare where he saw himself experiencing a painful death. Ahmad did not want anyone to feel bad for him, so he took the hard line and decided not to tell anyone about his illness, including his family.

Four months later, he decided to tell his family as he was scared of the idea that he might suffer a painful death alone. He called Rami who came immediately. They didn't speak for a minute or two. His great pain prevented him even from smiling at his brother's face. He died the next day. This was Ahmad's final leg of his life. Rami now regrets all the broken promises which had kept them apart for years.

Name: _____ ID: _____

Instructions:

Now, answer the following questions about the story you have just read. There is only one possible answer for each question.

التعليمات:

الآن المرجو الإجابة على الأسئلة التالية حول القصة التي قرأتها قبل قليل. هناك إجابة واحدة فقط صحيحة لكل سؤال.

1. The story is mainly about _____.
 - a. How a mother saved her two sons
 - b. Two sisters fighting all the time
 - c. Two brothers and their life story
 - d. A father who drinks alcohol all the time
2. The buildings in the city _____.
 - a. were nice and beautiful
 - b. were in good condition
 - c. were very modern
 - d. had many problems
3. Which one of the following points is true about Ahmad and Rami according to the story?
 - a. Both of them were shy in college.
 - b. They were both doctors.
 - c. Only one of them died.
 - d. They joined college in different years.
4. According to the story, Ahmad got depressed because _____.
 - a. he lost his job
 - b. his wife died
 - c. his father was ill
 - d. he didn't have children
5. How did Rami feel when he saw Ahmad in hospital?
 - a. He was happy to see Ahmad in good shape.
 - b. He could not believe how ill Ahmad was.
 - c. He was angry that nobody took care of Ahmad.
 - d. He was sure Ahmad would be fine.

Incidental spaced

Name: _____ ID: _____

Instructions:

Please read the following 4-part story once within 10 min and try to pay attention to the content as there will be some comprehension questions at the end. Please note that you will have to answer the comprehension questions without looking back at the text.

التعليمات:

المرجو قراءة القصة التالية والمكونة من أربعة أجزاء مرة واحدة خلال 10 دقائق. حاولي التركيز على المضمون حيث ستكون هناك أسئلة فهم في النهاية. المرجو ملاحظة أنه سيتوجب عليك الإجابة على أسئلة الفهم بدون النظر إلى النص مرة أخرى.

The story**The family and the neighborhood**

Ahmad and Rami were brothers. Ahmad was only one year older than Rami. They lived in a loving home with their parents and a dog. The sad fact was that they were going to leave London to live in Brighton. They had always promised that they were not going to leave, so their neighbours could not believe that it was going to happen. The neighbors were sad and it was hard to explain the pain they felt.

Their father decided to move to another city in order to expand his business and start a new IT company. They gave the house owner short notice of a month before they moved. Their house was big, so they found a maid, Aysha, whose native tongue was Indian. She often went on an easy walk to the nearby shop for the food. Many years later, she got ill and died, surrounded by their love and care.

At college

As Ahmad had missed one whole year in school because of an illness, Ahmad and Rami completed school in the same year and went to college together. They joined the local College of Fine Art and Design. They both had a strong interest in buildings and believed that their city needed a lot of work. The general public in the city agreed that buildings were in poor taste. The buildings were also in a bad state. Everyone was fed up with all the government's broken promises to fix all of these buildings. Ahmad and Rami decided to improve this situation when they graduated.

At college, both Ahmad and Rami were very popular, but Rami was friendlier. He loved helping his friends whenever it was possible. He was always ready for any little chat with a friend to explain what they should do in a given situation. For example, once he helped a friend who was dying and needed an operation. Rami was actually a natural leader and people always wanted to work with him. Ahmad was very shy. Rami always pushed Ahmad to open up to people, but he got tired. Even up to graduation he had a strange feeling in his stomach when faced with a new situation.

After college

Both Ahmad and Rami worked in a company that designed buildings. In the first general meeting for designers, there was a blank expression on their faces as they did not know what to say. Ahmad's low opinion of his abilities always stopped him from going forward. However, Rami took the hard line and pushed himself forward to become the manager within three months.

A few months later, the company decided to ask Ahmad to leave. He could not believe it and thought: "This must be a sick joke". As he was leaving the company, Rami promised Ahmad that he would try to find him a better job soon, but this only gave Ahmad a small comfort. He was very depressed and soon became a heavy smoker (having 40 cigarettes a day). He was sad and could only sleep in the white noise of the air conditioning. Even when his mother was very sick and wanted to see him, he did not visit her.

Last day

Ahmad's health started worsening. He had great pain in his chest and got fat because he drank lots of his favorite soft drink. He had a serious lung disease. He started thinking seriously of the final leg in his hopeless life. Every night, he had a terrible nightmare where he saw himself dying in pain. Ahmad did not want anyone to feel bad for him, so he kept his illness a dark secret from everyone including his family.

Four months later, he decided to tell his family, as he was scared of the idea that he might suffer a painful death alone. He called Rami who came immediately. There was a dead silence of a minute or two. Ahmad could not even smile at his brother's face because of the pain. He died the next day. This was Ahmad's last day. Rami now can't believe that he allowed small things to keep them apart for years.

Name: _____ ID: _____

Instructions:

Now, answer the following questions about the story you have just read. There is only one possible answer for each question.

التعليمات:
الآن المرجو الإجابة على الأسئلة التالية حول القصة التي قرأتها قبل قليل. هناك إجابة واحدة فقط صحيحة لكل سؤال.

1. The story is mainly about _____.
 - a. How a mother saved her two sons
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 - c. Two brothers and their life story
 - d. A father who drinks alcohol all the time

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 - b. were in good condition
 - c. were very modern
 - d. had many problems
3. Which one of the following points is true about Ahmad and Rami according to the story?
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 - c. Only one of them died.
 - d. They joined college in different years.
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 - a. he lost his job
 - b. his wife died
 - c. his father was ill
 - d. he didn't have children
5. How did Rami feel when he saw Ahmad in hospital?
 - a. He was happy to see Ahmad in good shape.
 - b. He could not believe how ill Ahmad was.
 - c. He was angry that nobody took care of Ahmad.
 - d. He was sure Ahmad would be fine.

Session 4

Incidental massed

Name: _____ ID: _____

Instructions:

Please read the following 4-part story once within 15 min and try to pay attention to the content as there will be some comprehension questions at the end. Please note that you will have to answer the comprehension questions without looking back at the text.

التعليمات:

المرجو قراءة القصة التالية والمكونة من أربعة أجزاء مرة واحدة خلال 10 دقائق. حاولي التركيز على المضمون حيث ستكون هناك أسئلة فهم في النهاية. المرجو ملاحظة أنه سيتوجب عليك الإجابة على أسئلة الفهم بدون النظر إلى النص مرة أخرى.

The story

Alia's problem

Alia was Lebanese and lived in London. She was fat for many years. Since childhood she was eating a lot of hamburgers and drinking Pepsi. Sadly, she was also a heavy smoker and couldn't go an hour without a cigarette. This was the dark secret that she kept from her family.

Her grandfather was also a heavy smoker and died painfully of cancer. Only her grandmother knew about the cancer. This was their dark secret for years. Alia had a low opinion of herself and was spending all her money on her food and cigarettes, but one day she decided to change her unhealthy lifestyle.

She stopped smoking and started going to the gym which was open 24 h a day. Her friend gave her some information about healthy eating. Alia thought it was a sick joke, but seeing her grandfather suffer gave her a strong interest in getting healthier.

Alia's study

When Alia lost weight, she decided to go to university to study arts. She had always had a strong interest in arts, but the university costs increased like some kind of a sick joke. Her parents helped her and she started studying at London University.

Alia's best friend is Mary, who speaks French. Mary has a dark secret, she suffers from depression. She also has weight problems and a low opinion of herself. She feels good when she talks to Alia because Alia was in a similar situation. Mary is alone in London, she doesn't have a lot of money and it is sad that she can't visit her family more often. She misses her parents and her home. She also has two younger brothers, and one of them is a heavy smoker.

Alia's job

Alia and Mary live together. They walk to the university and the gym. Because they both have a strong interest in swimming, they need to save money to go to on holiday. They saw jobs advertised in a coffee shop. During the interviews, the girls had a low opinion of the manager because he wasn't very friendly and made a sick joke about Mary's weight. However, he still had a strong interest in employing them because they could speak another language so both girls got a job.

The manager is not nice and he doesn't want to improve the coffee shop. He gets angry if Alia and Mary talk to the customers. He reduces employees' salary if they arrive late or calls them into his office and tells them they have to leave within a week. People first think it is a sick joke but he is serious. He is also a heavy smoker and is one of those people who has more than one dark secret. When Alia and Mary finish at night, they close the shop, sit down and just listen to the cars and buses passing by.

Alia's husband

The manager is like Alia's ex-husband, who was a heavy smoker as well. He had a strong interest in cars, so he opened his own business. At the beginning, he was so nice to her. But then he started acting very strange. One day, he told her he was leaving her. She first thought it was some kind of a sick joke, but soon realised he was serious. She was sad and cried so much. She remembered all his promises and how they were going to live happily. She had a low opinion of herself and thought she was not good enough for him.

That evening, while she was watching TV, she heard a message tone. She quickly realised her husband had left his phone. She read the message which said: "Hello darling! When am I going to see you again? I really miss you!". Her husband was seeing another girl and had kept this dark secret for a long time. Alia decided to forget about her past and return home to Lebanon. She travelled for 15 h and made the last part of her trip by bus, then walked to her parents' house. She thought they would have a low opinion of her, but they were very happy to see her.

Name: _____ ID: _____

Instructions:

Now, answer the following questions about the story you have just read. There is only one possible answer for each question.

التعليمات:

الآن المرجو الإجابة على الأسئلة التالية حول القصة التي قرأتها قبل قليل. هناك إجابة واحدة فقط صحيحة لكل سؤال.

- The story is mainly about _____.
 - Alia and her son.
 - The problems that Alia faced in her life.
 - How Mary helped Alia to buy a factory.
 - Why Alia and Mary hated each other.
- Which one of the following points is true about Alia and Mary according to the story?
 - Mary had a serious liver disease.
 - Mary was Alia's best friend.
 - Mary and Alia worked in a library.
 - Both Alia and Mary were very thin.
- What did Alia and Mary think of the coffee shop manager?
 - They loved his personality.
 - They did not like him.
 - They hated his appearance.
 - They thought he was attractive.
- According to the story, Alia's ex-husband _____.

- a. worked as a doctor in a hospital
 - b. was seeing another girl
 - c. was very old and ill
 - d. loved playing football all the time
5. Alia's parents house was in _____.
- a. Mexico
 - b. England
 - c. Egypt
 - d. Lebanon

Incidental spaced

Name: _____ ID: _____

Instructions:

Please read the following 4-part story once within 10 min and try to pay attention to the content as there will be some comprehension questions at the end. Please note that you will have to answer the comprehension questions without looking back at the text.

التعليمات:

المرجو قراءة القصة التالية والمكونة من أربعة أجزاء مرة واحدة خلال 10 دقائق. حاولي التركيز على المضمون حيث ستكون هناك أسئلة فهم في النهاية. المرجو ملاحظة أنه سيتوجب عليك الإجابة على أسئلة الفهم بدون النظر إلى النص مرة أخرى.

The story

Alia's problem

Alia was Lebanese and lived in London. She was fat for many years. Since childhood she was eating a lot of hamburgers and drinking Pepsi, her favourite soft drink. Sadly, she was also a heavy smoker and couldn't go an hour without a cigarette. She hid this from her family.

Her grandfather also smoked a lot and died of cancer, it was a painful death. Only her grandmother knew about the cancer for years and didn't tell anybody about this. Alia wasn't confident and was spending all her money on her food and cigarettes, but one day she decided to change her unhealthy lifestyle.

She stopped smoking and started going to the gym that was open 24 h a day to the general public. Her friend gave her some information about healthy eating. Alia thought her friend was joking, but seeing her grandfather suffer made her want to get healthier.

Alia's study

When Alia lost weight, she decided to study fine art at university. She had always had a strong interest in arts but the university was very expensive. Her parents helped her and she started studying at London University.

Alia's best friend is Mary, whose native tongue is French. She has weight problems and suffers from depression. Because of that, she has a very low opinion of herself. She feels good when she talks to Alia because it gives her a small comfort to know that somebody else had been in a similar situation. Mary is alone in London, she doesn't have a lot of money and the sad fact is that she can't visit her family often. She misses her parents and her loving home. She has two younger brothers, and one of them smokes a lot.

Alia's job

Alia and Mary live together. They have an easy walk to the university and the gym. Because they both love swimming, they need to save money to go to on holiday. They saw jobs advertised at a coffee shop. During the interviews, the manager had a blank expression on his face and wasn't very friendly. However, he was still very interested in employing them because they could speak another language so both girls got the job.

The manager is not a nice man and he doesn't want to improve the coffee shop. The furniture is old and in poor taste. He gets angry if Alia and Mary talk to the customers. The manager takes a hard line with employees who arrive late and reduces their salary. Or he calls them into his office for a little chat and tells them they have to leave within a week. It is such short notice that people can't believe he does it; you would not describe him as a natural leader. When Alia and Mary finish at night, they close the shop, sit down in the dead silence and just listen to the white noise of the cars and buses passing by.

Alia's husband

The manager is like Alia's ex-husband, who also smoked a lot. He loved cars, so he opened his own business. At the beginning, he was so nice to her. But then he started acting very strange. One day, he told her he was leaving her. She first thought it was some kind of sick joke, but soon realised he was serious. She was in a great pain and cried so much. She remembered all his broken promises: that they were going to live happily. She had such low confidence that she thought she was not good enough for him.

That evening, while she was watching TV, she heard a message tone. She quickly realised her husband had left his phone. She read the message which said: "Hello darling! When am I going to see you again? I really miss you!" Alia couldn't believe it. Her husband was seeing another girl and had kept this dark secret for a long time. Alia decided to forget about her past and return home to Lebanon. She travelled for 15 h and made the final leg of her trip by bus, then walked to her parents' house, who were very happy to see her.

Name: _____ ID: _____

Instructions:

Now, answer the following questions about the story you have just read. There is only one possible answer for each question.

التعليمات:

الآن المرجو الإجابة على الأسئلة التالية حول القصة التي قرأتها
قبل قليل. هناك إجابة واحدة فقط صحيحة لكل سؤال.

1. The story is mainly about _____.
 - a. Alia and her son.
 - b. The problems that Alia faced in her life.
 - c. How Mary helped Alia to buy a factory.
 - d. Why Alia and Mary hated each other.
2. Which one of the following points is true about Alia and Mary according to the story?
 - a. Mary had a serious liver disease.
 - b. Mary was Alia's best friend.
 - c. Mary and Alia worked in a library.
 - d. Both Alia and Mary were very thin.
3. What did Alia and Mary think of the coffee shop manager?
 - a. They loved his personality.
 - b. They did not like him.
 - c. They hated his appearance.
 - d. They thought he was attractive.
4. According to the story, Alia's ex-husband _____.
 - a. worked as a doctor in a hospital
 - b. was seeing another girl
 - c. was very old and ill
 - d. loved playing football all the time
5. Alia's parents house was in _____.
 - a. Mexico
 - b. England
 - c. Egypt
 - d. Lebanon

Session 5

Incidental massed

Name: _____ ID: _____

Instructions:

Please read the following 4-part story once within 10 min and try to pay attention to the content as there will be some comprehension questions at the end. Please note that you will have to answer the comprehension questions without looking back at the text.

التعليمات:

المرجو قراءة القصة التالية والمكونة من أربعة أجزاء مرة واحدة خلال 10 دقائق. حاولي التركيز على المضمون حيث ستكون هناك أسئلة فهم في النهاية. المرجو ملاحظة أنه سيتوجب عليك الإجابة على أسئلة الفهم بدون النظر إلى النص مرة أخرى.

The story

Mitsuko as a child

Mitsuko is from Japan. He has a father and one brother. His mother smoked a lot and passed away. When Mitsuko was 10 years old, his family moved to New York. Although Mitsuko's first language was Japanese, the sad fact is that he didn't speak it well because his family spoke English at home.

They lived in a tiny house and took small comfort in the fact that the house was within an easy walk of a big park and next to the Museum of Art. The park was beautiful, like a piece of fine art. Sometimes Mitsuko just liked to sit on the grass listening to the white noise of the wind moving the trees gently. Mitsuko and his friends loved playing in the park and visiting the museum that was open to everybody. They liked to observe paintings silently and to listen to the white noise of the people walking by.

Mitsuko and Tom

Tom was Mitsuko's best friend. Although Tom's family was wealthy and had a huge house that was also within an easy walk from the park, they were not happy. Tom's father had a giant company that sold Pepsi. But the sad fact was that he loved to spend his money on luxurious cars and pieces of fine art instead of his family. Mitsuko's dream was to make enough money to buy his father a better house and a car, but the sad fact was that he always thought he couldn't do it and that it would be nearly impossible to be wealthy.

Tom liked to make jokes. One day, he asked Mitsuko and his brother to come to his house urgently. When they arrived, Tom showed them a dead cat that he had put in his mother's freezer for her to find. When Mitsuko saw the cat, he was shocked. He didn't say anything and the only sound that could be heard was the white noise coming from the freezer. Mitsuko told Tom he thought his joke wasn't funny. When Tom's mother found the cat, she was upset and punished him by not letting him play football with his friends for a month. Tom, however, took a small comfort in the fact that he made his mother so angry.

Mitsuko and art

Mitsuko was interested in fine art, and he lived within an easy walk from the Museum of Art. On his last visit to the museum, he saw a painting of a renowned artist with a big face and a cigarette in his mouth; the sad fact was that the artist had a drinking problem until his death in 1970. Mitsuko was very interested in the artist and took small comfort in the fact that the artist had also moved from one country to another when he was 10.

Mitsuko was working at the local gym to save money for a degree in fine art. His customers were unfit and he really enjoyed working with them. He took a small comfort in knowing he was improving their quality of life. Mitsuko loved working in the gym and the white noise of the fitness machines helped him relax after the exercise. After work, he would take an easy walk back home.

Mitsuko, Lena and the race

One of his customers, Lena, also had a degree in fine art. After a bitter divorce, the sad fact was that she gained weight and promised to herself too many times to get healthy again. She talked to Mitsuko and he entered her into a race. She was going to change her old habits completely.

On the day of the race, there were many people and Mitsuko and Lena were excited. The sound of the crowd was like white noise which made them run even faster. As they entered the last part of the race Mitsuko felt a pain in his left leg. When they crossed the finish line, Mitsuko slowed to an easy walk. They found a first aid area, and Mitsuko entered to have his leg examined. They gave him some pain relief, which was of small comfort to the agonizing pain in his leg.

Name: _____ ID: _____

Instructions:

Now, answer the following questions about the story you have just read. There is only one possible answer for each question.

التعليمات

الآن المرجو الإجابة على الأسئلة التالية حول القصة التي قرأتها قبل قليل. هناك إجابة واحدة فقط صحيحة لكل سؤال.

1. The story is mainly about _____.
 - a. Mitsuko's new computer company
 - b. A girl who speaks Japanese only
 - c. The life of a Japanese boy
 - d. A doctor in New York
2. Which one of the following points is true according to the story?
 - a. Mitsuko can speak Japanese very well.
 - b. Mitsuko's father was a famous dentist.
 - c. Mitsuko spent most of his life in Mexico.
 - d. Mitsuko loved playing in the park with his friends.
3. According to the story, Tom (Mitsuko's friend) _____.
 - a. loved making jokes
 - b. had 10 brothers and sisters
 - c. had many health problems
 - d. loved travelling around the world
4. How did Mitsuko feel about his job in the gym?
 - a. He did not like it at all.
 - b. He thought it was boring.
 - c. He loved it very much.
 - d. He hated working with customers.
5. In the race that Mitsuko and Lena entered, _____.
 - a. Lena died suddenly
 - b. someone hit Lena on the face
 - c. Mitsuko hurt his leg.
 - d. Mitsuko's wife was watching

Incidental spaced

Name: _____ ID: _____

Instructions:

Please read the following 4-part story once within 10 min and try to pay attention to the content as there will be some comprehension questions at the end. Please note that you will have to answer the comprehension questions without looking back at the text.

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The story

Mitsuko as a child

Mitsuko is from Japan. He has a father and one brother. His mother was a heavy smoker and after many years of smoking, died a painful death. When Mitsuko was 10 years old, his family moved to New York. Although Mitsuko's native tongue was Japanese, the problem was that he didn't speak it well because his family spoke English at home.

They lived in a small house that was within an easy walk of a big park and next to the Museum of Art. The park was beautiful, like a magical place. Sometimes Mitsuko just liked to sit on the grass listening to the wind moving the trees gently. Mitsuko and his friends loved playing in the park and visiting the museum which was open to the general public. They liked to observe paintings in dead silence and to listen to other people walking by.

Mitsuko and Tom

Tom was Mitsuko's best friend. Although Tom's family was very rich and had a huge house, which was also very close to the park, it wasn't a loving home. Tom's father had a giant soft drink company that sold Pepsi. But the sad fact was that he loved to spend his money on expensive cars and pieces of fine art instead of family. Mitsuko's dream was to make enough money to buy his father a better house and a car but he always had a low opinion of himself and thought it would be impossible for him to become as wealthy as Tom's father.

Tom liked to make jokes. One day, he asked Mitsuko and his brother to come to his house on very short notice. When they arrived, Tom showed them a dead cat that he had put in his mother's freezer for her to find. When Mitsuko saw the cat, he was shocked. He didn't say anything and the only sound that could be heard was coming from the freezer. Mitsuko told Tom that he thought his joke was in poor taste. When Tom's mother found the cat, she was very angry, and punished him for such a sick joke by not letting him play football with his friends for a month. Tom, however, was happy with the fact that he made his mother so angry.

Mitsuko and art

Mitsuko was interested in paintings, and he often walked to the Museum of Art from his house. On his last visit to the museum, he saw a painting of a famous artist with a blank expression on his face and a cigarette in his mouth who had hidden the dark secret of his drinking problem until his death in 1970. Mitsuko had a strong interest in this artist because the artist had also moved from one country to another when he was 10.

Mitsuko was working in the local gym to save money to study art. He was a natural leader who listened well to and motivated their customers. They were unfit and he really enjoyed working with them. He felt happy that he was improving their quality of life. Mitsuko loved working in the gym and the sound of the fitness machines helped him relax after the exercise. After work, he would slowly walk back home.

Mitsuko, Lena and the race

One of his customers, Lena, also liked painting. Unfortunately, she gained weight after a divorce and made too many broken promises to herself to get healthy again. She and Mitsuko had a little chat, and he decided to take the hard line with her; he entered her into a race. She was going to change her old habits completely.

On the day of the race, there were many people and Mitsuko and Lena were excited. The sound of the crowd was like white noise which made them run faster. As they entered the final leg of the race Mitsuko felt a great pain in his left leg. When they crossed the finish line, Mitsuko started walking slowly. They found a first aid area, and Mitsuko entered to have his leg examined. They gave him some pain relief, which was of small comfort to the agonizing pain in his leg.

Name: _____ ID: _____

Instructions:

Now, answer the following questions about the story you have just read. There is only one possible answer for each question.

التعليمات:

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 - c. had many health problems
 - d. loved travelling around the world

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 - d. He hated working with customers.
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 - a. Lena died suddenly
 - b. someone hit Lena on the face
 - c. Mitsuko hurt his leg.
 - d. Mitsuko's wife was watching

References

- Benjamin, Aaron S. & Jonathan Tullis. 2010. What makes distributed practice effective? *Cognitive Psychology* 61(3). 228–247.
- Boers, Frank. 2020. Learning single words vs. multiword items. In Stuart Webb (ed.), *The Routledge handbook of vocabulary studies*, 158–173. London and New York: Routledge.
- Boers, Frank, Seth Lindstromberg & June Eyckmans. 2014. Some explanations for the slow acquisition of L2 collocations. *Vigo International Journal of Applied Linguistics* 11(1). 41–61.
- Boers, Frank & Stuart Webb. 2015. Gauging the semantic transparency of idioms: Do natives and learners see eye to eye? In Roberto R. Heredia & Anna B. Cieślicka (eds.), *Bilingual figurative language processing*, 368–392. Cambridge: Cambridge University Press.
- Cepeda, Nicholas J., Harold Pashler, Edward Vul, John T. Wixted & Dough Rohrer. 2006. Distributed practice in verbal recall tasks: A review and quantitative synthesis. *Psychological Bulletin* 132(3). 354–380.
- Crossley, Scott A., Salsbury Tom & Danielle S. Mcnamara. 2015. Assessing lexical proficiency using analytic ratings: A case for collocation accuracy. *Applied Linguistics* 36(5). 570–590.
- Dang, Thi Ngoc Yen, Cailing Lu & Stuart Webb. 2022. Incidental learning of single words and collocations through viewing an academic lecture. *Studies in Second Language Acquisition* 44(3). 708–736.
- Gyllstad, Henrik & Brent Wolter. 2016. Collocational processing in light of the phraseological continuum model: Does semantic transparency matter? *Language Learning* 66(2). 296–323.
- Hsu, Jeng-yih Tim & Chu-yao Chiu. 2008. Lexical collocations and their relation to speaking proficiency of college EFL learners in Taiwan. *Asian EFL Journal* 10(1). 181–204.
- Horst, Marlitse. 2005. Learning L2 vocabulary through extensive reading: A measurement study. *Canadian Modern Language Review* 61. 355–382.
- Hulstijn, Jan H. 2003. Incidental and intentional learning. In Catherine J. Doughty & Michael H. Long (eds.), *The handbook of second language acquisition*, 349–381. Oxford, England: Blackwell.
- Kim, Su Kyung & Stuart Webb. 2022. The effects of spaced practice on second language learning: A meta-analysis. *Language Learning* 72(1). 269–319.
- Kremmel, Benjamin, Tineke Brunfaut & J. Charles Alderson. 2017. Exploring the role of phraseological knowledge in foreign language reading. *Applied Linguistics* 38(6). 848–870.
- Küpper-Tetzel, Carolina E., Edgar Erdfelder & Oliver Dickhäuser. 2014. The lag effect in secondary school classrooms: Enhancing students' memory for vocabulary. *Instructional Science* 42(3). 373–388.

- Laufer, Batia. 2006. Comparing focus on form and focus on forms in second language vocabulary learning. *Canadian Modern Language Review* 63(1). 149–166.
- Laufer, Batia & Tina Waldman. 2011. Verb-noun collocations in second-language writing: A corpus analysis of learners' English. *Language Learning* 61(2). 647–672.
- Macis, Marijana. 2018. Incidental learning of duplex collocations from reading. *Reading in a Foreign Language* 1(30). 48–75.
- Macis, Marijana, Sonbul Suhad & Rezan Alharbi. 2021. The effect of spacing on incidental and deliberate learning of L2 collocations. *System* 103. <https://doi.org/10.1016/j.system.2021.102649>.
- Meara, Paul & Imma Miralpeix. 2017. *Tools for researching vocabulary*. Bristol: Multilingual Matters.
- Muqaibal, Muna Hussain, Rowena Kasproicz & Cathy Tissot. 2023. Evaluating the impact of spaced practice using computer-assisted language learning (CALL) on vocabulary learning in the classroom. *Language Teaching Research* 0(0). <https://doi.org/10.1177/13621688221146146>.
- Nation, Paul. 2007. The four strands. *Innovation in Language Learning and Teaching* 1(1). 2–13.
- Nation, Paul. 2012. The BNC/COCA word family lists. Document bundled with Range program with BNC/COCA lists, 25. Available at: <https://www.victoria.ac.nz/lals/about/staff/paul-nation#publications> (accessed 17 January 2023).
- Nation, Paul. 2015. Principles guiding vocabulary learning through extensive reading. *Reading in a Foreign Language* 27(1). 136–145.
- Nation, Paul & Karen Wang. 1999. Graded readers and vocabulary. *Reading in a Foreign Language* 12(2). 355–380.
- Nguyen, Thi My Hang & Stuart Webb. 2017. Examining second language receptive knowledge of collocation and factors that affect learning. *Language Teaching Research* 21(3). 298–320.
- Pellicer-Sánchez, Ana. 2017. Learning L2 collocations incidentally from reading. *Language Teaching Research* 21(3). 381–402.
- Pellicer-Sánchez, Ana. 2020. Learning single words vs. multiword items. In Stuart Webb (ed.), *The Routledge handbook of vocabulary studies*, 158–173. Oxon & New York: Routledge.
- Plonsky, Luke & Deidre J. Derrick. 2016. A meta-analysis of reliability coefficients in second language research. *The Modern Language Journal* 100(2). 538–553.
- Puimège, Eva & Elke Peters. 2020. Learning formulaic sequences through viewing L2 television and factors that affect learning. *Studies in Second Language Acquisition* 42(3). 525–549.
- R Core Team. 2021. *R: A language and environment for statistical computing*. Vienna, Austria: R Foundation for Statistical Computing. Available at: <https://www.R-project.org>.
- Rohrer, Doug & Harold Pashler. 2007. Increasing retention without increasing study time. *Current Directions in Psychological Science* 16(4). 183–186.
- Rogers, James. 2017. The spacing effect and its relevance to second language acquisition. *Applied Linguistics* 38(6). 906–911.
- Rogers, James & Anisa Cheung. 2020a. Input spacing and the learning of L2 vocabulary in a classroom context. *Language Teaching Research* 24(5). 616–641.
- Rogers, James & Anisa Cheung. 2020b. Does it matter when you review? Input spacing, ecological validity, and the learning of L2 vocabulary. *Studies in Second Language Acquisition* 43(5). 1138–1156.
- Schmitt, Norbert. 2010. *Researching vocabulary: A vocabulary research manual*. Houndmills, Basingstoke, Hampshire & New York: Palgrave Macmillan.
- Serrano, Raquel & Hsiao-Yun Huang. 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.
- Serrano, Raquel & Hsiao-Yun Huang. 2021. Time distribution and intentional vocabulary learning through repeated reading: A partial replication and extension. *Language Awareness* 32(1). 1–18.

- Sinclair, John. 1991. *Corpus, concordance, collocation: Describing English language*. Oxford: Oxford University Press.
- Snoder, Per. 2017. Improving English Learners' productive collocation knowledge: The effects of involvement load, spacing, and intentionality. *TESL Canada Journal* 34(3). 140–164.
- Stengers, Helene, Frank Boers, Alex Housen & June Eyckmans. 2011. Formulaic sequences and L2 oral proficiency: Does the type of target language influence the association? *International Review of Applied Linguistics* 49(4). 321–343.
- Sonbul, Suhad & Norbert Schmitt. 2013. Explicit and implicit lexical knowledge: Acquisition of collocations under different input conditions. *Language Learning* 63(1). 121–159.
- Sonbul, Suhad, Dina Abdel Salam El-Dakhs & Masrai Ahmed. 2022. Second language productive knowledge of collocations: Does knowledge of individual words matter? *Studies in Second Language Acquisition* 45(2). 480–502.
- Szudarski, Pawel. 2012. Effects of meaning- and form-focused instruction on the acquisition of verb-noun collocations in L2 English. *Journal of Second Language Teaching and Research* 1(2). 3–37.
- Szudarski, Pawel & Ron Carter. 2016. The role of input flood and input enhancement in EFL learners' acquisition of collocations. *International Journal of Applied Linguistics* 26(2). 245–265.
- Suzuki, Yuichi. 2017. The optimal distribution of practice for the acquisition of L2 morphology: A conceptual replication and extension. *Language Learning* 67(3). 512–545.
- Toppino, Thomas C. & Lance C. Bloom. 2002. The spacing effect, free recall, and two-process theory: A closer look. *Journal of Experimental Psychology: Learning, Memory, and Cognition* 28(3). 437–444.
- Vu, Duy Van & Elke Peters. 2021. Incidental learning of collocations from meaningful input. *Studies in Second Language Acquisition* 44(3). 685–707.
- Webb, Stuart & Anna C.S. Chang. 2015. How does prior word knowledge affect vocabulary learning progress in an extensive reading program? *Studies in Second Language Acquisition* 37(4). 651–675.
- Webb, Stuart & Anna C. S. Chang. 2022. How does mode of input affect the incidental learning of collocations? *Studies in Second Language Acquisition* 44(1). 35–56.
- Webb, Stuart & Paul Nation. 2017. *How vocabulary is learned*. Oxford: Oxford University Press.
- Webb, Stuart, Jonathan Newton & Anna Chang. 2013. Incidental learning of collocation. *Language Learning* 63(1). 91–120.
- Wray, Allison. 2002. *Formulaic language and the lexicon*. Cambridge: Cambridge University Press.
- Yamagata, Satoshi, Tatsuya Nakata & James Rogers. 2023. Effects of distributed practice on the acquisition of verb-noun collocations. *Studies in Second Language Acquisition* 2(45). 1–27.