

# Assessing the Verbal Redundancy Effect by Adding Narration to Written Text in Native and Non-Native Speakers

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## Abstract

The addition of verbal narration could impede reading performance, called the verbal redundancy effect. Two experiments in this study explored the moderating role of readers' vocabulary size and text difficulty in this effect. A total of 77 native English speakers in Experiment 1 and 45 non-native English speakers in Experiment 2 were divided into two groups of vocabulary-size in each experiment. In both experiments, participants read eight passages and answered questions. The study manipulated the narration presentation and text difficulty. Experiment 1 showed that adding narration impedes comprehension when high-vocabulary participants read easy passages, whereas it enhances comprehension when low-vocabulary participants read easy passages. The redundant narration effect was moderated by reading skills. Experiment 2 showed no significant narration effect, but comprehension scores were higher when high-vocabulary multilinguals read neutral passages with narration than without narration. These effects are aligned with previous research and well explained by cognitive load theory.

**Keywords:** redundancy effect, narration, multimedia learning, native speakers, non-native speakers, vocabulary size

## Introduction

Teachers recommend a myriad of learning tools to students, including written text, pictures, animations, and narrations. A general assumption is that listening to verbal narration while reading a text will enhance understanding of that passage—referred to as the modality effect (Ginns, 2005). However, studies on multimedia learning have indicated that presenting identical information in different modalities simultaneously may hinder the learning process, a phenomenon referred to as the redundancy effect (e.g., Gerjets et al., 2009; Mayer et al., 2001). This study aimed to investigate the impact of adding verbal narration to written text, a process that has received little attention in redundancy effect studies. We focused on individual differences as moderating factors.

## Theoretical Background of Redundancy Effect

The redundancy effect is robustly demonstrated when redundant information is presented as written text in addition to spoken text with pictures. Learning from graphics is impeded when they are accompanied by spoken and written text that simultaneously present the same verbal information, compared to spoken text alone (e.g., Kalyuga et al., 1999; Moreno & Mayer, 2002). This negative impact on learning performance due to redundant information is explained by cognitive load theory (CLT, Sweller et al., 1998) and the cognitive theory of multimedia learning (CTML, Mayer, 2005). CLT assumes three sources of cognitive load (Paas et al., 2003, 2004; Sweller 2010; Sweller et al., 1998). Extraneous cognitive load is imposed when the instructional format requires learners to engage in unnecessary cognitive processing. The redundancy effect occurs when different sources provide identical or unnecessary information, leading to extraneous cognitive load (e.g., Chandler & Sweller, 1991; Kalyuga, 2012; Kalyuga et al., 1999).

The visual and verbal channels in CTML further explain the robust redundancy effect when written text is added to spoken text with pictures. The visual channel processes input from the eyes and ultimately produces pictorial representations, while the verbal channel processes input from the ears and ultimately produces verbal representations (Mayer & Moreno, 2002). The visual channel can become overloaded when learners have to visually scan between pictures and written text. When learners receive both spoken and written text, the processing channel for verbal information in working memory may be overwhelmed by the competition between the spoken and written text (Mayer, 2009; Trypke et al., 2023).

## Studies on Verbal Redundancy Effect

The presentation of identical words in both written and spoken form, without visualizations, is known as verbal redundancy (Mayer, 2009). However, studies on verbal

redundancy show no consensus on its overall effects. Theoretically, identical written and spoken text could either hinder or enhance learning.

When both visual and verbal channels present essentially identical information, such as written and spoken text, the redundancy can hinder learning (Craig et al., 2002; Kalyuga et al., 2000, 2004; Mayer et al., 2001). The additional verbal information unnecessarily occupies working memory resources that are needed to meaningfully understand and integrate incoming information, potentially causing extraneous cognitive load (Fenesi & Kim, 2014; Sweller, 2005). Empirical studies have provided evidence supporting the verbal redundancy effect (e.g., Diao & Sweller, 2007).

In contrast, considering the input modalities of written and spoken text, dual-mode presentation may result in the modality effect. Visually presented information is processed in visual working memory, while aurally presented information is processed in verbal working memory, at least initially (Moreno & Mayer, 2002). Each mode can compensate for the other to maintain information. Notably, a meta-analysis by Adesope and Nesbit (2012) showed that adding written text to spoken text usually supports learning. Studies suggest that this is because written text can compensate for the transient nature of spoken text presentation.

### **Verbal Redundancy Effect by Adding Narration**

The inconsistent findings of previous studies on the verbal redundancy effect can be attributed to at least two issues. The first is the lack of distinction between studies that added written text and those that added spoken text. Redundant information can be in the form of spoken text (narration), but only a few studies have examined this type of redundant narration effect. For example, Diao and Sweller (2007) investigated the redundancy effect by comparing two instructional formats: written presentation only and written presentation concurrent with narration. They found that simultaneous presentations rendered text comprehension less effective compared to written presentation only. Similarly, Gerjets et al. (2009) showed that students learned more from written text only than from narration or combined written text and narration. However, Knoop-van Campen et al. (2018) showed no enhancing or impeding effect from adding narration. Given these contradictory results, caution must be exercised when drawing conclusions about the redundant narration effect. The few empirical studies conducted have used entirely different samples and materials.

Secondly, individual differences should be considered. As Scheiter et al. (2014) suggested, scholars must determine whether multimedia learning will be effective for all learners in the same way. Regarding the redundancy effect, learners' capacity and skill should moderate the effect. For example, Fenesi et al. (2015) focused on working memory capacity and found that only older adults are aided by the use of redundant information. Therefore, the effect of adding narration might differ according to the reader's capacity. Recently, Arima et al. (2023) demonstrated that the effect of adding verbal

narration is different depending on the combination of readers' skill and text difficulty. Seventy participants from a Japanese university were divided into two reading skill groups according to their vocabulary size. The participants read texts with and without narration in an in-person experiment. Half of the participants read easy texts chosen from a junior high school-level reading exercise book, while the other half read neutral texts chosen from the Common Test for University Admissions in Japan, a university-level entrance examination text. Results showed that for neutral text, the verbal redundancy narration effect occurred only for high skill readers. For easy text, the verbal redundancy narration effect occurred regardless of reading skill. Arima et al. (2023) suggest that whether the added narration causes extraneous cognitive load depends on the balance of text difficulty and readers' skill. However, Arima et al. (2023) did not find a reversed redundancy effect. They used a between-participants design. Additionally, the verbal redundancy effect could also theoretically occur when the text is too difficult for readers. Adding narration will hinder reading performance by straining their working memory due to the high intrinsic cognitive load involved in reading written text. Furthermore, they targeted native Japanese speakers because reading with narration is common in Japanese classrooms. Notably, although the participants were university students, they might be more familiar with reading with narration compared to readers in other cultures. Thus, research should replicate their study in other languages.

### **The Current Study**

We assessed the verbal redundancy effects when participants were presented written text with and without verbal narration. In Experiment 1, we modified and replicated Arima et al. (2023) targeting native Japanese speakers. We aimed to determine whether individual differences in reading skill and text difficulty would moderate the redundancy effects in native English speakers. We formulated two hypotheses.

Hypothesis 1-1: For high-skill native readers, adding narration hinders reading performance, because the written text is sufficiently intelligible for these readers. It will lead to extraneous cognitive load. This might be especially true when they read easy texts.

Hypothesis 1-2: For low-skill native readers, adding narration enhances reading performance, because the written text might not be sufficiently intelligible for these readers. This might be especially true when they read neutral (not easy) texts.

In Experiment 2, we exploratorily investigated the redundancy effect considering a larger deviation in cognitive load using the same materials as in Experiment 1. We targeted non-native English speakers in a multilingual environment in Experiment 2. Even with high-level English skills, reading comprehension in a second language can be cognitively more demanding due to the reduced size of available working memory in a second language (Diao & Sweller, 2007).

Hypothesis 2-1: Considering the higher cognitive load than native speakers, for high-skill non-native speakers, the resulting pattern would be similar to that of low-skill native speakers. Adding narration will promote reading because the written text is not sufficiently intelligible. This might be especially true when they read neutral texts.

Hypothesis 2-2: For low-skill non-native speakers, adding narration would hinder reading performance by straining their working memory due to the high intrinsic cognitive load involved. This might be especially true when they read neutral texts.

This study could contribute to the accumulation of findings on the redundant verbal narration effect and clarify how individual differences moderate the effect.

## **Common Methods for Experiments 1 and 2**

### **Experimental Design**

Both experiments used a 2 x 2 x 2 factorial design. The most important factor was Narration (narration/no-narration), which was manipulated within participants. The second factor was Vocabulary Level (high/low), which was a between-subjects factor. The participants, who were university students, were grouped based on their scores on the Vocabulary Size Test. This test was used to estimate individual differences in participants' reading skill. Notably, vocabulary size is only one aspect of reading ability. We selected this test for our experiment because studies have shown that reading ability and vocabulary are highly associated (Braze et al., 2016; Lawrence et al., 2019). The third factor was Text Difficulty (easy/neutral), which was manipulated within participants. The skill effect was expected to be clearer at the particular text level.

### **Reading Task**

The reading task consisted of eight trials. Participants read four passages with narration and the other four passages without narration. We counterbalanced the order of the Narration and No-narration blocks between participants. Passage assignment to the Narration/No-narration condition was also counterbalanced. Each passage was followed by true/false tests, consisting of two retention and two comprehension questions.

### **Written Text and Narrations**

The materials included eight English passages containing between 206 and 291 words (average 233 words). Easy and neutral passages were distinguished by source and the Flesch Reading Ease score.

The easy passages were chosen from state-standardized English & Language Arts tests published free for use online (Illinois Assessment of Readiness, n.d.; Missouri Department of Elementary & Secondary Education, 2018; Nebraska State Accountability Grade 6 Reading Practice Test, 2009; New York State Testing Program Grade 6 English Language Arts Test, 2022; Pearson Illinois, n.d.). Their Flesch Reading Ease

scores were rated from 62 to 86, the range recommended for students with reading levels from grades six through eight.

The neutral passages were chosen from practice books for the IELTS (Hogan, 2020; IELTS Reading Academic Text Book, 2020), a standardized test of English language proficiency often used by international students applying to universities in English-speaking countries. These passages were selected with the participants in Experiment 2 in mind. Their Flesch Reading Ease scores ranged between 30.9 and 55.2, the range recommended for students with reading levels from upper-high school to college.

All passages were chosen from 12 passages used in a pilot study with 15 native English speakers enrolled in Davidson College in North Carolina. All passages were converted to verbal narration using the text-to-speech voice reader software Speechify. The narration used the same automated female voice and was read at a default speed of 200 words per minute. All recordings were one minute and 30–40 seconds in length.

### **Retention and Comprehension Test**

Four true/false questions—two for retention and two for comprehension—followed each passage. The retention test measures superficial representation construction. In our study, retention questions were sentences copied directly from the passages, with some having a word or phrase altered. The comprehension test measures higher-level representation construction and requests concepts from the passages.

Some questions were selected from the practice materials mentioned above, while others were originally created by the authors. The pilot study validated that the average accuracy level was between 64% and 85%. The comprehension test score was relatively higher for neutral passages compared to easy passages. However, we prioritized ensuring that the score was higher than the chance level and that no ceiling effect occurred. Retention and comprehension scores were calculated separately for each condition: Easy/No-narration, Neutral/Narration, and Neutral/No-narration. Questions were scored by adding the number of correct responses to the retention and comprehension questions answered in the easy and neutral conditions for the narration and no-narration passages. The full score in each condition was four.

### **Estimation of Participants' Vocabulary Size**

All participants completed a shortened vocabulary-size test. We adapted the online Vocabulary Size Test developed by Nation and Beglar (2007) to assess written receptive vocabulary knowledge. The test proceeded as follows: On the left side of the screen, a word was presented and used in a sentence. On the right side, participants were instructed to choose from four presented meanings. Fifty words were used, and the number of correct answers for each participant was tallied. The original test includes 100 words, and the difficulty level increased with every ten words. For this study, we selected five out of every 10 words, totaling 50. None of the chosen words could be found in the study's passages.

## Procedure

All participants were tested individually through an online experiment developed using Gorilla Experiment Builder (Anwyl-Irvine et al., 2020). Before participation, all participants were given a detailed explanation of the tasks and a written informed consent form.

Participants completed eight trials of the reading task. Each trial consisted of a reading phase, a retention test, and a comprehension test. For the narration condition, participants were instructed to listen to the verbal narration while simultaneously reading the text. After each verbal narration, the survey automatically moved to the questions. For the no-narration condition, the participants were instructed to read through the presented passage once and click “next” without rereading the passage. During the retention and comprehension tests, participants clicked “true” or “false” for each answer without a time limit. They could not return to previous questions or passages. One practice trial was presented when the narration/no-narration conditions began.

After the eight trials, participants completed the Vocabulary Size Test. They were presented with a word and a sentence including the word, then asked to choose the correct meaning for that word. This section had no time limit.

## Analysis

We calculated the accuracy rates of the retention and comprehension tests in each experiment. We analyzed these rates through a repeated measures three-way ANOVA with a 2 (Narration: narration/no-narration) X 2 (Vocabulary Level: high/low) X 2 (Text Difficulty: easy/neutral) factorial design. The Holm test was used as a post-hoc test. Participants in each experiment were divided into two vocabulary level groups based on their median score on the Vocabulary Size Test in each experiment.

We estimated the appropriate sample size using G\*Power ver. 3.1.9.7 (Faul et al., 2007). The effect size in Arima et al. (2023) was small, according to Cohen’s (1988) criteria. With a significance criterion of  $\alpha = .05$  and power = .80, and assuming a moderate correlation of 0.5 among repeated measures, the minimum sample size was 72.

## Experiment 1

### Methods

**Participants** Our study used Prolific (prolific.com) to recruit 80 American participants who were enrolled in a university to complete an undergraduate degree, accounting for potential attrition. We excluded the data of three participants who took an extremely long time to finish the experiment, as they were presumed to have interrupted the experiment. Thus, our analysis used the data of 77 participants (32 females, 43 males, 2 others). The mean age was 21.75 years ( $SD = 1.97$ ). They reported having no literacy difficulties or language-related disorders, such as dyslexia. English was the first language of all participants. All procedures performed in this

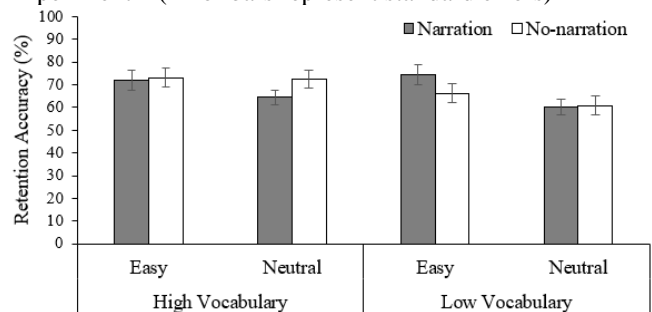
study were approved by the Research Ethics Review Board Committee of the first author’s university.

## Results

We grouped participants into high- or low-estimated vocabulary sizes based on their scores on the Vocabulary Size Test. The 40 participants who scored equal to or above the median (39) were assigned to the high vocabulary level group ( $M = 41.56$ ,  $SD = 2.36$ ), whereas the 37 participants who scored below the median were assigned to the low vocabulary level group ( $M = 33.65$ ,  $SD = 4.05$ ).

Retention test Figure 1 shows the mean retention accuracy scores. A three-way ANOVA showed that the main effect of Text Difficulty was significant ( $F(1, 75) = 10.242$ ,  $p = .002$ ,  $\eta_p^2 = .120$ ). The retention accuracy was higher in the easy condition than in the neutral condition. The main effect of Narration ( $F(1, 75) = 0.035$ ,  $p = .853$ ,  $\eta_p^2 < .001$ ) and Vocabulary Level ( $F(1, 75) = 2.583$ ,  $p = .112$ ,  $\eta_p^2 = .033$ ) were not significant. All interactions were not significant. Specifically, neither the interaction between Vocabulary Level and Narration ( $F(1, 75) = 2.595$ ,  $p = .111$ ,  $\eta_p^2 = .033$ ) nor the three-way interaction ( $F(1, 75) = 0.020$ ,  $p = .887$ ,  $\eta_p^2 < .001$ ) was significant.

**Figure 1.** Mean accuracy of the retention test in two text-difficulty conditions by two vocabulary-level groups in Experiment 1 (Error bars represent standard errors)

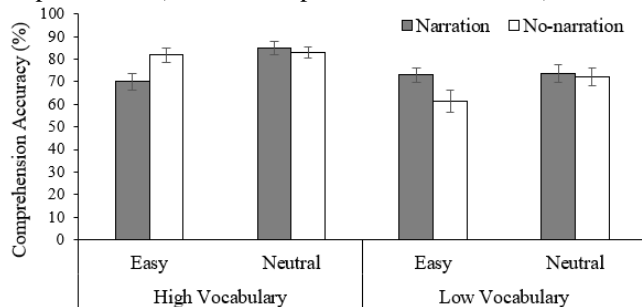


**Comprehension test** Figure 2 shows the mean comprehension scores. A three-way ANOVA showed that the main effect of Vocabulary Level was significant ( $F(1, 75) = 15.953$ ,  $p < .001$ ,  $\eta_p^2 = .175$ ). High-vocabulary participants recorded higher scores than low-vocabulary participants. The main effect of Text Difficulty was significant ( $F(1, 75) = 10.181$ ,  $p < .001$ ,  $\eta_p^2 = .120$ ). Comprehension accuracy was higher in the neutral condition than in the easy condition. The main effect of Narration was not significant ( $F(1, 75) = 0.064$ ,  $p = .801$ ,  $\eta_p^2 = .001$ ).

The expected interaction between Vocabulary Level and Narration ( $F(1, 75) = 4.136$ ,  $p = .046$ ,  $\eta_p^2 = .052$ ) and the three-way interaction ( $F(1, 75) = 5.205$ ,  $p = .025$ ,  $\eta_p^2 = .065$ ) were significant. The simple-simple effect of Narration was significant when low-vocabulary participants read easy passages ( $F(1, 150) = 4.310$ ,  $p = .040$ ,  $\eta_p^2 = .107$ ). Low-vocabulary participants performed better under the Narration condition than under the No-narration condition. The effect of Narration was also significant when high-vocabulary participants read easy passages ( $F(1, 150) = 4.980$ ,  $p = .027$ ,

$\eta_p^2 = .113$ ). In contrast to the low-vocabulary participants, high-vocabulary participants performed better under the No-narration condition than under the Narration condition.

**Figure 2.** Mean accuracy of the comprehension test in two text-difficulty conditions by two vocabulary-level groups in Experiment 1 (Error bars represent standard errors)



## Discussion

In Experiment 1, we examined how reading skill and text difficulty moderated the redundant narration effect among native English speakers. Hypothesis 1-1 was supported: for high-vocabulary participants, adding narration hindered comprehension, confirming the verbal redundancy effect, particularly with easy passages. Hypothesis 1-2 was partially supported: for low-vocabulary participants, adding narration enhanced comprehension, showing a reverse verbal redundancy effect, more pronounced than in Arima et al. (2023) with Japanese speakers. The key finding was that adding identical narration to written text either hindered or enhanced performance based on the reader's skill.

However, some results were inexplicable. First, the narration effect was absent in neutral-passage condition, which had longer words and sentence. The narration effect might be offset by intrinsic cognitive load in the neutral passages. When the intrinsic cognitive load is high, the narration may not be redundant (unnecessary) for high-vocabulary readers. It might help their comprehension. The negative effect of adding narration might be offset by intrinsic cognitive load. Similarly, the narration might be overwhelming for low-vocabulary readers in the neutral condition. Integrating narration with the written text may be a strain on their working memory because of the high intrinsic cognitive load involved in the text. The positive effect of adding narration might be offset by intrinsic cognitive load. In sum, the neutral-passage might be too complex. Second, no narration effect was found in the retention test. Theoretically, retention is higher under dual-mode presentation, as dual-route input would aid in the retrieval of superficial information. The positive effect of adding narration for retention might be offset by consuming cognitive resources for processing identical information, resulting in no clear effect.

We replicated this experiment with non-native English speakers in Experiment 2.

## Experiment 2

### Methods

**Participants** We recruited non-native English speakers from Universiti Sains Malaysia and Raffles University. In Malaysia, where bilingualism is prevalent, English is the official second language. Forty-five university students participated in the experiment (37 females, 8 males). The sample size was smaller due to the difficulty in recruiting bilingual students. However, it was sufficient to detect the redundancy effect based on the study by Arima et al. (2023), which used a between-participants design. The participants' mean age was 22.11 years ( $SD = 2.81$ ). The participants reported having no literacy difficulties or language-related disorders, such as dyslexia. We used the same Gorilla Experiment Builder interface in Experiment 1, but monitored the participants, and provided online help as necessary. All procedures performed in this study were reviewed and approved by the Jawatankuasa Etika Penyelidikan Manusia.

### Results

We grouped the participants into high or low-estimated vocabulary sizes based on their scores on the Vocabulary Size Test. The mean score was lower but not statistically different compared with that in Experiment 1 ( $t(120) = 1.881, p = .062, d = .351$ ). The 22 participants who scored above the median (35) were assigned a higher vocabulary level ( $M = 40.90, SD = 2.84$ ). The 23 participants who scored equal to or below the median were assigned a lower vocabulary level ( $M = 30.87, SD = 4.28$ ).

**Retention test** Figure 3 shows the mean retention accuracy scores. A three-way ANOVA showed that the main effect of Vocabulary Level was significant ( $F(1, 43) = 4.190, p = .047, \eta_p^2 = .089$ ). High-vocabulary non-native speakers recorded higher retention scores than low-vocabulary non-native speakers. The main effect of Text Level was significant ( $F(1, 43) = 6.061, p = .018, \eta_p^2 = .124$ ). Retention accuracy was higher in the easy- than in the neutral-passage condition. The main effect of Narration was not significant.

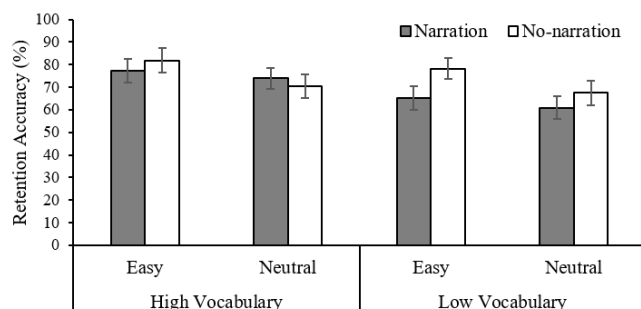
All interactions were not significant. Although the mean accuracy implied that low-vocabulary non-native speakers retained information more accurately without narration compared to with-narration in the easy-passage condition, it did not reach the significant level.

**Comprehension test** Figure 4 shows the mean comprehension scores. A three-way ANOVA showed that no main effect was significant (Narration:  $F(1, 43) = 2.642, p = .111, \eta_p^2 = .058$ ; Vocabulary Level:  $F(1, 43) = 0.052, p = .111, \eta_p^2 = .058$ ; Text Difficulty:  $F(1, 43) = 2.642, p = .111, \eta_p^2 = .058$ ).

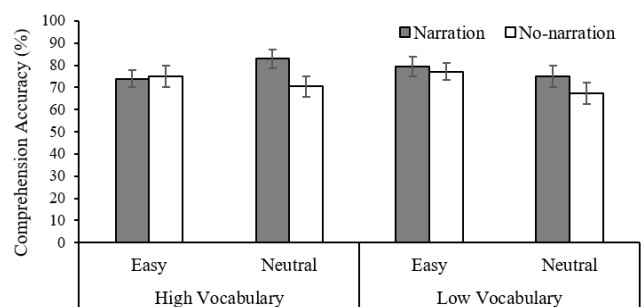
No interaction was significant. However, the effect size of two interactions was larger than .065—the effect size in the significant interaction in Experiment 1. Thus, we conducted post-hoc analyses to check if the narration effect could differ depending on the vocabulary level. Regarding the interaction between Vocabulary Level and Narration ( $F(1, 43) = 3.221, p = .080, \eta_p^2 = .070$ ), the post-hoc analysis showed that the

simple-simple effect of Narration was significant when high-vocabulary non-native speakers read neutral passages ( $F(1, 86) = 4.333, p = .040, \eta^2 = .171$ ). High-vocabulary non-native speakers performed better under the Narration condition than under the No-narration condition. Regarding the interaction between Vocabulary Level and Text Difficulty ( $F(1, 43) = 2.968, p = .092, \eta^2 = .065$ ), the post-hoc analysis showed no significant simple-simple effect.

**Figure 3.** Mean accuracy of the retention test in two text-difficulty conditions by two vocabulary-level groups in Experiment 2 (Error bars represent standard errors)



**Figure 4.** Mean accuracy of the comprehension test in two text-difficulty conditions by two vocabulary-level groups in Experiment 2 (Error bars represent standard errors)



## Discussion

Experiment 2 targeted non-native English speakers but used the same materials and procedures as those in Experiment 1. Generally, adding narration neither enhanced nor hindered reading. The hypotheses were not generally supported.

The absence of the narration effect might occur through a similar process as that of low-vocabulary readers in the neutral-passage condition in Experiment 1. For non-native speakers, processing verbal information is more demanding than for native speakers, resulting in high intrinsic cognitive load, even for high-vocabulary non-native speakers. Thus, the positive effect of adding narration might be offset by the consumption of cognitive resources for processing identical information, aligning with the cognitive load theory.

Although the effect was not statistically significant, adding narration tended to enhance reading comprehension for high-vocabulary non-native speakers. As with low-skill native speakers, aural input could compensate for the processing of complicated text. This effect occurred only with neutral

passages, suggesting that intrinsic cognitive load was not too large for high-vocabulary non-native speakers in the neutral condition. If so, verbal narration might be both helpful and redundant in easy-passage condition for high-vocabulary non-native speakers. This offset might be similar to that for high-vocabulary native speakers in the neutral condition.

It aligns with cognitive load theory, but we should not determine the reason for the absence of the narration effect solely from this study's results. Given that the sample size was smaller than originally planned, the statistical power may have been insufficient.

## General Discussion

Our study aimed to add new findings to the limited literature on the redundant narration effect and to provide clear evidence of the boundary conditions by combining readers' skill and text difficulty. Our experiments provided clear evidence that adding narration could enhance the reading performance of low-vocabulary native speakers (and high-vocabulary non-native speakers) but hinder that of high-vocabulary native speakers. The results differ in some aspects from the previous study on Japanese native speakers (Arima et al., 2023), but these differences could be attributed to variations in the sample and participants. Generally, in our experiment, the texts might be more demanding than those in Arima et al. (2023).

Our findings are well-explained by CLT and CTML assumptions. As Trypke et al. (2023) proposed, when the written text and narration represent identical content, the redundancy effect is moderated by learners' prior knowledge. This moderation shows a similar pattern to the expertise reversal effect (Kalyuga, 2005, 2007; Kalyuga et al., 2003). Learners with fewer cognitive tools often experience greater advantages when presented with information using various modes (Adesope & Nesbit, 2012). However, information that is essential for a novice may be redundant for a more knowledgeable learner. Similarly, in our study, readers' reading skill (estimated by vocabulary size level) moderated the effect. Low-skill readers' performance was enhanced by the added narration. In contrast, for high-skill native readers, identical narration was unnecessary and caused extraneous cognitive load, hindering reading.

Additionally, the absence of any enhancing effect in low-vocabulary native speakers and non-native speakers may suggest another type of verbal redundancy effect. For low-skill readers, processing identical written text and narration could cause an overload of the working memory capacity. This effect is consistent with CLT and CTML. Although the input modalities of the written text and narration are different and use the visual and verbal channels, both are processed in the verbal working memory. Low-skill readers might use more working memory capacity for reading written text. Therefore, integrating information from two modalities could cause overload in the verbal working memory. Although we did not find significant impeding effects, the enhancing effect of added narration might be offset in the case of low-vocabulary readers.

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