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RESEARCH ARTICLE

Vocabulary learning through viewing dual-subtitled videos: Immediate repetition versus spaced repetition as an enhancement strategy

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Abstract

Recent studies have shown that watching videos with dual subtitles can promote vocabulary learning. This study investigated the extent to which vocabulary learning may be enhanced through repeated viewings of dual-subtitled videos. A 3x3 counterbalanced experimental design was adopted to examine English as a foreign language (EFL) learners' immediate vocabulary gains and retention under different learning conditions across three experimental sessions, including (a) immediate repeated viewing, (b) spaced repeated viewing, and (c) no repeated viewing. Participants were 60 Chinese-speaking lower-intermediate university EFL learners. They were divided into three groups and given each of the three treatments in each experimental session. ANOVA results revealed that viewing dual-subtitled videos with repetition allowed learners to achieve greater vocabulary gains than viewing with no repetition, with evidence indicating the superiority of immediate repetitions over spaced repetitions.

Keywords: audiovisual input; dual subtitles; vocabulary learning; immediate repeated viewing; spaced repeated viewing

1. Introduction

Increasing evidence has shown that viewing videos with on-screen help options such as first language (L1) subtitles, second language (L2) captions, or a combination of both (dual subtitles) can benefit foreign language (FL) learning in many ways, such as fostering comprehension and vocabulary learning (Dizon, 2018; Dizon & Thanyawatpokin, 2021; Fievez, Montero Perez, Cornillie & Desmet, 2020; Gass, Winke, Isbell & Ahn, 2019; Lo, 2022; Montero Perez, 2022). Nevertheless, an emerging line of research has demonstrated that the effects of viewing captioned/subtitled videos on vocabulary learning can be positively mediated by the existence and nature of instructional interventions (Gesa & Miralpeix, 2022; Montero Perez, 2019), such as advance organisers (Teng, 2022a), gap-fill exercises (Pujadas & Muñoz, 2019), and previewing treatments. However, the benefits of these interventions may be confined to L2 classrooms since they require teachers' active involvement and preparation beforehand. To fully exploit the benefits of L2 learning through audiovisual input, it is necessary to explore other enhancement strategies that can help English as a foreign language (EFL) learners render their efforts at learning more impactful, even when class-based or teacher-led interventions are not available.

One strategy that can be practised autonomously by learners outside class is repeated viewing. However, only a few studies have addressed the effects of repetition on FL/L2 learning, such as learners' performance in comprehension (Gass *et al.*, 2019; Teng, 2019). Investigation into how

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repeated viewing may enhance vocabulary learning has been even scarcer (Majuddin, 2020; Muñoz, Pattemore & Avello, 2022). Moreover, there remains a paucity of evidence concerning repeated viewings operationalised in different ways, such as the case where repetitions are performed at different intervals. To my knowledge, the work by Muñoz *et al.* (2022) is the only one that has examined the mediating role that varying repeated viewing conditions may have on vocabulary learning through audiovisual input. Nonetheless, their study was based on L2 captioned video viewing, and their participants were upper-intermediate-level college students majoring in English. Little is known about the impact of repeated viewing in the context of other on-screen help options and among non-language-major participants or learners with lower proficiency levels. This quasi-experimental study investigates how repeated viewing operationalised in two different ways may benefit L2 vocabulary learning compared to single viewing in the context of dual-subtitled videos.

2. Literature review

2.1 L2 learning from audiovisual input

Over the past decade, numerous studies have examined the facilitative effects of varying video viewing conditions. Much focus has been placed on comparing learners' vocabulary gains from watching videos with L1 subtitles, FL/L2 captions, or no captions (Montero Perez, Peters & Desmet, 2018; Montero Perez, Van Den Noortgate & Desmet, 2013; Peters, 2019; Vanderplank, 2016). A theoretical explanation of the positive correlation between FL learning and viewing captioned/subtitled videos may be found in the bilingual dual coding theory (Paivio, 2014), which holds that verbal and imagery inputs have two separate representational systems that work together. Another theory that may explain the benefits of captioned/subtitled videos for FL/L2 learning is Mayer's (2001) cognitive theory of multimedia learning, which claims that a combination of verbal and visual stimulation promotes efficient processing of novice information.

2.2 Vocabulary learning through viewing dual-subtitled videos

While prior studies have focused on examining the superiority or otherwise of L2 captions over L1 subtitles, there has been a growing interest in the facilitative roles of other on-screen help options that have been made easily accessible with computer-assisted technology, such as the Chrome extension Language Reactor. One of the on-screen help options that has gained much attention in recent years is dual subtitles (bilingual subtitles), where L1 subtitles and L2 captions are concurrently displayed. Viewing dual-subtitled videos has been positively perceived (García, 2017) and is popular among many Chinese-speaking EFL learners (Liao, Kruger & Doherty, 2020). Empirical evidence has shown that viewing dual-subtitled videos can foster vocabulary learning (e.g. Hao, Sheng, Ardasheva & Wang, 2022; Lo, 2022; Wang, 2019; Wang & Pellicer-Sánchez, 2022). Li (2016) found that Chinese EFL learners who viewed BBC documentary clips with dual subtitles demonstrated greater vocabulary gains in meaning recognition and recall than those who viewed videos with L1 subtitles, L2 captions, or no subtitles. Results of a follow-up questionnaire also indicated that most participants in his study considered dual subtitles the most effective approach to vocabulary learning through viewing. Likewise, the eye-tracking study by Wang and Pellicer-Sánchez (2022) reveals that dual-subtitled videos were particularly effective in facilitating meaning recognition and establishing form–meaning links. However, the participants in these studies were primarily advanced or English-major students. Moreover, most existing studies only investigated the impact of dual-subtitled videos on incidental vocabulary learning. As Wang and Pellicer-Sánchez (2022) warned, "the effectiveness of bilingual subtitles for vocabulary learning might be maximised in intentional conditions where different form-focused techniques . . . could be employed to direct learners' attention to both L2 forms and L1 translations in a more planned

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way" (p. 765). Exceptions include a study by Lo (2022), who examined the impact of dual-subtitled videos on intentional vocabulary learning and found that low-intermediate and non-language-major EFL learners achieved significantly stronger vocabulary gains after viewing dual-subtitled videos accompanied by pedagogical interventions compared to single viewing. Such evidence is consistent with earlier work, which suggested that L2 learning through viewing can be greatly enhanced by the presence of instructional interventions (Gesa & Miralpeix, 2022; Montero Perez, 2019; Pujadas & Muñoz, 2019; Teng, 2019, 2022a). Later, Lo (2023) found that learners exhibited significantly stronger behavioural, emotional, and cognitive engagement when exposed to dual-subtitled viewing with interventions compared to single viewing without intervention, and that learner engagement was positively correlated with vocabulary gains. However, preparing pedagogical interventions can be time-consuming, and the benefits can be confined to viewing in a one-off learning session or inside L2 classrooms where teachers are actively involved. A benefit of L2 learning through audiovisual input is that learners can easily seek extensive exposure to the target language outside the typical few hours of language learning in a classroom context (Lindgren & Muñoz, 2013; Muñoz, 2008; Pattemore, Suárez & Muñoz, 2020; Suárez & Gesa, 2019). Of course, extensive viewing can also be integrated into the language teaching curriculum (Suárez & Gesa, 2022). Hence, an area worth investigating is how the effects of vocabulary learning through dual-subtitled video viewing can be enhanced through strategies that learners may employ autonomously, even without pre-prepared instructional interventions.

2.3 Repetition as enhancement strategies

One such viewing strategy involves giving learners more time to process and decode input in order to notice unknown words, since more frequent encounters with a word can benefit vocabulary learning (Charles & Trenkic, 2015). Hence, some prior studies have sought to foster incidental vocabulary learning by enabling repeated encounters with the target vocabulary by manipulating item frequency (Pellicer-Sánchez, 2017; Peters, Heynen & Puimège, 2016). However, in the case of vocabulary learning through authentic audiovisual materials, it is ecologically invalid to artificially manipulate the frequency of occurrence of target items (Majuddin, 2020). One alternative to increasing encounters with the target items is through extensive viewings, such as watching many episodes of the same television programme (Webb, 2015). Another alternative is exposing learners to the same audiovisual input twice (Muñoz *et al.*, 2022). Some studies have found that repeated viewing led to better performance in L2 learning (Gass *et al.*, 2019; Teng, 2019; Winke, Gass & Sydorenko, 2010). For example, Winke *et al.* (2010) and Gass *et al.* (2019) found that learners who viewed a video twice appeared to exhibit more attention to details and meaning. Majuddin (2020) investigated the impact of repeated viewing (once or twice) and caption condition (no captions, normal captions, or typographically enhanced captions) on learners' acquisition of multi-word expressions (MWEs) in both incidental and intentional learning settings. It was found that repeated viewing (irrespective of the caption conditions) in the incidental learning conditions fostered acquisition of language forms but not meaning. Moreover, Majuddin (2020) found that the same effect of repetition was not found in the intentional learning conditions and thus suggested that repeated viewing may not necessarily support intentional learning of MWE form recognition.

Nevertheless, Majuddin's (2020) findings that repeated viewings failed to enhance meaning acquisition contradict the evidence from a study by Muñoz *et al.* (2022), who found that repeated viewings did contribute to gains in both recognition and recall of meaning. Moreover, Muñoz *et al.* (2022) took the effects of a time lag between repeated viewings into consideration and compared the effects between "immediate repetition" and "spaced repetition" (operationalised as repeated viewing one week later in their study) in the context of captioned videos. In examining incidental learning of single words and MWEs achieved in the two types of repeated viewings, they found that learners in both treatment groups exhibited gains in the short and longer term, but those exposed to spaced repetition demonstrated slightly stronger gains in their immediate posttest. The

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authors hypothesised that the potential lag effects might have been neutralised since the load on working memory was eased by the presence of captions.

2.4 Spacing effects in cognitive psychology and second language acquisition studies

Many cognitive psychology studies have demonstrated the superiority of learning and retention in spaced conditions (i.e. spacing repetitions) over that in massed conditions (i.e. immediate repetitions), commonly known as "spacing effect" (Carpenter & DeLosh, 2005; Kornell, 2009; Toppino & Gerbier, 2014), which can be explained by mechanisms such as retrieval effort and encoding variability (Carpenter, 2017). Retrieval effort refers to recovering the meaning of target items through memory trace when attempting to recall information previously learned. Encoding variability theory suggests that spaced presentation may benefit learners by increasing memory traces and/or associative cues for future retrieval and recall (Raviv, Lupyan & Green, 2022), and when learners encounter target items in spaced conditions, they are able to associate each encounter with specific contextual cues, thus enhancing the chances of successful retrieval.

While these accounts suggest the advantage of spacing over massing, inconsistent findings on the impacts of different time lags (e.g. one-day versus one-week spacing) on learning outcomes have been reported in second language acquisition (SLA) studies that examine vocabulary learning through repeated reading practice (Liu & Todd, 2014; Rogers, 2017; Webb & Chang, 2012). In L2 studies of decontextualised associative vocabulary learning, some studies suggest that long spacing between repeated encounters is superior to no spacing (Nakata & Suzuki, 2019), while others found that shorter spacing yielded better results than longer spacing (Rogers & Cheung, 2018). Conversely, some studies on L2 contextual vocabulary learning showed that shorter lags could be more beneficial than longer lags. In investigating how assisted repeated reading with audio support under different time distributions led to incidental vocabulary learning, Serrano and Huang (2018) found that learners who had intensive assisted repeated reading (once for five consecutive days over a week) outperformed those receiving the same treatment with a spaced interval (once every week for five consecutive weeks). Similar results were revealed in their other study, where repeated reading sessions under a one-day intersession interval were more beneficial than repeated reading carried out in a seven-day interval in fostering intentional vocabulary learning (Serrano & Huang, 2023). Such mixed findings in this area may be attributed to methodological differences and the use of either contextualised or decontextualised materials, and further research is needed to clarify learning outcomes in relation to spacing effects.

2.5 Repeated viewings and different spacing intervals

In many SLA studies on spacing effects, the learners are merely shown the words and do not hear any of them. Little is known about how word retention may be affected in different spaced conditions with an integration of audio elements, such as through repeated viewings of captioned videos. From the perspective of phonological mediation theory, which posits that word identification proceeds from orthographic to phonological representations of printed words and "maps sound to meaning" (van Orden, 1987: 181), this manipulation may have positive effects on the retention of meaning since the words are presented to learners through captions and uttered to them by actors. However, investigation into the effects of time lags between repetitions in vocabulary learning through audiovisual input has been scarce (Majuddin, 2020; Muñoz *et al.*, 2022). To my knowledge, the study by Muñoz *et al.* (2022) was the first to focus on the potential effects that intervals between repeated viewings of captioned videos may have on learners' meaning recognition and meaning recall. Their work has provided many pedagogical insights into how repetitions and lag effects may play a role in optimising contextualised vocabulary learning from audiovisual input.

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However, while Muñoz *et al.* (2022) compared the effects of two types of repetitions, their study did not involve a comparison of treatment groups with repeated viewings versus those without repeated viewings. Hence, it can be unjustified to conclude that learners' vocabulary gains were due to repeated viewings. Experimentation comparing the effects of no repetition (single viewing), immediate repetition, and spaced repetition is needed to confirm the positive effects of repetitions on vocabulary learning through viewing and uncover the most optimal lag between repeated viewings. Moreover, Muñoz *et al.*'s (2022) participants were upper-intermediate-level university students majoring in English, who may have stronger proficiency and motivation to engage in deliberate learning, and the audiovisual input concerned videos with L2 captions only. Little is known about whether the same results may apply to non-language-major EFL learners with lower proficiency levels and whether repeated viewings of videos with other types of on-screen help options may render the same outcomes.

3. The current study

Given the above literature gaps, this quasi-experimental study aims to investigate the effects of repeated viewing on intentional vocabulary learning in the context of dual-subtitled videos. Particular interest rests on EFL learners' vocabulary gains and retention resulting from immediate repeated viewing, spaced repeated viewing versus viewing with no repetition. The following research questions guided this study:

1. To what extent does viewing dual-subtitled videos with immediate repetition and spaced repetition lead to immediate vocabulary gains under intentional learning conditions? How do the results compare with that of viewing without repetition?
2. To what extent do the three different repetition conditions lead to vocabulary retention?

In the present study, intentional vocabulary learning was used in the sense that participants were forewarned of the upcoming posttests (Peters, Hulstijn, Sercu & Lutjeharms, 2009). Vocabulary gains refer to both immediate vocabulary gains and vocabulary retention, with a focus on two aspects of form–meaning mapping knowledge – that is, meaning recall and meaning recognition.

4. Method

4.1 Participants

Sixty undergraduate social science students at a university in Macao participated in the study. The participants were native speakers of Chinese (L1) with at least 12 years of exposure to formal instruction in English (L2) in classroom settings. They were considered low-intermediate EFL learners based on their scores[1] in a placement test (32%–48%) and two 2000-level vocabulary tests (33%–44%) available on Cobb's (2021) VocabProfilers in Compleat Lexical Tutor (https://www.lextutor.ca/tests/levels/productive/) administered at the onset of the study. The participants were assigned to three groups, each comprising 20 participants whose names were coded as S1-60 to preserve anonymity. A one-way analysis of variance (ANOVA) test performed on the overall scores showed no significant difference between the groups, $F(2, 57) = [0.30]$, $p > 0.05$, suggesting that the three groups were comparable in terms of their proficiency and were appropriate for the present study.

[1]The placement test was an in-house multiple-choice test focusing on vocabulary and reading comprehension. The two vocabulary-level tests were equivalent to Laufer and Nation's (1999) Level Test in controlled production format, each requiring learners to complete 18 gapped sentences (e.g. There are a doz___eggs in the basket). Students scoring below 50 out of 100 points in both tests were considered lower-intermediate learners.

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Table 1. Counterbalancing of treatments across groups

	Session 1: The Racial Wealth Gap	Session 2: The Future of Meat	Session 3: Royalty
Group 1 (S1-20)	Spaced repetition (SR)	Immediate repetition	No repetition
Group 2 (S21-40)	Immediate repetition (IR)	No repetition	Spaced repetition
Group 3 (S41-60)	No repetition (NR)	Spaced repetition	Immediate repetition

4.2 Design

This study comprised three experimental sessions, each lasting for three weeks. In each session, the same dual-subtitled video was shown to the three groups of participants, with each group being assigned to one of the three conditions: *spaced repeated viewing*, *immediate repeated viewing*, and *no repeated viewing*. This 3x3 counterbalanced Latin-square design was performed to minimise effects arising from experimental orders and individual differences so that the results reflect each of the three groups' vocabulary gains from each of the three treatments (Table 1).

4.3 Instruments

4.3.1 Audiovisual input

The videos used were three episodes from the narrated documentary television series "Explained" available on the Netflix streaming service: *The Racial Wealth Gap*, *The Future of Meat*, and *Royalty*.[2] These audiovisual materials were chosen as they featured clearly articulated narrations with a relatively stable pace and were confirmed to have never been watched by the participants prior to the study. The duration ranged from 16 to 25 minutes, but for consistency, only the first 15 minutes were shown to the participants. As the original pace was meant for native or near-native speakers, all three videos were shown at a slightly slower pace of 0.75x (without narration being negatively affected). This approach also aligns with the "subtitle principle" (Mayer, Fiorella & Stull, 2020), which suggests that slower-paced videos[3] should be used if subtitles are to be included to stimulate vocabulary acquisition. Dual subtitles were enabled via the Chrome extension Language Reactor, which was also used to access the transcripts for scrutiny of the lexical items entailed in the video. Figure 1 exemplifies the font type and size of the dual-subtitled videos concerned.

4.3.2 Target words

Ten target words were selected for each experimental session. All were mid-frequency words (K4–K9 frequency levels in BNC-COCA lists) based on Nation's (2013) classification. The target words were initially chosen based on assessment by the participants' instructor and only those that appeared in the same video once were selected.[4] The selected items were then piloted with a separate group of EFL learners ($n = 20$) who shared a similar level of proficiency. Finally, a verifying procedure[5] was performed four weeks before the experiment proper to ensure that the words were all unknown to them. Participants of the main study were given 100 words (including the initially selected words and distractors) and asked to translate items they knew into Chinese. Only words confirmed to be unknown to the participants before the experiments were adopted.

[2]For reasons of ecological validity, authentic audiovisual materials accessible in daily life were adopted and the input and target items were not manipulated.

[3]According to Mayer, Lee and Peebles (2014), a slow-paced video (141 words/minute) may less likely result in working memory overload and is thus more suited to learners with lower proficiency levels.

[4]It was also verified that the selected words did not appear in the other videos.

[5]It was confirmed in the immediate posttests that such exposure had little impact on the main study, since none of the participants indicated prior knowledge of the target words before viewing.

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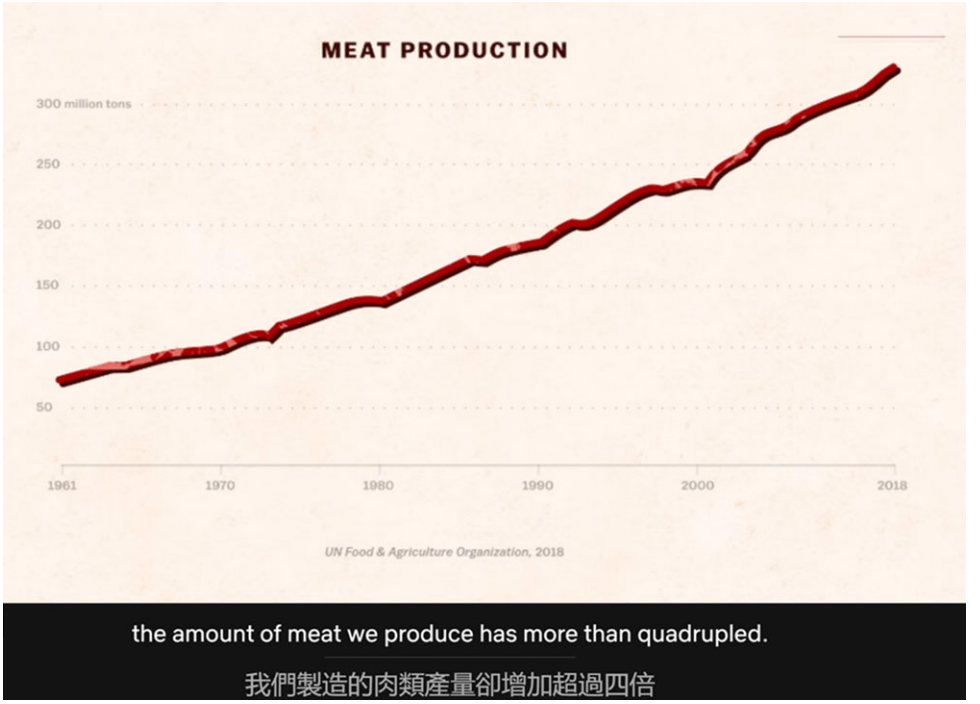


Figure 1. A capture of dual subtitles displayed on the screen.

4.3.3 Posttests

Two aspects of form-meaning mapping knowledge (meaning recall and recognition) were included in the posttests to assess learners' vocabulary gains in different repetition conditions. The immediate and delayed posttests adopted in each experimental session were identical in content but in a different order, each comprising a meaning recall test and a meaning recognition test. The meaning recall test required participants to define the 10 target items by providing their L1 equivalents or L2 explanations/synonyms. The meaning recognition test was a bilingual matching vocabulary test. Participants were presented with the same 10 target words (L2) in the left column and asked to choose the correct L1 equivalent for each of the 10 words from the opposite column, which contained their Chinese translation and three distractors in random order, as illustrated in Figure 2.

The two parts of each posttest were carefully sequenced to avoid test effects, such that participants only received the meaning recognition test after completing the meaning recall test. The reliability of the instruments for all experiments measured in a pilot study ($n = 20$) was high, with Cronbach's coefficient α ranging between 0.87 and 0.89. The content and face validity of the posttests was confirmed by two ELT professionals.

4.4 Procedures

All three experiments were conducted during regular class time over nine weeks, with a seven-day intersession interval[6] per week. Participants were briefly informed of the procedures and subsequent posttests before commencement. During the first experimental session (Week 1), the spaced repetition group viewed the dual-subtitled video once. In the following week (Week 2),

[6]The seven-day interval aligns with some SLA research on spacing effect over long-spaced sessions (Muñoz *et al.*, 2022; Serrano & Huang, 2023).

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millennia	_____	a) 集團
vestiges	_____	b) 沒爭議性
monarchy	_____	c) 征服
uncontentious	_____	d) 奴隸制度
impartial	_____	e) 殘影
deformation	_____	f) 畸形
reigning	_____	g) 販賣
conquering	_____	h) 貴族
enslavement	_____	i) 在位的
trafficking	_____	j) 幾千年
		k) 君主制
		l) 暴跌
		m) 中立的

Figure 2. Example of meaning recognition test

they viewed the video again and completed the corresponding immediate posttests. The immediate repetition group viewed the video twice (immediate repeated viewing within the same week), while the no repetition group viewed the video once.[7] Both were administered the same immediate posttests. In the subsequent week with a seven-day interval (Week 3), all three experimental groups were given the same delayed posttests.[8] Identical procedures were repeated in Experimental Session 2 (Weeks 4–6) and Experimental Session 3 (Weeks 7–9),[9] except that the participants swapped roles. All groups of participants were eventually exposed to the three treatments in a different order.

4.5 Scoring and analysis

Vocabulary gains in the posttests were operationalised as correct responses (i.e. correct L1–L2 translation in the meaning recall test and correct matching option in the bilingual matching vocabulary test). All tests were scored binomially, with one mark for each correct response and 0 for an incorrect response. Descriptive and parametric statistical analyses were performed to investigate the three experimental groups' scores in meaning recall (maximum score = 10) and meaning recognition (maximum score = 10) on their immediate and delayed posttests. Data analysis was conducted along two dimensions: between and within subjects. Three separate one-way ANOVA procedures were conducted to examine the effects of the independent variables (i.e. treatments with different repetition conditions) on the dependent variables (i.e. learners' immediate vocabulary gains and retention) between the three repetition groups (with participants swapping roles in each experiment) throughout the three experimental sessions. Two separate one-way ANOVA repeated measures were performed to measure immediate vocabulary gains and

[7]These two groups watched the video in the second week as no spaced repetition is involved. This arrangement enables all three groups to take the posttests the week following their corresponding treatment.

[8]The seven-day interval between the immediate and delayed posttests adopted in this study was shorter than SLA studies on spacing effects with more advanced learners (e.g. 4.5-week interval in Muñoz *et al*., 2022, and two-week interval in Majuddin, 2020) considering the practicability of implementing three experiments (each involving three weeks) within the semester and the lower proficiency levels of the participants. However, this time interval aligns with recent studies on the impact of different interventions on vocabulary learning through dual-subtitled video viewing (e.g. Lo, 2022).

[9]The participants were given the corresponding set of immediate and delayed posttest in each of the three experimental sessions (10 target words for each experimental session).

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vocabulary retention found in the three different repetition conditions within the same group of participants. Bonferroni post hoc tests were used when ANOVA results indicated significant differences.

5. Results

Overall, both between-group and within-group results indicated significantly different levels of immediate vocabulary gains and vocabulary retention among the three treatments, where participants generally performed better when viewing dual-subtitled videos with immediate repetition (IR) compared to viewing with spaced repetition (SR), but both repetition conditions led to greater vocabulary gains compared to no repetition (NR). The same tendency was consistently observed in each of the three experimental sessions, regardless of the group of participants and the episodes involved.

5.1 Between-group results

Between-group results were examined to compare the scores between the three repetition groups. Table 2 summarises the descriptive statistics of the immediate and delayed posttest results among three different groups of participants in each of the three experimental sessions.

The first research question addressed the lag effect on learners' immediate vocabulary gains, measured by the meaning recall and recognition scores on their immediate posttests. The results of all three experimental sessions show the same tendency regardless of the videos, experimental order, and groups of participants involved, with IR recipients consistently scoring highest in meaning recall and recognition on their immediate posttests, SR recipients scoring the second highest, and NR recipients scoring the lowest. A highly significant treatment effect was observed in the one-way ANOVA test results of participants' scores in their immediate meaning recall posttest (Experiment 1: $F(2, 57) = [241.48]$, $p < .001$, $\eta p2 = 0.89$; Experiment 2: $F(2, 57) = [196.40]$, $p < .001$, $\eta p2 = 0.87$; Experiment 3: $F(2, 57) = [138.72]$, $p < .001$, $\eta p2 = 0.83$) and immediate meaning recognition posttest (Experiment 1: $F(2, 57) = [354.2]$, $p < .001$, $\eta p2 = 0.93$; Experiment

Table 2. Immediate and delayed posttest scores across Experimental Sessions 1–3 (Max score = 10 for each)

		Meaning recall				Meaning recognition			
		Immediate posttest		Delayed posttest		Immediate posttest		Delayed posttest	
Session	Treatment (Participants)	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
1	SR (S1-20)	5.10	.718	4.10	.91	6.30	.80	5.35	.99
	IR (S21-40)	7.05	.887	6.05	.99	8.45	.69	7.35	.93
	NR (S41-60)	1.65	.745	.85	.58	2.30	.73	2.05	.76
2	SR (S41-60)	5.25	.851	4.05	.89	6.35	.88	5.55	.61
	IR (S1-20)	7.20	1.056	6.15	1.14	8.55	.89	7.40	1.23
	NR (S21-40)	1.35	.933	.75	.72	2.50	.94	2.25	1.55
3	SR (S21-40)	5.15	.875	4.20	.77	6.55	.94	5.65	.93
	IR (S41-60)	7.05	.945	6.25	.72	8.40	.75	7.85	.88
	NR (S1-20)	1.75	1.209	1.05	.83	2.70	1.17	2.15	.74

Note. SR = spaced repetition; IR = immediate repetition; NR = no repetition.

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2: $F(2, 57) = [229.9]$, $p < .001$, $\eta p2 = 0.89$; Experiment 3: $F(2, 57) = [178.68]$, $p < .001$, $\eta p2 = 0.86$). Post hoc comparisons using the Bonferroni test revealed that the mean values of scores of all three groups in the three experimental sessions were significantly different ($p < .001$).

The second research question addressed the lag effect on learners' vocabulary retention, measured by meaning recall and recognition scores on their delayed posttests. All three experimental sessions revealed that both IR and SR recipients scored higher than NR recipients in both aspects of word meaning knowledge (Table 2). ANOVA test results followed by post hoc comparisons using the Bonferroni test also indicated a significant treatment effect on participants' delayed posttest scores, with those receiving the IR condition demonstrating significantly higher scores than the other two groups on meaning recall (Session 1: $F(2, 57) = [190.48]$, $p < .001$, $\eta p2 = 0.87$; Session 2: $F(2, 57) = [171.52]$, $p < .001$, $\eta p2 = 0.86$; Session 3: $F(2, 57) = [230.72]$, $p < .001$, $\eta p2 = 0.89$) and meaning recognition (Session 1: $F(2, 57) = [177.33]$, $p < .001$, $\eta p2 = 0.86$; Session 2: $F(2, 57) = [95.20]$, $p < .001$, $\eta p2 = 0.77$; Session 3: $F(2, 57) = [226.18]$, $p < .001$, $\eta p2 = 0.89$).

5.2 Within-subjects results

Within-subject results were examined to compare the scores among the same group of participants when receiving the three treatments. Descriptive data of the immediate posttest within the same groups of participants showed the same tendency. Participants exhibited higher scores for meaning recall ($M = 7.10$, $SD = 0.95$) and meaning recognition ($M = 8.47$, $SD = 0.70$) in the IR condition compared to the SR condition (meaning recall = 5.17, $SD = 0.81$; meaning recognition = 6.40, $SD = 0.87$), and single viewing resulted in the lowest scores in both meaning recall ($M = 1.58$, $SD = 0.98$) and meaning recognition ($M = 2.50$, $SD = 0.97$). One-way repeated measures ANOVA results followed by Bonferroni test revealed a significant treatment effect on participants' scores on their immediate posttests (meaning recall: $F(2, 118) = 514.76$, $p < 0.001$, $\eta p2 = 0.90$; meaning recognition: $F(2, 118) = 654.99$, $p < 0.001$, $\eta p2 = 0.92$).

Delayed posttest results showed a consistent pattern, where all participants demonstrated the strongest level of retention in the IR condition (meaning recall: $M = 6.15$, $SD = 0.95$; meaning recognition: $M = 7.58$, $SD = 0.98$), followed by the SR condition (meaning recall: $M = 4.12$, $SD = 0.85$; meaning recognition: $M = 5.50$, $SD = 0.85$), and the lowest in the NR condition (meaning recall: $M = 0.88$, $SD = 0.72$; meaning recognition: $M = 2.07$, $SD = 0.76$). Results of a one-way repeated measures ANOVA confirmed this observation, indicating a statistically significant high correlation between the repetition conditions and delayed posttest scores. Pairwise comparisons using the Bonferroni post hoc test revealed that all participants' meaning recall and meaning recognition scores on their delayed posttests were significantly different across the three repetition treatments (meaning recall: $F(2, 118) = 608.1$, $p < 0.001$, $\eta p2 = 0.91$; meaning recognition: $F(2, 118) = 715.71$, $p < 0.001$, $\eta p2 = 0.92$).

6. Discussion

The present study investigated the effects of viewing a dual-subtitled video on vocabulary learning, with a focus on the outcomes of viewing the video under three repetition conditions (immediate, spaced, no repetition). Two major findings emerged. First, it was found that repeated viewings of dual-subtitled videos significantly enhanced immediate vocabulary gains and vocabulary retention through such audiovisual input compared to single viewings. Such finding accords with the phonological mediation theory, which posits that the audio route has positive impacts on meaning retention (van Orden, 1987) and aligns with the cognitive theory of multimedia learning that audiovisual input can promote efficient processing of novice information (Mayer, 2001). Meanwhile, the evidence on the impact of repeated viewings on vocabulary learning supports findings of prior studies on repeated viewings, which indicate that viewing videos twice led to

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more benefits in L2 learning (Gass *et al*., 2019; Muñoz *et al*., 2022; Teng, 2019; Winke *et al*., 2010). Nevertheless, prior studies in this area have focused on caption conditions ranging from no captions and full captions to keyword captions. This study is the first to examine the impact of repeated viewings on vocabulary gains in the context of dual-subtitled videos.

Vocabulary gains in this study were measured by two dimensions of vocabulary knowledge. The inclusion of both meaning recall and meaning recognition tests hypothetically enables more detailed tracking of small increases in meaning acquisition and more accurate measurement of vocabulary knowledge (Montero Perez *et al*., 2018; Nation & Webb, 2011). It was not surprising that participants' meaning recognition scores were generally higher than their meaning recall scores, since meaning recall is one of the most difficult aspects of initial form–meaning mappings (Laufer & Goldstein, 2004). However, the present study's finding that repeated viewings led to greater learning gains in these two aspects of word knowledge adds to the mixed results regarding the facilitative role of repetitions in fostering meaning acquisition. The results are generally consistent with those of Muñoz *et al*. (2022), who also found that repeated viewings of captioned videos could effectively foster meaning recognition and meaning recall, but are contrary to Majuddin's (2020) claim that repeated viewings of uncaptioned, captioned, and enhanced captioned videos only led to gains in form acquisition but not meaning acquisition. The discrepancy between findings by Majuddin (2020) and Muñoz *et al*. (2022) can likely be attributed to the different comparisons involved in their studies, since the former compared learning gains between two viewings and one viewing (i.e. repetition versus no repetition), whereas the latter compared learning between two types of repeated viewings (immediate versus spaced repetition) and no viewing.[10] It is therefore not surprising that more learning gains were observed in the study by Muñoz *et al*. (2022).

However, Muñoz *et al*.'s findings (2022) should also be interpreted with care. As their comparison was between two viewings and no viewing, the results may not necessarily reflect an effect of repeated viewing. It is plausible that their participants' vocabulary gains may have been yielded from their first exposure to the video. Meanwhile, the contradictory findings between this study and that of Majuddin (2020) can be due to several factors. First, the target items under investigation in the present study were single words rather than MWEs, which could impose more challenges for meaning acquisition. Second, the audiovisual input involved in the current study was dual-subtitled videos, whereas Majuddin focused on videos with different forms of L2 captions. Moreover, Majuddin only compared "no repetition" and "with repetition" without evaluating potential lag effects associated with repeated viewing and there was a lack of clear indication of the intervals between the two viewings in her experiment. Hence, it is uncertain whether her findings reflected the outcomes of immediate repetition or spaced repetition.

Moreover, while Majuddin (2020) found no significant effect of repetition on intentional MWEs meaning and form recall among advanced learners, the findings of the current study suggest otherwise, where the two repetition conditions yielded significantly greater vocabulary gains than the "no repetition" condition. Such differing outcomes can be due to differences in language pair and learners' proficiency levels. The extremely low immediate vocabulary gains on both meaning and form recall suggest that lower-intermediate EFL Chinese learners may have inadequate competence to learn completely novel words at first glance. Another plausible reason is that lower-proficiency learners may not have their attention directed to the target words within one single episode.[11] This explanation corroborates Lo's (2022, 2023) findings that lower-intermediate learners had very low vocabulary gains and exhibited relatively low behavioural, emotional, and cognitive engagement in learning vocabulary when viewing dual-subtitled videos alone without any enhancement strategies.

[10]This is the major difference between their studies, since both adopted videos that were quite comparable in terms of their nature (American sitcom), length (20-minute), and quantity of target items (ranging from 18 to 23).

[11]As the accuracy was consistently low regardless of which video and group of participants were involved in the NR condition, it was less likely that the results were due to participants' attention being diverted to something else, such as the plot or visuals of the videos.

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Another major finding of the present study was that immediate repetitions were more effective than spaced repetitions in fostering vocabulary learning in the context of dual-subtitled video viewing among lower-intermediate EFL learners. Such a result is contrary to cognitive psychology research where spaced condition is often found to be more beneficial for learning and retention than massing condition due to its advantages in fostering retrieval effort and encoding variability (Carpenter, 2017; Kornell, 2009; Toppino & Gerbier, 2014). However, it supports the findings in some SLA studies on the impacts of repetitions and lag effects of contextual vocabulary learning through assisted repeated readings with audio support, where a shorter lag yielded better results than a longer lag (Rogers & Cheung, 2018; Serrano & Huang, 2018, 2023). This difference could be explained by the involvement of decontextualised versus contextualised learning in the experiments. Cognitive psychology studies that point to the advantage of spaced condition over massed condition often involve the use of decontextualized materials such as through flashcards or word lists (e.g. Kornell, 2009; Carpenter & DeLosh, 2005), whereas SLA studies pointing to the superiority of a short spacing over a longer spacing involve contextualised vocabulary learning (e.g. Serrano & Huang, 2018, 2023).

However, studies that examine contextual vocabulary learning from audiovisual input have also yielded inconsistent results. The superiority of intensive repeated viewing over spaced repetition observed in the present study was not detected in the study by Muñoz *et al.* (2022). Instead, their results suggested that the otherwise was true (i.e. spaced repetitions were more beneficial than immediate repetitions in fostering vocabulary learning). Such contradictory findings may be partly due to the difference in learners' proficiency levels and language pair involved in the two studies. The participants in the study by Muñoz *et al.* (2022) were bilingual Catalan/Spanish EFL learners majoring in English, whereas the participants in the present study were lower-intermediate Chinese EFL learners who did not major in English. Prior studies have shown that learner-related factors such as language aptitude and proficiency levels may influence their vocabulary gains from viewing videos (Pattemore & Muñoz, 2020; Teng, 2022b) regardless of age (Gesa & Suárez, 2022). As acknowledged by Muñoz *et al.* (2022), language-major students may not only be more proficient in L2 but also more likely to be more motivated to learn. So far, the mixed results from the scarce evidence seem to suggest that immediate repetition may be more optimal for EFL learners with lower proficiency levels, while repeated viewing with a one-week spaced interval may render more positive outcomes for advanced L2 learners. However, as the audiovisual input (e.g. on-screen texts) and language pairs between the present study (Chinese-English) and that by Muñoz *et al.* (Spanish-English) are not entirely comparable, future research is needed to confirm this observation.

Another interesting finding is that while Majuddin (2020) asserted that repeated viewings only resulted in vocabulary gains under the incidental learning conditions but did not lead to any gains under intentional learning conditions, the evidence from the present study suggests otherwise. This inconsistency may be due to several factors. First, as Majuddin (2020) noted, the comparison between the outcomes of her incidental and intentional learning conditions was not direct, since her participants were not exposed to the same target items. Second, the participants in her study were ESL learners with mixed L1 backgrounds (some Mandarin and some Malay), whereas the present study concerned lower-intermediate Chinese EFL learners. Third, as noted earlier, Majuddin (2020) only observed learning gains in form acquisition but not in meaning recognition and recall. Hence, her claim that repeated viewings were redundant in an intentional learning setting in that it led to a similar level of vocabulary gains may only be confined to the context of form acquisition among ESL learners. Likewise, although there is insufficient evidence to claim that the superiority of different repetition conditions found in the present study and that of Muñoz *et al.* (2022) may be attributed to the different learning conditions (intentional versus incidental) involved, the possible impact of test announcements cannot be entirely ruled out. In fact, prior studies on vocabulary learning have reported that learners achieved significantly more

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vocabulary gains in conditions where participants were aware they would be tested (Peters *et al.*, 2009). The mixed impact of test announcements on learners' vocabulary gains has also been reported in two studies by Serrano and Huang. In their earlier study, Serrano and Huang (2018) found that in an incidental learning condition (without test announcement), a shorter lag stimulated more immediate vocabulary gains, but a longer lag yielded greater long-term retention. In an extended study, Serrano and Huang (2023) found that repetition with a one-day intersession (shorter lag) led to greater immediate vocabulary gains and vocabulary retention compared to a seven-day intersession (longer lag) in an intentional learning condition. However, whether there is significant interaction between repeated viewings and test announcement effects is still an area that awaits further experimentation.

7. Conclusion

Recent research has suggested that viewing videos with dual subtitles can benefit vocabulary learning, and there has been growing interest in whether or how interventions that require teachers' active preparation or involvement may enhance the benefits of viewing. The present study makes an important contribution to this field by demonstrating that repeated viewing can enhance the effects of vocabulary learning through dual-subtitled video viewing. This finding can be particularly encouraging, since repeated viewing can be easily and autonomously adopted by learners even without the presence of class-based or teacher-led interventions. As Montero Perez *et al.* (2018: 22) noted, "video is so easily accessible in everyday life that one of its most important benefits probably lies in its potential to facilitate increased exposure to the foreign language outside the classroom".

While it is not inconceivable that enhancing encounters of a word through repeated viewings can lead to vocabulary gains, this study is one of a few to put forward this idea as a scholarly inquiry. It is the first to seek empirical answers to whether and how repeated viewings of dual-subtitled videos may contribute to immediate gains and retention concerning two aspects of word knowledge. This study also contributes to the growing area of research on repeated viewings by considering how the presence/absence of repetitions and the length of the interval between repetitions may affect vocabulary learning through video viewing, providing a more holistic comparison of the potential effects of different repetitions.

Some pedagogical implications arise from this study. For example, frontline educators may consider adopting dual-subtitled videos to foster intentional vocabulary learning. However, the evidence that single viewings may not be sufficient to direct lower-intermediate learners' attention to the meaning and form of unknown words implies the need to at least show the videos twice to help them acquire more new vocabulary. Alternatively, from a more practical standpoint, learners may benefit from viewings that enable repeated exposure to the same target vocabulary. Meanwhile, given the specific evidence that immediate repeated viewing may lead to more pronounced gains in meaning recall and recognition compared to spaced repeated viewing, educators may consider employing potential treatments based on such spacing intervals. Learners may also benefit from educators' guidance on such optimal time lag for repetitions that may render their out-of-class efforts to intentionally learn vocabulary through audiovisual materials more impactful.

This study has its limitations. First, learners' vocabulary retention in this study was on delayed posttests administered one-week post-viewing, so the findings are not generalisable to longer-term retention. Future studies that can afford a longer duration of experiments may consider administering the delayed posttests a few weeks later to examine whether the vocabulary gains are retained in the longer term. Moreover, this study only compared the vocabulary gains between no repetitions, immediate repetitions, and spaced repetitions with a one-week (seven-day) interval

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and not other spacing intervals. It is not unreasonable to assume that a longer interval (e.g. four-week) may lead to fewer vocabulary gains, as was suggested by Muñoz *et al.* (2022). The specific cohort involved is another limitation of this study. For example, the impact of different repetition conditions on other cohorts such as school-age or younger learners remains uncertain and awaits future experimentation. Further investigations are also needed to shed more light on how repeated viewings may be optimally operationalised in different learning contexts, such as the case with other on-screen help options. It is hoped that the present study may inspire future studies on the facilitative role of other enhancement strategies for vocabulary acquisition through audio-visual input.

Ethical statement and competing interests. All participation in the study was voluntary and informed consent was obtained. Anonymity of all participants was maintained throughout the study. The author declares no competing interests.

References

Carpenter, S. K. (2017) Spacing effects on learning and memory. In Wixted, J. T. (ed.), *Learning and memory: A comprehensive reference* (2nd ed.). Oxford: Academic Press, 465–485. https://doi.org/10.1016/B978-0-12-809324-5.21054-7

Carpenter, S. K. & DeLosh, E. L. (2005) Application of the testing and spacing effects to name learning. *Applied Cognitive Psychology*, 19(5): 619–636. https://doi.org/10.1002/acp.1101

Charles, T. & Trenkic, D. (2015) Speech segmentation in a second language: The role of bi-modal input. In Gambier, Y., Caimi, A. & Mariotti, C. (eds.), *Subtitles and language learning: Principles, strategies and practical experiences*. Bern: Peter Lang, 173–198.

Cobb T. (2021) *Web Vocabprofile*. https://www.lextutor.ca/

Dizon, G. (2018) Netflix and L2 learning: A case study. *The EuroCALL Review*, 26(2): 30–40. https://doi.org/10.4995/eurocall.2018.9080

Dizon, G. & Thanyawatpokin, B. (2021) Language learning with Netflix: Exploring the effects of dual subtitles on vocabulary learning and listening comprehension. *Computer Assisted Language Learning*, 22(3): 52–65.

Fievez, I., Montero Perez, M., Cornillie, F. & Desmet, P. (2020) Vocabulary learning through viewing captioned or subtitled videos and the role of learner- and word-related factors. *CALICO Journal*, 37(3): 233–253. https://doi.org/10.1558/cj.39370

García, B. (2017) Bilingual subtitles for second-language acquisition and application to engineering education as learning pills. *Computer Applications in Engineering Education*, 25(3): 468–479. https://doi.org/10.1002/cae.21814

Gass, S., Winke, P., Isbell, D. R. & Ahn, J. (2019) How captions help people learn languages: A working-memory, eye-tracking study. *Language Learning & Technology*, 23(2): 84–104.

Gesa, F. & Miralpeix, I. (2022) Effects of watching subtitled TV series on foreign language vocabulary learning: Does learners' proficiency level matter? In Lütge, C. (ed.), *Foreign language learning in the digital age: Theory and pedagogy for developing literacies*. Abingdon: Routledge, 159–173. https://doi.org/10.4324/9781003032083-14

Gesa, F. & Suárez, M. M. (2022) Individual differences in young learners' L2 vocabulary development: The case of language aptitude and exposure to subtitled TV series. In De Wilde, V. & Goriot, C. (eds.), *Second language learning before adulthood: Individual differences in children and adolescents*. Berlin: De Gruyter Mouton, 65–86. https://doi.org/10.1515/9783110743043-004

Hao, T., Sheng, H., Ardasheva, Y. & Wang, Z. (2022) Effects of dual subtitles on Chinese students' English listening comprehension and vocabulary learning. *The Asia-Pacific Education Researcher*, 31(5): 529–540. https://doi.org/10.1007/s40299-021-00601-w

Kornell, N. (2009) Optimising learning using flashcards: Spacing is more effective than cramming. *Applied Cognitive Psychology*, 23(9): 1297–1317. https://doi.org/10.1002/acp.1537

Laufer, B. & Goldstein, Z. (2004) Testing vocabulary knowledge: Size, strength, and computer adaptiveness. *Language learning*, 54(3): 399–436. https://doi.org/10.1111/j.0023-8333.2004.00260.x

Laufer, B. & Nation, P. (1999) A vocabulary size test of controlled productive ability. *Language Testing*, 16(1): 33–51. https://doi.org/10.1177/026553229901600103

Li, M. (2016) *Investigation into the differential effects of subtitles (first language, second language, and bilingual) on second language vocabulary acquisition*. The University of Edinburgh, unpublished doctoral dissertation.

Liao, S., Kruger, J.-L. & Doherty, S. (2020) The impact of monolingual and bilingual subtitles on visual attention, cognitive load, and comprehension. *The Journal of Specialised Translation*, 33: 70–98.

Lindgren, E. & Muñoz, C. (2013) The influence of exposure, parents, and linguistic distance on young European learners' foreign language comprehension. *International Journal of Multilingualism*, 10(1): 105–129. https://doi.org/10.1080/14790718.2012.679275

Liu, Y. T. & Todd, A. G. (2014) Implementation of assisted repeated reading techniques for the incidental acquisition of novel foreign vocabulary. *Language Teaching Research*, 20: 53–74. https://doi.org/10.1177/1362168814559802

https://doi.org/10.1017/S0958344024000053 Published online by Cambridge University Press

Lo, S. (2022) Learning vocabulary through dual-subtitled viewing: The impact of different ILH-based interventions. *Computer Assisted Language Learning*. Advance online publication. https://doi.org/10.1080/09588221.2022.2126497

Lo, S. (2023) Viewing dual-subtitled videos under different learning conditions: Effects on learners' behavioural, emotional, and cognitive engagement. *Computer Assisted Language Learning*. Advance online publication. https://doi.org/10.1080/09588221.2023.2219711

Majuddin, E. (2020) *Incidental and intentional acquisition of multiword expressions from audio-visual input: The effects of typographically enhanced captions and repetition*. Victoria University of Wellington, unpublished doctoral dissertation.

Mayer, R. E. (2001) *Multimedia learning*. New York: Cambridge University Press. https://doi.org/10.1017/CBO9781139164603

Mayer, R. E., Fiorella, L. & Stull, A. (2020) Five ways to increase the effectiveness of instructional video. *Educational Technology Research & Development*, 68(3): 837–852. https://doi.org/10.1007/s11423-020-09749-6

Mayer, R. E., Lee, H. & Peebles, A. (2014) Multimedia learning in a second language: A cognitive load perspective. *Applied Cognitive Psychology*, 28(5): 653–660. https://doi.org/10.1002/acp.3050

Montero Perez, M. (2019) Pre-learning vocabulary before viewing captioned video: An eye-tracking study. *The Language Learning Journal*, 47(4): 460–478. https://doi.org/10.1080/09571736.2019.1638623

Montero Perez, M. (2022) Second or foreign language learning through watching audio-visual input and the role of on-screen text. *Language Teaching*, 55(2): 63–192. https://doi.org/10.1017/S0261444821000501

Montero Pérez, M., Peters, E. & Desmet, P. (2018) Vocabulary learning through viewing video: The effect of two enhancement techniques. *Computer Assisted Language Learning*, 31(1–2): 1–26. https://doi.org/10.1080/09588221.2017.1375960

Montero Perez, M., Van Den Noortgate, W. & Desmet, P. (2013) Captioned video for L2 listening and vocabulary learning: A meta-analysis. *System*, 41(3): 720–739. https://doi.org/10.1016/j.system.2013.07.013

Muñoz, C. (2008) Symmetries and asymmetries of age effects in naturalistic and instructed L2 learning. *Applied linguistics*, 29(4): 578–596. https://doi.org/10.1093/applin/amm056

Muñoz, C., Pattemore, A. & Avello, D. (2022) Exploring repeated captioning viewing as a way to promote vocabulary learning: Time lag between repetitions and learner factors. *Computer Assisted Language Learning*. Advance online publication. https://doi.org/10.1080/09588221.2022.2113898

Nakata, T. & Suzuki, Y. (2019) Effects of massing and spacing on the learning of semantically related and unrelated words. *Studies in Second Language Acquisition*, 41(2): 287–311. https://doi.org/10.1017/S0272263118000219

Nation, I. S. P. (2013) *Learning vocabulary in another language* (2nd ed.). Cambridge: Cambridge University Press. https://doi.org/10.1017/CBO9781139858656

Nation, I. S. P. & Webb, S. (2011) *Researching and analyzing vocabulary*. Boston: Heinle.

Paivio, A. (2014) Bilingual dual coding theory and memory. In Heredia, R. & Altarriba, J. (eds), *Foundations of bilingual memory*. New York: Springer, 41–62. https://doi.org/10.1007/978-1-4614-9218-4_3

Pattemore, A. & Muñoz, C. (2020) Learning L2 constructions from captioned audio-visual exposure: The effect of learner-related factors. *System*, 93: Article 102303. https://doi.org/10.1016/j.system.2020.102303

Pattemore, A., Suárez, M. D. M. & Muñoz, C. (2020) Exploring L2 TV mode preferences and perceptions of learning. In Frederiksen, K.-M., Larsen, S., Bradley, L. & Thouësny, S. (eds.), *CALL for widening participation: Short papers from EUROCALL 2020*. Voillans: Research-publishing.net, 272–278. https://doi.org/10.14705/rpnet.2020.48.1200

Pellicer-Sánchez, A. (2017) Learning L2 collocations incidentally from reading. *Language Teaching Research*, 21(3): 381–402. https://doi.org/10.1177/1362168815618428

Peters, E. (2019) The effect of imagery and on-screen text on foreign language vocabulary learning from audiovisual input. *TESOL Quarterly*, 53(4): 1008–1032. https://doi.org/10.1002/tesq.531

Peters, E., Heynen, E. & Puimège, E. (2016) Learning vocabulary through audiovisual input: The differential effect of L1 subtitles and captions. *System*, 63: 134–148. https://doi.org/10.1016/j.system.2016.10.002

Peters, E., Hulstijn, J. H., Sercu, L. & Lutjeharms, M. (2009) Learning L2 German vocabulary through reading: The effect of three enhancement techniques compared. *Language Learning*, 59(1): 113–151. https://doi.org/10.1111/j.1467-9922.2009.00502.x

Pujadas, G. & Muñoz, C. (2019) Extensive viewing of captioned and subtitled TV series: A study of L2 vocabulary learning by adolescents. *The Language Learning Journal*, 47(4): 479–496. https://doi.org/10.1080/09571736.2019.1616806

Raviv, L., Lupyan, G. & Green, S. C. (2022) How variability shapes learning and generalization. *Trends in Cognitive Sciences*, 26(6): 462–483. https://doi.org/10.1016/j.tics.2022.03.007

Rogers, J. (2017) The spacing effect and its relevance to second language acquisition. *Applied Linguistics*, 38(6): 906–911. https://doi.org/10.1093/applin/amw052

Rogers, J. & Cheung, A. (2018) Input spacing and the learning of L2 vocabulary in a classroom context. *Language Teaching Research*, 24(5): 616–641. https://doi.org/10.1177/1362168818805251

Serrano, R. & Huang, H.-Y. (2018) Learning vocabulary through assisted repeated reading: How much time should there be between repetitions of the same text? *TESOL Quarterly*, 52(4): 971–994. https://doi.org/10.1002/tesq.445

Serrano, R. & Huang, H.-Y. (2023) Time distribution and intentional vocabulary learning through repeated reading: A partial replication and extension. *Language Awareness*, 32(1): 1–18. https://doi.org/10.1080/09658416.2021.1894162

https://doi.org/10.1017/S0958344024000053 Published online by Cambridge University Press

Suárez, M. D. M. & Gesa, F. (2019) Learning vocabulary with the support of sustained exposure to captioned video: Do proficiency and aptitude make a difference? *The Language Learning Journal*, 47(4): 497–517. https://doi.org/10.1080/09571736.2019.1617768

Suárez, M. D. M. & Gesa, F. (2022) Integrating foreign language vocabulary research into the curriculum: Extensive video viewing in the university classroom. In McCallum, L. (ed.), *English language teaching: Policy and practice across the European Union*. Singapore: Springer, 219–237. https://doi.org/10.1007/978-981-19-2152-0_13

Teng, F. (2019) Incidental vocabulary learning for primary school students: The effects of L2 caption type and word exposure frequency. *The Australian Educational Researcher*, 46(1): 113–136. https://doi.org/10.1007/s13384-018-0279-6

Teng, F. (2022a) Vocabulary learning through videos: Captions, advance-organizer strategy, and their combination. *Computer Assisted Language Learning*, 35(3): 518–550. https://doi.org/10.1080/09588221.2020.1720253

Teng, F. (2022b) Incidental L2 vocabulary learning from viewing captioned videos: Effects of learner-related factors. *System*, 105: Article 102736. https://doi.org/10.1016/j.system.2022.102736

Toppino, T. C. & Gerbier, E. (2014) About practice: Repetition, spacing, and abstraction. In Ross, B. H. (ed.), *Psychology of learning and motivation* (Vol. 60). Waltham: Academic Press, 113–189. https://doi.org/10.1016/B978-0-12-800090-8.00004-4

Vanderplank, R. (2016) 'Effects of' and 'effects with' captions: How exactly does watching a TV programme with same-language subtitles make a difference to language learners? *Language Teaching*, 49(2): 235–250. https://doi.org/10.1017/S0261444813000207

van Orden, G. C. (1987) A ROWS is a ROSE: Spelling, sound, and reading. *Memory & cognition*, 15(3): 181–198. https://doi.org/10.3758/BF03197716

Wang, A. & Pellicer-Sánchez, A. (2022) Incidental vocabulary learning from bilingual subtitled viewing: An eye-tracking study. *Language Learning*, 72(3): 765–805. https://doi.org/10.1111/lang.12495

Wang, Y. (2019) Effects of L1/L2 captioned TV programs on students' vocabulary learning and comprehension. *CALICO Journal*, 36(3): 204–224. https://doi.org/10.1558/cj.36268

Webb, S. (2015) Extensive viewing: Language learning through watching television. In Nunan, D. & Richards, J. C. (eds.), *Language learning beyond the classroom*. New York: Routledge, 159–168.

Webb, S. & Chang, A. C.-S. (2012) Vocabulary learning through assisted and unassisted repeated reading. *The Canadian Modern Language Review*, 68(3): 267–290. https://doi.org/10.3138/cmlr.1204.1

Winke, P., Gass, S. & Sydorenko, T. (2010) The effects of captioning videos used for foreign language listening activities. *Language Learning & Technology*, 14(1): 65–86.

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