The Effects of Multisensory Memory Strategies on Korean EFL Students' Vocabulary Learning

Migyeong Jang[*] and YiBoon Chang

This study investigated the effects of multisensory memory strategies of pairing visual and aural learning strategies of aural lexical advance organizers (LAO) and read-alouds on 146 Korean high school students learning the meaning and pronunciation of 18 unfamiliar English words. In this quasi-experimental design, the control group learned the words on a single mode of written LAO and silent reading as opposed to two treatment groups of aural LAO and silent reading, and of aural LAO and read-alouds, respectively. The effects were tested three times via pre-, post-(immediately after learning), and delayed (30 days later) tests. The immediate and long-term effects were examined by detecting the differences across the three groups in post- and delayed-tests by one-way ANOVA, and the retention of effects was examined by paired t-tests in each group across the three tests. The results indicated that pairing aural LAO and read-aloud strategies was most effective in learning and retention of both vocabulary meaning and pronunciation.

*First Author: Migyeong Jang, English Teacher, Pungsan Middle School

Corresponding Author: YiBoon Chang, Lecturer, College of Engineering, Seoul National University; 1 Gwanak-ro, Gwanak-gu, Seoul 08826, Korea; Email: lemon22@snu.ac.kr

1. INTRODUCTION

Developing and implementing appropriate and effective vocabulary learning strategies is crucial to facilitating second language (L2) learning and student outcomes (Alves, 2014; Yang, Kuo, Eslami, & Moody, 2021), given the pivotal role of vocabulary knowledge in learning other aspects of L2 such as grammatical and syntactic rules and literacy skills as well as in constructing intended meaning (Folse, 2004; Goundar, 2019). In the English as a foreign language (EFL) context, especially at K-12 levels, the importance increases because the students, in lack of sufficient L2 input, are imposed the burden of massively expanding their vocabulary size and depth to attain the required literacy skills. Nevertheless, vocabulary learning has not received enough and separate attention in L2 pedagogy simply because "many dominant traditional language-teaching paradigms do not focus on this domain" (Icht & Mama, 2022, p. 80). This lack of pedagogical attention on L2 vocabulary has raised a special challenge in EFL classroom that teachers are not able to set enough time to focus on vocabulary learning under the limited class hours allocated by the school or national curricula (Teng, 2022). Distinctive contexts of K-12 level EFL practice can often aggravate such challenge as seen in South Korea where high school students are profoundly geared to developing reading skills and test-taking strategies due to the dominance of reading in the Korean college scholastic ability test (Shin, Chon, & Kim, 2011). Here, individual students cannot help being burdened with the full responsibility for cultivating a strong foundation of vocabulary knowledge to succeed in such an intensive L2 reading comprehension test.

To meet the current pervasive demand for L2 reading comprehension skills in various genres and topics (Teng, 2022), EFL students at K-12 levels, especially at upper levels, are supposed to expand receptive vocabulary size given that comprehension skills are essentially determined by vocabulary size and receptive vocabulary knowledge (Henriksen, 1999). In fact, it was demonstrated that Korean EFL high school students' English vocabulary knowledge is a significant predictor of their reading skills (Y. Kang, H.-S. Kang, & Park, 2012). L2 vocabulary size, which denotes the number of familiar L2 words, has been known to better expand via explicit vocabulary learning (Elgort & Nation, 2010; Icht & Mama, 2022; Karami & Bowles, 2019) by more directly and efficiently drawing learners' attention to L2 vocabulary. As for useful strategies of explicit learning to expand vocabulary size, memory strategies (traditionally known as *mnemonics*) are widely adopted to promote the retention of new vocabulary information by constructing its links with old information in learners' existing knowledge (Atay & Ozbulgan, 2007).

These traditional memory strategies for L2 vocabulary learning have recently gain meaningful inspiration from multimedia learning (Mayer, 2001) which promotes encoding new vocabulary knowledge by taking input from multiple senses of textual, visual, and auditory modes (Teng & Zhang, 2023). Integrating multisensory memory strategies into L2

vocabulary learning is relatively new emerging in the late 2010s, and the tools tend to be predominantly oriented to multimedia technology such as videos, apps, and online vocabulary games (Karami, 2019; Teng, 2022). However, these tools require additional efforts and considerable time for teachers to develop as classroom materials to be implemented into regular classroom activities, albeit new and interesting. In tandem with the aforementioned lack of time allotted to vocabulary learning in L2 classroom, most K-12 level L2 textbooks are known not to contain separate vocabulary tasks but to subordinate them to the traditional four language skills of listening, speaking, reading, and writing (Ookawa, 2017). In South Korea, for example, high school English textbooks are reported to cover only a few key words or expressions via listening as pre-reading activities or via presenting some example sentences as after-reading activities, so that most new words were simply listed up along with the reading texts without particular learning activities (Takeda, Choi, Mochizuki, & Watanabe, 2006). In this regard, EFL students' vocabulary learning in classroom essentially depends on individual teachers' capabilities. For effective vocabulary learning, it is thus critical to find the way to integrate effective multisensory memory strategies that are more convenient for teachers to develop and implement.

To this end, this study aims to explore the possibilities of integrating multimodality into conventional vocabulary learning tools of lexical advance organizers and read-alouds as valid multisensory strategies for L2 vocabulary learning. In addition to the ease of development and implementation, these conventional tools were selected due to their solid theoretical foundations as effective memory encoding strategies; lexical advance organizers are grounded upon the subsumption theory (Ausubel, 1960) and read-alouds, a common memory mechanism of the production effect (Icht & Mama, 2015). Since the common lexical advance organizers have been generally implemented in unisensory modes, either visual (e.g., Chang, 2007) or aural (e.g., Chung & Huang, 1998), this study combined them into aural lexical advance organizers by providing aural input of pronouncing the words along with the visual textual input of meaning and example sentences. On the other hand, read-aloud techniques inherently entail multisensory modes of integrating visual (seeing the text) and oral (pronouncing the text) as opposed to silent reading in the unisensory mode of visual (seeing the text). In this study, these two multisensory memory strategies were adopted to test the effects on learning vocabulary meaning and pronunciation, as specified in the following research questions:

1) What are the effects of pairing the aural lexical advance organizer and read-aloud method on Korean EFL students' learning vocabulary meaning?
2) What are the effects of pairing the aural lexical advance organizer and read-aloud method on Korean EFL students' learning vocabulary pronunciation?

2. REVIEW OF THE LITERATURE

2.1. Theoretical Framework for Vocabulary Knowledge and Learning

Vocabulary knowledge is multidimensional (Yang et al., 2021) in that its properties contain multiple aspects and each aspect comprises multiple components. One aspect of vocabulary knowledge is a word, which comprises with form, meaning, and use (Nation, 2013); form refers to phonetic (pronunciation) and visual (spelling) manifestations of a word, meaning represents the associations of form of a word and its referents or concepts, and use denotes the conditions or regulations of using words such as grammar, collocation, and register. These components can also be distinguished into multiple aspects such as the depth (or quality) of vocabulary knowledge and the modes of engagement in verbal interaction. As for the depth of vocabulary knowledge, which is often contrasted with the size, Henriksen (1999) delineated vocabulary size as partial-precise vocabulary knowledge vis-à-vis the depth of vocabulary knowledge. The former is usually manifested in one's vocabulary size commonly measured by word-recognition, L1-L2 translation, or multiple-choice question tasks. The latter denotes the complexity of vocabulary knowledge that entails "a rich meaning representation of a word" (Henriksen, 1999, p. 305) under syntactic, morphological, and syntagmatic (collocational) restrictions. When it comes to the modes of engagement in verbal interaction, the receptive-productive distinction is a conventional aspect of vocabulary knowledge; One uses receptive knowledge to perceive and retrieve the form, meaning, and use of a word while reading and listening, while using productive knowledge to express meaning via speaking and writing by retrieving the form, meaning, and use of a word (Nation, 2013).

This multidimensional nature of vocabulary knowledge has been predominantly embodied into incidental versus explicit learning in classroom-based vocabulary teaching. Incidental vocabulary learning is committed to expanding vocabulary knowledge without learners' any specific intention to pay attention to vocabulary (Nation, 2013; Read, 2000). On the other hand, explicit vocabulary learning implements intentional or instructed learning of words, paying focal attention to expanding vocabulary knowledge (Nation, 1990). Although the presence of attention to words is often regarded as an apparent factor of determining incidental-explicit distinction (Karami, 2019), some researchers argued that the differences in learners' attention to vocabulary learning needs to be understood as different focus of the attention, not the absence versus presence of whole attention (Arndt & Woore, 2018); For example, Ellis (1999) posited that explicit learning entails learners' focal attention to linguistic form of vocabulary and peripheral attention to overall meaning not a complete ignorance of meaning, and vice versa in incidental learning.

While the relative effects of explicit versus incidental learning on developing vocabulary

knowledge have been largely mixed with predominant effects of explicit learning (Laufer & Nation, 2012; Nation & Chung, 2009; Sonbul & Schmitt, 2010) and incidental learning (Karami & Bowles, 2019; Nation, 2011), the effects of explicit learning have been strongly suggested to surpass those of incidental learning in L2 context (Elgort & Nation, 2010). To be more specific, de-contextualization (form-focused) of explicit vocabulary learning has been widely reported to boost the learning effects (Folse, 2004; Prince, 1995; Qian, 1996), which allows "learners to concentrate exclusively on words" for mastery (Icht & Mama, 2022, p. 82). Given the relative lack of input and interaction required for incidental learning in L2 context (Karami, 2019), de-contextualized explicit learning focusing on the form of vocabulary is believed to provide the impetus for enhancing L2 vocabulary knowledge, especially in EFL context.

2.2. Vocabulary Learning Strategy

The significance of L2 vocabulary learning strategies has been grounded upon the fundamental role of vocabulary knowledge in learning other L2 skills (Huckin & Bloch, 1993). In line with this acknowledgement of supporting role of L2 vocabulary knowledge, rather than a stand-alone L2 skill, research on L2 vocabulary learning strategies enjoyed its progress in the late 1990s and some researchers made a valuable contribution to unveiling the nature. The initial attempt of conceptualizing vocabulary learning strategies identified a key trait of structured learning that various tools are utilized to support self-initiated learning (Sanaoui, 1995), which profoundly corresponds to explicit learning in terms of learners' greater awareness and control of their learning (Schmitt, 2007). As for the types of vocabulary learning strategies, Gu and Johnson (1996) proposed more detailed categories of guessing, using dictionary, note-taking, rehearsal, encoding, and activation based on individual believes about vocabulary learning and metacognitive regulation. Schmitt (1997) also categorized 58 vocabulary learning strategies into five types of determination, social, memory, cognitive, and metacognitive strategies.

More recently, Gounder (2019) consolidated these categories into four aspects of metacognitive, cognitive, memory, and activation strategies of vocabulary learning. Metacognitive strategies entail selective attention to identify essential words for comprehension and self-initiation in order to utilize various methods to interpret the meaning of words. Cognitive strategies are to support learners' understanding of words by guessing, using linguistic items or dictionaries, and note taking. Memory strategies comprise rehearsals and encoding; the former is a practice exercise with word lists and repetition, and the latter is to associate the meanings and forms of words with visual, imaginary, auditory, semantic, structural, or contextual cues. Activation strategies are to use words in various context so that learners are able to elicit their vocabulary knowledge for adequate use of

words.

Among these four types of vocabulary learning strategies, memory strategies are particularly vital for EFL students at upper K-12 or tertiary levels who are required to immensely grow vocabulary size "to enhance their literacy in school and beyond" (Teng, 2022, p. 519). Developing and implementing memory strategies to meet this demand is thus a key component of deliberate form-focused vocabulary learning (Elgort & Nation, 2010). In L2 context, memory strategies for form-focused vocabulary learning are characterized by creating strong meaning-form links between L1 meaning and L2 phonetic/orthographical form (Icht & Mama, 2022). The effect of offering bilingual pairs, in which the meaning of L2 words is represented by an L1 translation, is known to outweigh that of monolingual pairs (Nation, 2013). In addition to the cross-linguistic sources to build strong meaning-form links, integrating multiple sensory input to vocabulary learning has been recently introduced as useful memory strategies (Andrä, Mathias, Schwager, Macedonia, & von Kriegstein, 2020).

2.3. Multisensory Vocabulary Learning Strategies

Integrating multimodality into vocabulary learning was largely triggered by increasing recognition and availability of digital and multimedia learning tools in L2 learning context, which is in line with the growing recognition of multimedia learning (Mayer, 2001). Theoretical foundation of multimedia learning lies in the superiority of learning new information via a combination of multiple modes of input such as images, text, sound, and videos (Plass & Jones, 2005) that can be distinguished into textual, visual, and auditory modes (Teng & Zhang, 2023). The superiority is largely supported in the literature of human cognition; Since the human brain has been evolved to learn and operate new information via multisensory interactions in natural environments, multisensory interactions are the rule of human processing in which "learning mechanisms operate optimally under multisensory conditions" (Shams & Seitz, 2008, p. 415).

This solid theoretical foundation of multisensory or multimedia learning has prompted L2 researchers and practitioners to integrate video sources into vocabulary learning including general videos (Al-Seghayer, 2001), videos with diverse on-screen text types (Peters, 2019), and authentic videos including TV programs (McKeown, Crosson, Moore, & Beck, 2018). Traditional vocabulary learning strategies, which do not demand additional effort to create or edit video sources, also began to be conceptualized from the perspectives of multimedia learning as valid and convenient multisensory vocabulary learning strategies for L2 classroom. Among others, two traditional vocabulary learning strategies, lexical advance organizers and read-alouds, are discussed below from the perspectives of multisensory learning as multisensory encoding strategies to enhance the memory of L2 vocabulary knowledge.

2.3.1. Lexical advance organizers

Lexical advance organizers refer to advance introduction to relevant concepts or materials for the target words. They have been known to have derived from the subsumption theory by Ausubel (1960) that the process of learning a large amount of information is to create subsuming bridges to connect new materials into existing materials in mental ideas. Advance organizers thus can operate as the subsuming bridges in learning process and promote learning effects. They can take a wide variety of kinds such as pictures, illustrations, graphs, matrices, outlines, questions, and concept maps, which can be presented in various modes of visuals, audio, or audio-visuals.

Lexical advance organizers typically consist of words appearing in the text, which are new or difficult to learners (Chang, 2007; Mortazavi, 2011) as commonly seen in the keyword advance organizers in reading classroom to introduce the words important to understanding the given text. Lexical advance organizers have been widely applied to enhancing L2 listening skills and the effects were tested by L2 listening comprehension tests (Chang, 2007; Chung, 2002; Wilberschied & Berman, 2004), rather than as a tool solely for L2 vocabulary learning. They have often been combined with additional multisensory encoding sources such as videos (e.g., Li, 2014; Teng, 2022), primarily to enhance L2 learners' awareness of L2 culture (Karami & Bowles, 2019). Since cultural awareness is fundamentally associated with the depth of vocabulary knowledge, the potential effects of multisensory lexical advance organizers need to be explored separately as memory encoding strategies to expand vocabulary size.

2.3.2. Read-alouds

The traditional conflicting views on the relative benefit of reading aloud vis-à-vis silent reading in L2 context have reached a general consensus that the effects vary according to learners' reading proficiency level; reading aloud is more advantageous to the beginning level readers who need to be involved in a slow but accurate reading procedure (Fisher, Flood, Lapp, & Frey, 2004; Hickman, Pollard-Durodola, & Vaughn, 2004), while reading silently is more effective to advanced level students as oral reading may slow down their reading speed (Griffin, 1992). Still, many L2 teachers have their students read aloud, pointing out some of its benefits such as expansion of spoken vocabulary, facilitating awareness of the sounds of the language, and developing self-confidence. In addition, the facilitative effects of strategically conducted read-alouds were evidenced on the learners struggling with decoding skills (Beck & McKeown, 2001). Well-constructed classroom read-alouds were also found to be beneficial in promoting L2 learners' vocabulary knowledge as well as reading comprehension (Santoro, Chard, Howard, & Baker, 2008).

Read-alouds are so traditional and familiar classroom activities (Castel, Rhodes, & Friedman, 2013) that their effects earned initial focus in the literature and began to be conceptualized as a common learning device of vocal production (Icht & Mama, 2015) with the theoretical foundation of production effect (Ozubko, Hourihan, & MacLeod, 2012). The production effect refers to "memory advantage for produced items (read aloud) over non-produced items (read silently)" in which produced items are distinctively encoded to memory so that the retrieval and retention are enhanced (Icht, & Mama, 2022, p. 79). The assumed memory benefit of read-alouds as a vocal production technique has been already demonstrated over other production techniques such as typing or mouthing as well as non-production ones (Bodner & MacLeod, 2016). However, empirical evidence has been limited to certain population groups such as older adults, pre-school children, or hearing-impaired individuals (Icht & Mama, 2022). Further studies on young adult groups or students at K-12 levels are thus necessary to gain a more comprehensive understanding of the benefits of read-alouds on building L2 vocabulary knowledge.

3. METHODOLOGY

3.1. Instruments

3.1.1. Lexical advance organizers

A total of 24 words for lexical advance organizers (LAOs) were selected by the first author and two in-service English teachers of the research site, a high school in Gyeonggi-do province in South Korea. The words were then examined whether the meanings would be unfamiliar enough to the students and the discrepancies between the spellings and pronunciations were high enough so that the students had to rely on the treatments of LAOs and read-alouds for learning. After the review, 18 words were finally selected: *itinerary, affordable, accounting, real estate agency, aisle, dairy, sturdy, resistant, acid rain, sulphur dioxide, nitrogen oxide, primary pollutant, fragrance, artificial, chemical, odds, asthma,* and *ventilated*. To ensure the adequacy of these words for this experiment, a pilot test was conducted to 40 first or second grade student members of the English extracurricular program at the same high school of this study. When over 50% of the students were unable to either bring up its meaning or pronounce it correctly, the word was included in the word list of LAOs. The students were asked to fill out blanks with the meaning of each word for 5 minutes, and then to individually pronounce each word. The result of pilot study is summarized in Table 1.

TABLE 1
Pilot Test Results of LAOs Word List

No.	Word	Correct Pronunciation (%)	Correct Meaning (%)
1	itinerary	1	5
2	affordable	2	10
3	accounting	1	5
4	real state agency	2	10
5	aisle	9	45
6	dairy	1	5
7	sturdy	0	0
8	resistant	3	15
9	acid rain	6	30
10	sulphur dioxide	0	0
11	nitrogen oxide	0	0
12	primary pollutant	1	5
13	fragrance	0	0
14	artificial	4	20
15	chemical	8	40
16	odds	0	0
17	asthma	2	10
18	ventilated	0	0

During the pilot test, the test-takers produced common pronunciation errors from exceptional phonics rules such as [əfɔ́:rdéibəl] for *affordable*, or pronouncing the silent "s" for *aisle*. These common errors were recorded for the researchers' reference to determine the criteria for grading in vocabulary pronunciation test.

Using the chosen 18 words, written LAOs were created into two versions of the print and PowerPoint presentation. The printed written LAOs contained the spelling of each word, its meaning in Korean, an exemplary sentence, and the Korean translation of the sentence (Appendix A). The provision of L1 meaning and translation per se works as a powerful subsuming bridge for the students to connect the new information of L2 word form and meaning into their existing L1 representations of the referents or concepts. By the same token, L2 exemplary sentences along with L1 translations facilitate the students' association of the form and meaning of new L2 words by using their existing L2 vocabulary knowledge to encode the meaning of L2 sentences as a whole. The PowerPoint presentation of written LAOs displayed the same information of the written LAOs, designed to include the first 2 slides to explain how to study LAOs and to control the pace of students studying LAOs by turning 18 slides of the 18 words (Appendix B). Each slide was shown for 30 seconds, so that the students spent about 10 minutes to watch the whole presentation.

Aural LAOs of the same 18 words consisted of three sets: the printed written LAOs, the PowerPoint presentation of the written LAOs, and a native English speaker's sound of reading each word aloud and its exemplary sentence. The voice was adopted from online English dictionary service available at *Naver Korean-English-Korean online dictionary*

(dictionary.naver.com). The articulation of words and sentences was recorded in Standard American English, which the Korean students have been more commonly exposed to in their learning via textbooks and at school than other dialects such as British or Australian English. During the 30 seconds allotted to each slide, the pronunciation of each word and its exemplary sentence repeated twice.

3.1.2. Vocabulary meaning test

In the vocabulary meaning test (VMT), the students were asked to fill in the blanks in the answer sheet with Korean definition(s) of the 18 words within a 10-minute time limit. The same test was used to three VMTs in this study, namely pre-VMT, post-VMT, and delayed VMT. Pre-VMT was implemented to test students' prior knowledge about the meaning of 18 words. The grading of pre-VMT was lenient and flexible in that the meanings other than those in LAO were accepted as correct answers including those of different parts of speech. For example, while *isle* is used as a term describing a walkway between two sections in a supermarket in LAO, the answer that refers to a walkway between seats in an airplane was also accepted as a correct answer. *Resistant* and *chemical* are a homonym that involves two different meanings with one written form, particularly in different parts of speech of an adjective and a noun. Thus, either the meaning as an adjective or a noun was accepted as a correct answer for the words. This was because pre-VAT was not to test the effects of students learning particular meanings of the target words, but to examine students' existing knowledge of the words.

After the treatment of vocabulary learning via LAOs or reading-aloud, post-vocabulary meaning test (post-VMT) was conducted in the same format of pre-VMT. Unlike grading pre-VMT, student answers to post-VMT were graded to be correct only when they corresponded to those of presented in LAO. Delayed VMT, conducted 30 days after post-VMT, also followed the same procedure of implementation and grading with those of post-VMT. The answer sheets of pre-, post- and delayed-VMT are displayed in Appendix C.

3.1.3. Vocabulary pronunciation

Participants' knowledge about vocabulary pronunciation was tested by individual interview in which students read aloud the 18 words in the LAO word list. The pre-, post- and delayed- vocabulary pronunciation test (VPT) questions and implementation were the same; each question required the students to correctly pronounce each word from LAO and one correct pronunciation was counted as one point to the total score of 18. The word list showed only the spells not the meaning or other additional information. Interviewers audio-recorded the student pronunciations, not grading the student pronunciation during the

interview in front of the students in case test-takers watching their performance being graded might motivate or de-motivate student performance.

Pre-VPT was conducted individually before the treatment by the first author, and post- and delayed- VPT were conducted by the first author and a college-student assistant. The assistant's help was needed to save time since the time available for the interview session was only 40 minutes due to the regular class schedules. The students were randomly distributed into two groups, and the first author interviewed one group while the assistant interviewed the other. To prevent students from overhearing the performance of the others, the two groups were separately located in different research spots where no distracting sound was heard. Waiting for their turns, the students stayed in the classroom of their group. Delayed-VPT was conducted 30 days after post-VPT with the same test procedure.

Pre-VPT results were graded by the first author, and post- and delayed-VPT results were graded by the first author and the assistant by listening to the recorded pronunciation of the students. As for post-and delayed-VPT results, the first author graded twice by listening to the recorded sound of students to ensure grading consistency. In the first-round of grading, the assistant worked with the first author by providing information about the student performance to decide student errors. The final decision was primarily made by the first author so that the grading procedure and its result could be consistent.

3.2. Data Collection

3.2.1. Participants

The participants of the present study were one female English teacher, the first author of this study, and a total of 146 third grade students at a co-ed high school in Gyeonggi province in South Korea. The first author recruited the student participants, by explaining the research and voluntary participation and then collecting the consent from the students under the approval of the school. Most of the students had received English education at school for 9 years at the time of participation, three years in elementary school, three years in middle school, and three years in high school, following the national curriculum in South Korea. Some of them might have received longer or more intensive English education from private sectors, but student experiences in private education was not considered a critical factor of determining student participation since pre-test was to reveal their current vocabulary knowledge in this study. Nevertheless, those who had stayed in English-speaking countries over 6 months were excluded from this study so as to avoid possible influence of such intensive previous L2 input on the speed of learning and retention of vocabulary memory.

The chosen student participants were aged around 17 and 18 years, consisting of 80 males and 66 females. They were divided into three sub-groups in this quasi-experimental design:

a control group, a treatment group of aural LAO and silent reading, and a treatment group of pairing aural LAO and read-aloud. Although this study involved a control group, the students were not randomly assigned across the groups as the treatments were offered during the regular class hours. As a result, students in the same classes were grouped together and the number of students in each group slightly differed. The control group was engaged in a unisensory (versus multisensory) written LAO and silent reading as the equivalent class activities of the treatments. Detailed information about the student group formations and treatments are summarized in Table 2.

TABLE 2
Participant Information & Group Treatments

Group	N	Male	Female	Treatments
C	48	19	29	written lexical advance organizer + silent reading
A	46	36	10	aural lexical advance organizer + silent reading
R	52	25	27	aural lexical advance organizer + read-aloud
Total	146	80	66	

To ensure the students across the groups were comparable in their vocabulary knowledge, a pre-VT was conducted and Table 3 shows the descriptive statistics of the mean scores of pre-VT pronunciation and meaning.

TABLE 3
Descriptive Statistics for Pre-Vocabulary Test Scores

Group	N	Pronunciation			Meaning		
		PPS	M	SD	PPS	M	SD
C	48	18	9.75	3.60	18	3.73	2.76
A	46	18	9.78	4.01	18	4.24	2.95
R	52	18	10.44	3.08	18	3.77	2.57
Total	146		10.0	3.55		3.90	2.75

Note. Group C refers to a control group with written LAO and silent-reading activities, Group A refers to aural LAO treatment group, and Group R refers to the group with reading-aloud treatment along with aural LAO. PPS stands for possible perfect score.

As Table 3 illustrates, the students had much higher prior knowledge about the pronunciation of the target words than that of meaning, which reflects the fact that high school students have already established solid knowledge of English phonics from previous learning experiences. Still, they were not able to correctly pronounce almost the half of the target words, which represents the high spelling-pronunciation discrepancies of the target words.

TABLE 4
One-way ANOVA of Pre-Vocabulary Test Scores

	Pronunciation				Meaning			
	SS	*DF*	*F*	Sig.	*SS*	*DF*	*F*	Sig.
Between Groups	15.34	2	.604	.548	7.578	2	.499	.608
Within Groups	1815.65	143			1085.080	143		
Total	1830.99	145			1092.658	145		

To determine the homogeneity of the three groups from non-random sampling, one-way ANOVA test was conducted as seen in Table 4. The mean differences of pre-VT for pronunciation across the three groups were not significant ($F = .604$, $p = .548$), and those of meaning were not significant as well ($F = .499$, $p = .608$). These groups were thus proved to be homogeneous in terms of their prior knowledge on the pronunciation and meaning of target words, so that further data collections and analyses proceeded.

3.2.2. Experimental procedures

After the students finished taking the pre-VT, they participated in the experiment. To prevent students from learning the target words by chance before the experiment, the experiment was conducted in no more than 2 days after the pre-VT. The experiment consisted of two parts: the first 20 minutes were spent on student exposure to LAO, and the next 10 minutes were allotted for students studying LAO on their own. Right after the experiment, the students took post-VT, followed by delayed-VT 30 days after post-VT. The experimental procedures for individual participants are summarized in Table 5.

TABLE 5
Summary of Experimental Procedures for Individual Students

Session	Activity	Time (min.)
Preparation	Pre-vocabulary test for meaning	10
	Pre-vocabulary test for pronunciation	2
1	Lexical advance organizer distribution & presentation	20
	Self-study on lexical advance organizer	10
2	Post-vocabulary test for meaning	10
	Post-vocabulary test for pronunciation	2
3	Delayed-vocabulary test for meaning	10
	Delayed-vocabulary test for pronunciation	2

Detailed descriptions of proceeding session 1 to 3 in each group are as follows. In Control group ($N = 48$), for the first 20 minutes, students were provided with the written LAO. For 20 minutes, they silently read the printed written LAO while watching the PowerPoint

presentation of the written LAO. After watching the presentation twice, the students were asked to study the target 18 words on their own for 10 minutes. During that time, they were asked to read the words silently, but not read aloud the words or write down the spelling or definitions. This equivalent unisensory learning activities may have had different impacts on the students learning L2 word meaning and pronunciation, since the students did not directly experience learning about L2 pronunciation from the visual-only written LAO and silent reading. In this regard, Control group might not have gained learning of L2 pronunciation comparable to that of L2 meaning. We assumed that, however, the visual-only encoding process from written LAO and silent reading could have provided the students with sufficient learning opportunities to utilize their existing knowledge on phonics to learn the pronunciations of L2 target words especially during silent reading when they were able to rehearse the pronunciations in their mind. Unlike L2 meaning, L2 pronunciation is profoundly rule-based so that the students could have gained relevant learning from the unisensory learning activities in the lack of direct exposure to L2 pronunciation. We also considered the fact that most current vocabulary learning activities in textbooks are predominantly visual only as reviewed in the literature (e.g., Takeda et al., 2006), and expected to examine the relative effects of visual unisensory vocabulary learning strategies vis-à-vis those of multisensory ones via this study.

Students in Aural LAO + Silent reading group (*N* = 46) listened to the sound of aural LAO twice, while either watching the PowerPoint presentation of the written LAO or looking through the printed written LAO. During the 20-minute of aural LAO exposure time, they read the words silently, and were totally prevented from reading aloud the words. During the self-study time for 10 minutes, they silently read the words and sentences, not being allowed to write down the words for practice.

Students in Aural LAO + Read-aloud group (*N* = 52) also listened to the sound of aural LAO twice by looking at the written LAO, but they heard the sound in silence for the first time and orally repeated the sound for the second time. During the 20-minute of aural LAO exposure time, the students read aloud each word and its exemplary sentence twice. During the self-study time, they were asked to only read out the target words on the written LAO but not write them down for practice.

All participants handed in the printed written LAOs to the first author for the post-VT on meaning and pronunciation. After a 5-minute break, they filled out the blanks on the post-VMT sheet with the L1 meaning of the words. After submitting the post-VMT sheets, the students participated in the post-VPT individually. After 30 days, all participants took a delayed-VT; both delayed-VMT and VPT were conducted in the same way as the pre- and post-VT had been conducted. While 30-day gap might not be long enough to manifest the long-term effects of memory strategies, given the existing time gap of 2 days (Kang, Gollan, & Pashler, 2013), 7 days (Ozubko et al., 2012), and 14 days (Icht & Mama, 2022) in the

literature, it was assumed that the students would experience considerable loss of their memory during 30 days. In addition, over 30-day time gap is highly likely to involve larger potential influences of other input on the learning effects via individual studies from school and other educational institutions.

3.3. Data Analysis

To examine the immediate and long-term effects of multisensory memory strategies of aural LAO and read-alouds, the differences in the scores of pre-VT, post-VT and delayed-VT were analyzed across the three groups, respectively, via the one-way ANOVA ($\alpha = 0.05$) and post-hoc Scheffe test. To further examine which memory strategies most aided the retention of vocabulary memory across time, paired t-test was conducted for each group between the scores of pre- and post-tests, post- and delayed tests, and pre- and delayed tests, respectively. The independent variables were combined treatments of different modes of LAO (written or aural) and reading methods (aloud or silent). Statistical package for social studies (SPSS) version 20.0 was used as the main statistical program for the analyses.

4. RESULTS

Section 4 is organized to answer the two research questions about the effects of pairing aural LAO and read-aloud methods on Korean EFL students' learning of vocabulary. Section 4.1 addresses Question 1 about the effects on vocabulary meaning and Section 4.2 addresses Question 2 about the effects on vocabulary pronunciation. The pairing denotes multisensory memory strategies of integrating aural and oral modes into the visual-only mode in the written channel of control group strategies (i.e., written LAO and silent reading).

4.1. Effects of Multi-sensory Memory Strategies on Learning L2 Vocabulary Meaning

Section 4.1.1 depicts the immediate effects of multi-sensory memory strategies on learning L2 vocabulary meaning by comparing the scores of post-vocabulary meaning test (post-VMT) across control, aural LAO, and aural LAO + read aloud groups. Section 4.1.2 reports the long-term effects with the comparison in the scores of delayed-VMT scores across the three groups. Section 4.1.3 investigates the retention of effects on learning vocabulary meaning.

4.1.1. Immediate effects of multisensory memory strategies on vocabulary meaning

To examine the immediate effects of the multisensory memory strategies on each group's learning of vocabulary meaning, the means and standard deviations of the post-VMT scores of three groups were analyzed. Table 6 shows the descriptive statistics of three groups' post-VMT scores with the possible perfect scores of 18.

TABLE 6
Descriptive Statistics for Post-Vocabulary Meaning Test Scores

	N	PPS	Post-VMT M	SD
Control	48	18	15.58	4.326
Aural LAO + Silent-reading	46	18	14.15	4.561
Aural LAO + Read-aloud	52	18	15.88	2.572
Total	146		15.24	3.926

Note. PPS stands for possible perfect score.

The results illustrate that each group marked apparently comparable scores in the post-VMT. Aural LAO + Read-aloud group obtained the highest score ($M = 15.88$) as expected, but the control group interestingly marked the second highest score ($M = 15.58$) with the lowest score ($M = 14.15$) from Aural LAO + Silent-reading group. When these comparable scores were analyzed via one-way ANOVA, no significant difference was detected ($F = 2.713, p = .070$) as seen in Table 7, which evidences that the multisensory memory strategies did not make immediate effects on student learning of vocabulary meaning.

TABLE 7
One-way ANOVA of Post-VMT Scores

	SS	df	MS	F	Sig.
Between Groups	81.700	2	40.850	2.713	.070
Within Groups	2152.909	143	15.055		
Total	2234.610	145			

4.1.2. Long-term effects of multisensory memory strategies on vocabulary meaning

A delayed-VMT was conducted after 30 days after the experiment and post-VMT to examine the long-term effects. As the test questions were the same between post- and delayed-VMTs, the possible perfect score of delayed-VMT was 18. Descriptive statistics of delayed-VMT scores in Table 8 reveals considerable student memory loss with the total mean score dropped more than half from 15.24 in post-VMT to 7.36. Despite this drastic decline of mean test score, Aural LAO + Read-aloud group maintained relatively high score

($M = 9.44$) compared to Aural LAO + Silent-reading group ($M = 6.96$) and Control group ($M = 5.48$). It is noteworthy in that these two groups lost nearly 60% of the points in long-term effect from their comparable immediate effects of around 15-point scores with Aural LAO + Read-aloud group.

TABLE 8
Descriptive Statistics for Delayed-Vocabulary Meaning Test Scores

		Delayed-VMT		
	N	PPS	*M*	*SD*
Control	48	18	5.48	4.672
Aural LAO + Silent-reading	46	18	6.96	4.422
Aural LAO + Read-aloud	52	18	9.44	5.147
Total	146		7.36	5.024

Note. PPS stands for possible perfect score.

This drastic difference was statistically confirmed by the result of one-way ANOVA that demonstrates a significant difference across their mean scores ($F = 8.842, p = .000$) as seen in Table 9. According to the post-hoc Scheffe test result (Table 10), the difference derived from the significantly higher score of Aural LAO + Read-aloud group than the other two groups ($p < .05$) when the scores of the two were not significantly different ($p > .05$).

TABLE 9
One-way ANOVA of Delayed-VMT Scores

	SS	*df*	*MS*	*F*	Sig.
Between Groups	402.760	2	201.380	8.842	.000*
Within Groups	3256.719	143	22.774		
Total	3659.479	145			

*$p < .05$

TABLE 10
Post-hoc Scheffe Test of Delayed-VMT Scores

Group		Mean Difference	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
C	A	-1.477	.985	.327	-3.91	.96
	R	-3.963	.955	.000*	-6.33	-.160
A	C	1.477	.985	.327	-.96	3.91
	R	-2.486	.966	.039*	-4.88	-.10
R	C	3.963	.955	.000*	1.60	6.33
	A	2.486	.966	.039*	.10	4.88

Note. Group C refers to a control group with written LAO and silent-reading activities, Group A refers to aural LAO treatment group, and Group R refers to the group with reading-aloud treatment along with aural LAO. *$p < 0.5$

Overall, the long-term effects of multisensory strategies on vocabulary meaning involved a big memory loss after 30 days in Aural LAO + Silent reading group and Control group, and the source of the difference in the effects among the three groups was the addition of read-alouds.

4.1.3. Retention of learning effects of multisensory memory strategies on vocabulary meaning

To probe the retention of student knowledge in vocabulary meaning according to memory strategies, the scores of pre-, post-, and delayed-VMT were compared in each group. Figure 1 displays the changes of VMT scores in each group across the three tests.

FIGURE 1
Changes of VMT Scores in Each Group (Mean Score Comparison)
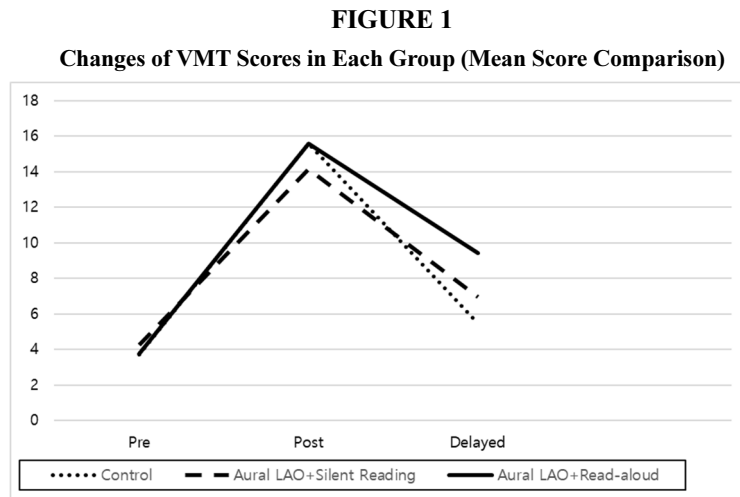
Although the three groups obtained comparable scores in post-VMT, the scores appear noticeably different in delayed-VMT. In order to detect statistically significant difference among the test scores, the three VMT results are analyzed by paired t-test for each group (Table 11). Pair 1 consists of pre- and post-VMT scores, Pair 2, post- and delayed-VMT scores, and Pair 3, pre- and delayed-VMT scores.

According to Table 11, in all groups, VMT scores dramatically increased right after the experiment as seen in the largest mean difference in Aural LAO + Read-aloud group (MD = 12.115) in Pair 1. One noteworthy finding is that Aural LAO + Silent-reading group displayed smaller difference (MD = 9.913) than Control group (MD = 11.854). As for the loss of memory, the results of Pair 2 demonstrate that Control group lost the biggest amount of knowledge about vocabulary meaning (MD = -10.154), whereas Aural LAO + Read-aloud group lost the smallest amount (MD = -6.442), which was followed by Aural LAO + Silent-

reading group (*MD* = -7.196). The overall retention of memory on vocabulary meaning after 30 days was found to be highest in Aural LAO + Read-aloud group (*MD* = 5.673) in Pair 3, whereas Control group retained the least (*MD* = 1.750).

TABLE 11
Paired t-test Result of Scores on VMT

| Group | Pair | Paired Differences | | *t* | *df* | Sig. (2-tailed) |
		MD	*SD*			
C	1	11.854	3.952	20.783	47	.000*
	2	-10.104	4.896	-14.299	47	.000*
	3	1.750	3.278	3.699	47	.001*
A	1	9.913	4.125	16.300	45	.000*
	2	-7.196	4.455	-10.954	45	.000*
	3	2.717	3.060	6.023	45	.000*
R	1	12.115	3.116	28.034	51	.000*
	2	-6.442	4.925	-9.434	51	.000*
	3	5.673	4.528	9.036	51	.000*

Note. Group C refers to a control group with written LAO and silent-reading activities, Group A refers to aural LAO treatment group, and Group R refers to the group with reading-aloud treatment along with aural LAO. *p < 0.5

Overall, the three groups illustrated statistically significant effects and losses of learning at both immediate and longer time intervals. The retention of multisensory memory strategies on vocabulary meaning, however, was found to be the largest and longest with the smallest losses.

4.2. Effects of Multi-sensory Memory Strategies on Learning L2 Vocabulary Pronunciation

Section 4.2.1 depicts the immediate effects of multi-sensory memory strategies on learning L2 vocabulary pronunciation by comparing the scores of post-VPT across Control, Aural LAO + Silent-reading, and Aural LAO + Read-aloud groups. Section 4.2.2 reports the long-term effects with the comparison in the scores of delayed-VPT scores across the three groups. Section 4.2.3 investigates the retention of effects on learning vocabulary pronunciation.

4.2.1. Immediate effects of multisensory memory strategies on vocabulary pronunciation

To examine the immediate effects of the multi-sensory memory strategies on each group's learning the pronunciation of words, the means and standard deviations of the post-VPT scores of three groups were analyzed. Table 12 shows the descriptive statistics of three

groups' post-VPT scores with the possible perfect scores of 18.

TABLE 12

Descriptive Statistics for Post-Vocabulary Pronunciation Test Scores

	N	PPS	*M*	*SD*
		Post-VPT	
Control	48	18	11.04	3.038
Aural LAO + Silent-reading	46	18	12.24	4.132
Aural LAO + Read-aloud	52	18	16.23	2.016
Total	146		13.27	3.853

Note. PPS stands for possible perfect score.

Unlike the comparable scores of the three groups in post-VMT, a conspicuous strength is observed in the post-VPT scores of Aural LAO + Read-aloud group (M = 16.23), while those of Control (M = 11.04) and Aural LAO + Silent-reading groups (M = 12.24) were similar. When these scores were analyzed using one-way ANOVA (Table 13), a significant difference was detected from the mean scores (F = 37.693, p = .000).

TABLE 13

One-way ANOVA of Post-VPT Scores

	SS	*df*	MS	*F*	Sig.
Between Groups	743.065	2	371.533	37.693	.000*
Within Groups	1409.517	143	9.857		
Total	2152.582	145			

*p < .05

Sources of the difference, according to the post-hoc Scheffe test result (Table 14), turned out to be the higher score of Aural LAO + Read-aloud group (p < .05), when the scores of Control and Aural LAO groups were not significantly different (p > .05).

TABLE 14

Post-hoc Scheffe Test of Post-VPT Scores

Group		Mean Difference	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
C	A	-1.197	.648	.185	-2.80	.40
	R	-5.189	.628	.000*	-6.74	-3.63
A	C	1.197	.648	.185	-.40	2.80
	R	-3.992	.635	.000*	-5.56	-2.42
R	C	5.189	.628	.000*	3.63	6.74
	A	3.992	.635	.000*	2.42	5.56

Note. Group C refers to a control group with written LAO and silent-reading activities, Group A refers to aural LAO treatment group, and Group R refers to the group with reading-aloud treatment along with aural LAO. *p < 0.5

Overall, the immediate effects of multisensory memory strategies on vocabulary pronunciation were clear unlike the case of vocabulary meaning, and the source of the effects was the combination of Aural LAO and Read-aloud strategies.

4.2.2. Long-term effects of multisensory memory strategies on vocabulary pronunciation

A delayed-VPT was conducted 30 days after the experiment and post-VPT to examine the long-term effects. As the test questions were the same between post- and delayed-VPTs, the possible perfect score of delayed-VPT was 18. Descriptive statistics of delayed-VPT scores in Table 15 reveals that the students' delayed-VPT scores far less decreased across all three groups compared to delayed-VMT scores, especially in Aural LAO + Silent-reading ($M =$ 11.43) and Control groups ($M =$ 10.25) maintaining two-digit scores in line with the score of Aural LAO + Read-aloud group ($M =$ 14.12).

TABLE 15
Descriptive Statistics for Delayed-Vocabulary Pronunciation Test Scores

		Delayed-VPT		
	N	PPS	*M*	*SD*
Control	48	18	10.25	3.687
Aural LAO + Silent-reading	46	18	11.43	3.291
Aural LAO + Read-aloud	52	18	14.12	2.935
Total	146		12.00	3.677

Note. PPS stands for possible perfect score.

However, these apparently similar scores in delayed-VPT were found to be significantly different one another in the results of one-way ANOVA ($F =$ 18.011, $p =$ .000) as can be seen in Table 16. The post-hoc Scheffe test (Table 17) confirmed that the score of Aural LAO + Read-aloud was significantly higher than the other two groups ($p <$ .05) when the scores of the two were not significantly different.

TABLE 16
One-way ANOVA of Delayed-VPT Scores

	SS	*df*	*MS*	*F*	Sig.
Between Groups	394.388	2	197.194	18.011	.000*
Within Groups	1565.612	143	10.948		
Total	1960.000	145			

*p < .05

Overall, the long-term effects of multisensory strategies on vocabulary pronunciation involved a relatively small memory loss after 30 days in Aural LAO + Silent-reading and

Control groups, but the effects differed across the three groups when the source of the difference lied in Aural LAO + Read-aloud group.

<div align="center">TABLE 17</div>
<div align="center">Post-hoc Scheffe Test of Delayed-VPT Scores</div>

Group		Mean Difference	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
C	A	-1.185	.683	.225	-2.87	.50
	R	-3.865	.662	.000*	-5.50	-2.23
A	C	1.185	.683	.225	-.50	2.87
	R	-2.681	.670	.001*	-4.34	-1.02
R	C	3.865	.662	.000*	2.23	5.50
	A	2.681	.670	.001*	1.02	4.34

Note. Group C refers to a control group with written LAO and silent-reading activities, Group A refers to aural LAO treatment group, and Group R refers to the group with reading-aloud treatment along with aural LAO. $*p < 0.5$

4.2.3. Retention of learning effects of multisensory memory strategies on vocabulary pronunciation

To probe the retention of student knowledge in vocabulary pronunciation according to memory strategies, the scores of pre-, post-, and delayed-VPT were compared in each group. Figure 2 displays the changes of VPT scores in each group across the three tests.

<div align="center">FIGURE 2</div>
<div align="center">Changes of VPT Scores in Each Group (Mean Score Comparison)</div>
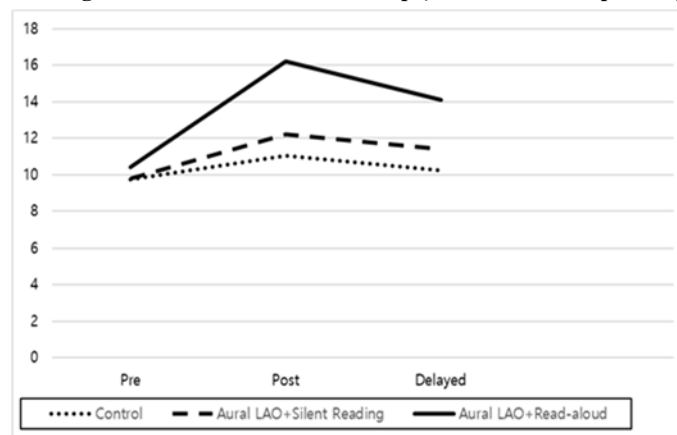
Unlike the comparable differences across the three groups in post-VMT scores, post-VPT scores were noticeably different across the groups with prominent increase in Aural LAO +

Read-aloud group. While the increase was mitigated in delayed-VPT scores, the superiority maintained over Aural LAO + Silent-reading and Control groups that showed a little increase in post-VPT and even a marginal increase in delayed-VPT from pre-VPT.

In order to detect statistically significant difference among the test scores, the three VPT results are analyzed by paired t-test for each group (Table 18). Pair 1 consists of pre- and post-VPT scores, Pair 2, post- and delayed-VPT scores, and Pair 3, pre- and delayed-VPT scores.

TABLE 18
Paired t-test Result of Scores on VPT

Group	Pair	Paired Differences		t	df	Sig. (2-tailed)
		MD	SD			
	1	1.292	1.856	4.821	47	.000*
C	2	-0.792	2.240	-2.448	47	.018*
	3	.500	2.535	-1.367	47	.0178
	1	2.457	2.656	6.273	45	.000*
A	2	-0.804	2.187	-2.494	45	.016*
	3	1.652	2.359	4.750	45	.000*
	1	5.788	2.710	15.400	51	.000*
R	2	-2.115	1.592	-9.580	51	.000*
	3	3.673	2.455	10.788	51	.000*

Note. Group C refers to a control group with written LAO and silent-reading activities, Group A refers to aural LAO treatment group, and Group R refers to the group with reading-aloud treatment along with aural LAO. *$p < 0.5$

According to Table 18, only Control group did not show statically significant difference in the scores between pre- and delayed-VPT scores, which indicates no retention of learning effect after 30 days. Control group showed smallest but statistically significant increase in post-VPT score (*MD* = 1.292), when Aural LAO + Read-aloud group displayed the biggest increment (*MD* = 5.788). Although Control group lost the smallest amount of scores in delayed-VPT (*MD* = -0.792), the statistically significant loss of memory seems to bring about no retention of knowledge in vocabulary pronunciation after 30 days compared to their prior knowledge. Aural LAO + Read-aloud group lost the biggest score in delayed-VPT (*MD* = -2.115) presumably due to the largest increase in post-VPT score, but eventually retained the learning effect the most even after 30 days (*MD* = 3.673). While Aural LAO + Silent-reading group appeared to retain the learning effect even less than 2 points in delayed VPT (*MD* = 1.652), it still achieved statistically significant increase (*p* = .000). When comparing the retention of learning effects observed between post- and delayed-VPT, Aural LAO + Read-aloud strategy was found to be more powerful (*p* = .000) than Aural LAO only strategy (*p* = .016).

Overall, only multisensory memory strategies were found to be effective in the retention

of learning vocabulary pronunciation after 30 days and the effects were stronger in Aural LAO + Read-aloud group than Aural LAO + Silent-reading group. Control group of visual-only unisensory memory strategies, which achieved immediate but a slight learning effect, eventually failed to retain long-term effect.

5. CONCLUSION

Overall, the multisensory memory strategies of pairing aural LAO and read-aloud were found to yield dominant effects on learning vocabulary meaning and pronunciation. The student who studied target words using aural LAO while reading them aloud recognized and understood more words right after learning and successfully retained the learning even after 30 days. Meanwhile, those who received aural LAO only multisensory input did not show statistically significant differences from Control group in long-term effects of learning vocabulary meaning and pronunciation. Since Control group participated in learning in this study albeit unisensory modes, modest learning effects were observed in vocabulary meaning from the comparisons of post-VMT and delayed VMT, and pre-VMT and delayed VMT. However, Control group was found to have no learning effect on vocabulary pronunciation when compared with the scores of pre-VPT and delayed-VPT.

Besides such clear effects of multisensory memory strategies, a couple of issues are worth of further scrutiny. Firstly, it needs to investigate why Aural LAO + Silent-reading group did not significantly outperform Control group despite its multisensory mode of LAO. One possible reason might be the power of production effect that can overweigh the effect of multimodality in vocabulary learning. The fact that no statistically different differences were observed between Control and Aural LAO + Silent-reading groups in both pre-post and post-delayed tests on vocabulary meaning and pronunciation demonstrates that multimodality of input receiving alone cannot make noticeable differences in vocabulary learning effects. Rather, multimodality came into effect when implemented to production strategies of read-alouds. This effect echoes the surprising learning effects of simple vocal production of given words even without deeper semantic processing such as retrieving words based on contexts as in the generation technique (Ozubko & MacLeod, 2010). In this regard, further research needs to explore how multimodality interacts with traditional information receiving oriented encoding strategies like LAO vis-à-vis production-oriented strategies.

Secondly, the type of vocabulary knowledge, namely meaning and pronunciation, seems to interact with the multisensory learning strategies. Considering the lack of immediate learning effects of multimodal encoding only on vocabulary meaning and the failure of unisensory learning in Control group in learning vocabulary pronunciation, the sensory mode of target vocabulary knowledge, visual mode in orthographical representation of

vocabulary meaning and oral mode in phonetic representation of vocabulary pronunciation, might have influenced on the effects of multisensory memory strategies. The result also might be related to the current research design that Control group received direct visual information about L2 meaning in L1 translations but did not receive direct visual information about L2 pronunciation such as phonetic symbols. Student exposure to L1 translation of L2 meaning, which has been known to very effective to enhance L2 vocabulary memory, could have resulted in comparable learning effects regardless of the presence of multimodality at least for immediate learning. The lack of exposure to direct learning about pronunciation, on the other hand, might not have led to even minor effects on immediate learning, unlike the researchers' expectation that was mentioned in Methodology. One thing interesting is that not just Control group but Aural LAO + Silent-reading group did not acquire significant immediate learning about word pronunciation. Given that most current vocabulary teaching practice in classroom is being conducted by simply presenting spelling or meaning of words even without phonetic symbols for high school students in South Korea, further research is needed to unveil what kinds of strategies, either providing sound information or vocal production or both, would be more effective for teaching and learning L2 word pronunciation.

Applicable level: Secondary

REFERENCES

Al-Seghayer, K. (2001). The effect of multimedia annotation modes on L2 vocabulary acquisition: A comparative study. *Language, Learning & Technology, 5*(1), 202-232.

Alves, S. M. L. (2014). Vocabulary acquisition in second language. *International Journal of Linguistics and Communication, 2*(1), 1–11.

Andrä, C., Mathias, B., Schwager, A, Macedonia, M., & von Kriegstein, K. (2020). Learning foreign language vocabulary with gestures and pictures enhances vocabulary memory for several months post-learning in eight-year-old school children. *Educational Psychology Review, 32*(3), 815-850.

Arndt, H. L., & Woore, R. (2018). Vocabulary learning from watching YouTube videos and reading blog posts. *Language Learning & Technology, 22*(3), 124-142.

Atay, D., & Ozbulgan, C. (2007). Memory strategy instruction, contextual learning and ESP vocabulary recall. *English for Specific Purposes, 26*(1), 39-51.

Ausubel, D. P. (1960). The use of advance organizers in the learning and retention of meaningful verbal material. *Journal of Educational Psychology, 51*(5), 267-272.

Beck, I. L., & McKeown, M. G. (2001). Text talk: Capturing the benefits of read-aloud experiences for young children. *The Reading Teacher, 55*(1), 10-20.

Bodner, G. E., & MacLeod, C. M. (2016). The benefits of studying by production . . . And of studying production: Introduction to the special issue on the production effect in memory. *Canadian Journal of Experimental Psychology, 70*(2), 89–92.

Castel, A. D., Rhodes, M. G., & Friedman, M. C. (2013). Predicting memory benefits in the production effect: The use and misuse of self-generated distinctive cues when making judgments of learning. *Memory & Cognition, 41*(1), 28–35.

Chang, A. C.-S. (2007). The impact of vocabulary preparation on L2 listening comprehension, confidence and strategy use. *System, 35*(4), 534–550.

Chung, J.-M. (2002). The effects of using two advance organizers with video texts for the teaching of listening in English. *Foreign Language Annals, 32*(3), 295-308.

Chung, J. M., & Huang, S. C. (1998). The effect of three aural advance organizers for video viewing in a foreign language classroom. *System, 26*(4), 553–565.

Elgort, I., & Nation, I. S. P. (2010). Vocabulary learning in a second language: Familiar answers to new questions. In P. Seedhouse, S. Walsh, & C. Jenks (Eds.), *Conceptualising 'learning' in applied linguistics* (pp. 89–104). Basingstoke, England: Palgrave Macmillan.

Ellis, R. (1999) Factors in the incidental acquisition of second language vocabulary from oral input. In R. Ellis (Ed.), *Learning a second language through interaction* (pp. 35–62). Amsterdam: John Benjamins.

Fisher, D., Flood, J., Lapp, D., & Frey, N. (2004). Interactive read-alouds: Is there a common set of implementation practices? *The Reading Teacher, 58*(1), 8–17.

Folse, K. S. (2004). Myths about teaching and learning second language vocabulary: What recent research says. *TESL Reporter, 37*(1), 1–13.

Goundar, P. (2019). Vocabulary learning strategies (VLSs) employed by learners of English as a foreign language (EFL). *English Language Teaching, 12*(5), 177-189.

Griffin, S. M. (1992). Reading aloud: An educator comments. *TESOL Quarterly, 26*(4), 784-787.

Gu, Y., & Johnson, R. K. (1996). Vocabulary learning strategies and language learning outcomes. *Language Learning, 46*(4), 643-679.

Henriksen, B. (1999). Three dimensions of vocabulary development. *Studies in Second Language Acquisition, 21*(2), 303-317.

Hickman, P., Pollard-Durodola, S., & Vaughn, S. (2004). Storybook reading: Improving vocabulary and comprehension for English-language learners. *The Reading Teacher, 57*(8), 720–730.

Huckin, T., & Bloch, J. (1993). Strategies for inferring word meaning in context: A cognitive model. In T. Huckin, M. Haynes, & J. Coady (Eds.), *Second language reading and vocabulary learning* (pp. 153-179). Norwood, NJ: Ablex.

Icht, M., & Mama, Y. (2015). The production effect in memory: A prominent mnemonic in children. *Journal of Child Language, 42*(5), 1102–1124.

Icht, M., & Mama, Y. (2022). The effect of vocal production on vocabulary learning in a second language. *Language Teaching Research, 26*(1), 79-98.

Kang, S. H., Gollan, T. H., & Pashler, H. (2013). Don't just repeat after me: Retrieval practice is better than imitation for foreign vocabulary learning. *Psychonomic Bulletin & Review, 20*(6), 1259–1265.

Kang, Y., Kang, H.-S., & Park, J. (2012). Is it vocabulary breadth or depth that better predict Korean EFL learners' reading comprehension? *English Teaching, 67*(4), 149-171.

Karami, A. (2019). Implementing audio-visual materials (Videos) as an incidental vocabulary learning strategies in second/foreign language learners' vocabulary development: A current review of the most recent research. *Journal of English Language Teaching, 9*(2), 60-70.

Karami, A., & Bowles, F. (2019). Which strategy promotes retention?: Intentional vocabulary learning, incidental vocabulary learning, or a mixture of both? *Australian Journal of Teacher Education, 44*(9), 25-43.

Laufer, B., & Nation, I. S. P. (2012). Vocabulary. In S. M. Gass & A. Mackey (Eds.), *The Routledge handbook of second language acquisition* (pp. 163-176). New York: Routledge.

Li, C. H. (2014). An alternative to language learner dependence on L2 caption-reading input for comprehension of sitcoms in a multimedia learning environment. *Journal of Computer Assisted Learning, 30*(1), 17–29.

Mayer, R. E. (2001). *Multimedia learning.* Cambridge, England: Cambridge University Press.

McKeown, M. G., Crosson, A. C., Moore, D. W., & Beck, I. L. (2018). Word knowledge and comprehension effects of an academic vocabulary intervention for middle school students. *American Educational Research Journal, 55*(3), 572-616.

Mortazavi, S.-M. (2011). The relationship between time lapse between introducing lexical advance organizers and video viewing, and comprehension in a foreign language classroom. *Procedia Social and Behavioral Sciences, 15*, 2023–2027.

Nation, I. S. P. (1990). *Teaching and learning vocabulary.* New York: Newbury House.

Nation, I. S. P. (2011). Research into practice: Vocabulary. *Language Teaching, 44*(4), 529-539.

Nation, I. S. P. (2013). *Learning vocabulary in another language.* Cambridge, England: Cambridge University Press.

Nation, I. S. P., & Chung, M. (2009). Teaching and testing vocabulary. In M. H. Long & C. J. Doughty (Eds.), *Handbook of language teaching* (pp. 543-559). Malden, MA: Wiley-Blackwell.

Ookawa, A. (2017). Analyzing high school English textbooks in Japan and Korea. *Journal of Applied Linguistics and Language Research, 4*(7), 75-96.

Ozubko, J. D., Hourihan, K. L., & MacLeod, C. M. (2012). Production benefits learning: The production effect endures and improves memory for text. *Memory, 20*(7), 717–727.

Ozubko, J. D., & MacLeod, C. M. (2010). The production effect in memory: Evidence that distinctiveness underlies the benefit. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 36*(6), 1543–1547.

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.

Plass, J. L., & Jones, L. C. (2005). Multimedia learning in second language acquisition. In R. E. Mayer (Ed.), *The Cambridge handbook of multimedia learning* (pp. 467-488). New York: Cambridge University Press.

Prince, P. (1995). Second language vocabulary learning: The role of context versus translations as a function of proficiency. *Modern Language Journal, 80*(4), 478–493.

Qian, D. (1996). ESL vocabulary acquisition: Contextualization and des contextualization. *Canadian Modern Language Review, 53*(1), 120–142.

Read, J. (2000). *Assessing vocabulary*. Cambridge, England: Cambridge University Press.

Sanaoui, R. (1995). Adult learners' approaches to learning vocabulary in second languages. *The Modern Language Journal, 79*(1), 15-28.

Santoro, L. E., Chard, D. J., Howard, L., & Baker, S. K. (2008). Making the very most of classroom read-alouds to promote comprehension and vocabulary. *The Reading Teacher, 61(5*), 396‑408.

Schmitt, N. (1997). Vocabulary learning strategies. In N. Schmitt & M. McCarthy (Eds.), *Vocabulary: Description, acquisition, and pedagogy* (pp. 199–227). Cambridge, England: Cambridge University Press.

Schmitt, N. (2007). Current perspectives on vocabulary teaching and learning. In J. Commins & C. Davison (Eds.), *International handbook of English language teaching* (pp. 827-841). New York: Springer.

Shams, L., & Seitz, A. R. (2008). Benefits of multisensory learning. *Trends in Cognitive Sciences*, *12*(11), 411-417.

Shin, D., Chon, Y., & Kim, H. (2011). Receptive and productive vocabulary sizes of high school learners: What next for the basic word list?, *English Teaching, 66*(3), 123-148.

Sonbul, S., & Schmitt, N. (2010). Direct teaching of vocabulary after reading: Is it worth it? *ELT Journal, 64*(3), 253-260.

Takeda, A., Choi, E.-S., Mochizuki, N., & Watanabe, Y. (2006). Analysis and comparison of the junior and senior high school level English textbooks for Japan and Korea. *Second Language Studies, 25*(1), 53-82.

Teng, F. (2022). Vocabulary learning through videos: Captions, advance-organization strategy, and their combination. *Computer Assisted Language Learning, 35*(3), 518-550.

Teng, F., & Zhang, D. (2023). The associations between working memory and the effects of multimedia input on L2 vocabulary learning. *International Review of Applied Linguistics in Language Teaching, 61*(3), 1021-1049.

Wilberschied, L., & Berman, P. M. (2004). Effect of using photos from authentic video as advance organizers on listening comprehension in an FLES Chinese class. *Foreign Language Annals, 37*(4), 534-540.

Yang, X., Kuo, L.-J., Eslami, Z. R., & Moody, S. M. (2021). Theoretical trends of research on technology and L2 vocabulary learning: A systematic review. *Journal of Computers in Education, 8*(4), 465-483.

APPENDIX A

Lexical advance organizer (Printed version)

	단어	뜻	예문	예문해석
1	itinerary	여행일정	complete a short overnight **itinerary**	1박 2일의 짧은 여행일정을 마치다
2	affordable	가격이 알맞은	There are few **affordable** apartments in big cities.	대도시에는 가격이 알맞은 아파트가 거의 없다.
3	accounting	회계, 회계학	The **accounting** firm audited the company every year.	그 회계 법인은 매년 그 회사의 회계 감사를 했다.
4	real estate agency	부동산 중개소	I'm renting a room out through a **real estate agency**.	나는 부동산 중개소에 방을 내놓았다.
5	aisle	통로	Coffee and tea are in the next **aisle**.	커피와 차 종류는 다음 통로에 있습니다.
6	dairy	유제품의	The women are selling **dairy** products.	여자들이 유제품을 팔고 있다.
7	sturdy	튼튼한, 견고한	a **sturdy** pair of boots	튼튼한 부츠 한 켤레
8	resistant	~에 잘 견디는	fire-**resistant** materials	불에 잘 타지 않는 물질
9	acid rain	산성비	We've been having frequent **acid rain** lately.	최근 산성비가 자주 내린다.
10	sulphur dioxide	이산화황	**Sulphur dioxide** is a pollutant and a major contributor to acid rain.	이산화황은 오염물질이자 산성비의 주요 원인이다.
11	nitrogen oxide	질소산화물	Sulphur dioxides and **nitrogen oxide**s also produce acid rain.	이산화황과 질소산화물도 산성비를 만든다.

12	primary pollutant	1차 오염물질	Ozone is formed when sunlight shines on **primary pollutant**s.	오존은 1차 오염물질에 햇빛이 비칠 때 형성된다.
13	fragrance	향기	The bath oil comes in various **fragrance**.	그 목욕용 오일은 여러 가지 향으로 나온다.
14	artificial	인공의	These **artificial** roses are quite lifelike.	이 인공장미들은 꼭 살아있는 것 같다.
15	chemical	화학물질	The **chemical** had a noisome odor.	그 화학물질은 불쾌한 냄새가 났다.
16	odds	가능성	The **odds** are very much in our favor.	우리가 성공할 가능성이 아주 크다.
17	asthma	천식	a severe **asthma** attack	심한 천식 발작
18	ventilated	환기되는	a well-**ventilated** room	환기가 잘 되는 방

APPENDIX B

Lexical advance organizer (PowerPoint version)

APPENDIX C

Pre-, post-, and delayed-vocabulary meaning test answer sheets (PowerPoint version)

Pre-VOCA TEST			Post-VOCA TEST			Delayed-VOCA TEST		
학번: 이름: 다음 영어단어의 뜻을 쓰세요.			학번: 이름: 다음 영어단어의 뜻을 쓰세요.			학번: 이름: 다음 영어단어의 뜻을 쓰세요.		
	단어	뜻		단어	뜻		단어	뜻
1	itinerary		1	itinerary		1	itinerary	
2	affordable		2	affordable		2	affordable	
3	accounting		3	accounting		3	accounting	
4	real estate agency		4	real estate agency		4	real estate agency	
5	aisle		5	aisle		5	aisle	
6	dairy		6	dairy		6	dairy	
7	sturdy		7	sturdy		7	sturdy	
8	resistant		8	resistant		8	resistant	
9	acid rain		9	acid rain		9	acid rain	
10	sulphur dioxide		10	sulphur dioxide		10	sulphur dioxide	
11	nitrogen oxide		11	nitrogen oxide		11	nitrogen oxide	
12	primary pollutant		12	primary pollutant		12	primary pollutant	
13	fragrance		13	fragrance		13	fragrance	
14	artificial		14	artificial		14	artificial	
15	chemical		15	chemical		15	chemical	
16	odds		16	odds		16	odds	
17	asthma		17	asthma		17	asthma	
18	ventilated		18	ventilated		18	ventilated	