L2 Learners’ Retrieval of Pre-learned Word Meanings While Reading in a New Context

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Abstract

This study investigated how L2 learners comprehend newly learned words in a sentential context. Theoretically, learners’ experiences of recalling pre-learned word meanings and applying this knowledge to new contexts may enhance future lexical performance. In the experiment, 84 undergraduate students learned low-frequency words in English with example sentences; half were highly imageable (i.e., it was easy to evoke a mental image while reading) for learners. After the learning phase, the participants were presented with a list of new sentences and asked to interpret the pre-learned words in context. After a one-week delay, the participants were given a recall task that tested their memory of both the target words and example sentences. The results suggested some difficulty in meaning retrieval when learners encountered words in a new context. Further analysis showed that correctly interpreted words were retained better. In addition, the retention of pre-learned word meanings was affected by memory of example sentences, suggesting the effectiveness of giving more easily remembered imageable example sentences. Research findings are discussed in terms of transfer-appropriate processing and other related theoretical frameworks.

1. Background

1.1 Learning Word Meanings in L2

The goal of learning vocabulary in a second and foreign language (L2) is not only to possess knowledge about words in one’s memory, but for this lexical knowledge to be available during understanding or producing language (i.e., listening, speaking, reading, and writing). Focusing on a receptive aspect of lexical knowledge, this study aimed to explore the difficulty of retrieving meanings of pre-learned vocabulary while reading an L2 sentence. Recent studies on second language acquisition (SLA) suggest that the most economical way to learn L2 vocabulary is to first memorize the form and meaning of new words deliberately (i.e., intentional learning) and then learn contextualized aspects such as collocation knowledge through extensive exposure in context (Ellis & Shintani, 2014). This combination of learning methods is effective in that students can build a form-meaning mapping in their mental lexicons and develop their intuition...
about other aspects of knowledge through their second, third, and subsequent exposures to that word in different contexts (Nation, 2013; Schmitt, 2010). The importance of contextual input is also explained by usage-based models of language acquisition, derived from Langacker (1987): A variety of contextual input makes lexical knowledge richer and more sophisticated (see also Ellis, 2002). As learners encounter pre-learned vocabulary in new contexts, their knowledge is reinforced through repeated activation of pre-learned meaning.

However, learners’ second encounter with a newly learned word in a new context may not always be successful. An obvious problem exists in retrieving pre-learned words’ meanings when the target word is used in a different sense from its previously learned meaning; for example, L2 learners tend to misinterpret *bark* as referring to the sound an animal makes, when the context is actually referring to the surface of a tree trunk (Ushiro et al., 2013). However, this problem is not limited to ambiguous words. Inflexibility of learners’ lexical knowledge can also be observed for words that are previously learned with translations in their first language (L1). Dependence on translations in L1 and lack of contextual input leads to the fossilization of lexical knowledge (Jiang, 2000), which inhibit learners’ swift access to lexical knowledge in meaningful and communicative contexts. Researchers have long asserted that memory for words learned outside their meaningful context is not sustained for very long (Oxford & Scarcella, 1994). Therefore, it seems reasonable to provide students with contextual information during intentional learning of new words. The easiest way to add contextual input to intentional vocabulary learning may be to present example sentences. However, a consensus has not been reached about whether supplying usage examples eases difficulty in applying knowledge of newly learned vocabulary to new contexts (Webb, 2007).

Even if a new word is taught in context, it is still difficult to apply knowledge of the word to another context. In fact, L2 learners cannot always recall word meanings they have already learned when the words are presented in a new context. Researchers believe that learners’ knowledge of newly learned vocabulary is first episodic memory (also called context-dependent memory), which gradually changes to procedural memory (also called context-independent memory; Godden & Baddeley, 1975; see also Kadota, Noro, Shiki, & Hase, 2014, pp. 45–53). During intentional learning of a word list consisting of target words, translations, and example sentences, a learner first encodes words in the context of all surrounding information (such as the example sentence, the classroom environment, and even the language instructor). However, learners’ memory of word meanings becomes gradually context-independent as the same words are encountered repeatedly in various situations and contexts. In this manner, when words are finally mastered, learners are able to comprehend and use them without remembering any situational information. This assumption suggests that memory of newly learned vocabulary is associated with the learning environment and context. In other words, it is difficult for learners who have just learned new words with translations and example sentences to apply their lexical knowledge to a different situation.
1.2 Theories Related to This Study

Transfer-appropriate processing theory may explain why it is difficult for learners to apply their vocabulary knowledge flexibly (Morris, Bransford, & Franks, 1977). This theory explains the importance of the relationship between learning and testing methods in test performance; its basic assumption is that the effect of a variable on memory depends on the nature of the task a learner performs during learning and testing. For example, translation-based learning should facilitate performance on translation-based tasks; usage-based learning should facilitate performance on usage-based tasks. A similar assumption is proposed in the encoding specificity principle (Tulving & Thomson, 1973) and more recently, the type of processing-resource allocation (TOPRA) model (Barcroft, 2002, 2003). In line with transfer-appropriate processing theory, the TOPRA model visualizes the relationship between different amounts of specific types of processing, learning, and predicted performance. Among these theoretical frameworks, this study mainly refers to transfer-appropriate processing theory, because of the focus on difficulty transferring previously learned words into new contexts.

In terms of transfer-appropriateness, learners’ best performance of recalling pre-learned word meanings while reading a text is attained when the learning phase involves mental processes that are required in post-learning reading. For example, imagine a student learned the low-frequency word *indite*, which is synonymous with *write*, and later read a sentence such as *He is young, but he can indite a long story by himself*. While reading this sentence, the learner tries to retrieve the meaning of *indite* by activating memory of the word’s form-meaning association. In addition, the concept or situation described in the sentence is also activated in the learner’s mind. Therefore, potential sources of retrieval of the meaning of *indite* are both the word form and contextual information. The learner’s burden increases if contextual clues are scarce, as in the following sentence: *He is young, but he can indite something by himself*. Assuming the learner’s memory is inflexible, the probability of successful retrieval of the meaning of *indite* depends on both (a) whether the pre-learned meaning matches the meaning of *indite* in the current context and (b) whether the pre-learning involved a reading context resembling the current sentence. These two factors are closely related because word sense in a particular context is determined by context (Aitchison, 2012). As mentioned earlier, the impact of the first factor seems obvious (e.g., the two meanings of *bark*). To discuss the second factor, another theoretical framework should be introduced.

Bilingual dual-coding theory (Paivio & Desrochers, 1980; see also Paivio, 2006) assumes that human processing of L2 word meaning is completed by two components of the mind: verbal and imagery processors. When a sentence is read, cognitive processes involve not only linguistic mechanisms such as syntactic parsing and propositional understanding of language, but also activation of mental imagery related to the content. The relationship between linguistic input and activation of mental imagery is explained in terms of the following three levels: (a) linguistic and
imaginal representations formed in one’s mind (i.e., *representational* level), (b) interconnections between the two types of representations (i.e., *referential* level), and (c) associations between images or between linguistic units (i.e., *associative* level). Using these terms, this theory also explains the effect of language instruction approaches that emphasize the role of contextual information in the learning process (Paivio & Desrochers, 1980, p. 398). The form-meaning associations of words are enhanced when the representation of context is in the mind during vocabulary learning; in addition, the mental representation can be subsequently used as a search-retrieval cue for the target word. Taken together with the predictions of transfer-appropriate processing theory, activation of mental imagery in the mind may function as an effective bridge between the learning context (i.e., example sentences) and the testing context (i.e., new sentences including the previously learned words). If example sentences presented in a pre-learning phase evoke imagery to learners, and if this imagery is also available in the subsequent testing or reading phase, recall rates may be greater than when imagery clues are not available.

1.3 Retrieval of Vocabulary Meanings in Context

Transfer-appropriate processing theory expects that similarity between learning and testing situations predicts retrieval of word meanings, while dual-coding theory emphasizes the importance of availability of imagery during learning and recalling. Thus, it seems important to consider the ease of arousing a mental image (e.g., visual picture) of example sentences for learning (hereafter *imageability* of the sentence).

It has been unclear to what extent learners can apply knowledge of newly learned vocabulary to new sentences (Grabe & Stoller, 2011, p. 108). Although a number of both small and large scale studies have shown positive effects of learning vocabulary on reading comprehension in L2 (e.g., Carlo et al., 2004), most studies focused on the relationship between text comprehension and number of words previously learned or between vocabulary size and general reading comprehension skills. To address this issue, Webb (2009) examined if different methods of pre-learning vocabulary affect how well learners comprehend newly learned words used in a sentence. In his experiment, 71 Japanese undergraduate students studying English learned a list of 10 unfamiliar words paired with their translations in six minutes. Then, the participants were presented with a series of new sentences including the pre-learned words and were asked if the words were used correctly in context. Although the learning and testing situations were different in that no contextual input was provided during learning, the results showed that scores on this sentence recognition test were rather high, ranging from 64% to 73%. Scores varied between learning conditions, namely, L1-to-L2 and L2-to-L1 mnemonics. Additionally, an explicit test of word meanings cued by target word forms was conducted, resulting in scores ranging from 63% to 66%. However, this test was placed after another task using pictures related to word meanings. One may argue that it is hard to distinguish the learning effect between the word list and pictures.
Webb (2009) did not compare learning methods with and without example sentences because these methods had already been compared (Prince, 1996; Webb, 2007). Prince (1996) showed that although effective use of contextual information was difficult for novice learners, among advanced learners, a context-based learning method enhanced performance on a context-based test and translation-based learning increased translation-based test scores. These findings are consistent with transfer-appropriate processing theory. If translations of target words and example sentences are presented together to learners, the major source of lexical knowledge will be the translations (Hasegawa, 2014b; Webb, 2007), which is consistent with SLA suggestions that use of translation is the most economical method for learning new words (see Section 1.1).

However, the effects of example sentences should not be ignored because learners’ scores on context-based tests may increase by learning target words in the context of highly imageable example sentences (Hasegawa, 2014a). In fact, Hasegawa’s (2014b) think-aloud experiment suggested that types of reading processes may differ between more and less imageable example sentences. That is, for the less imageable sentences, learners’ reading process was more analytic in nature (e.g., syntactic parsing and verbatim understanding of sentences), whereas reading was more inferential for more imageable sentences (e.g., understanding what is not explicitly stated in the sentences). According to dual-coding theory, contextual information accompanied by mental imagery is retained longer in the learners’ mind.

Finally, Johnson’s (1982) study is also worth mentioning; however, the results should be considered carefully. One of the main findings from the experiment was that learning the meaning of target words before reading a text including these words had no significant effect on two comprehension tests. In the experiment, around 20% of running words in the text were low-frequency words. In terms of the accuracy of reading comprehension, vocabulary learning prior to reading seemed more effective than when glossary definitions of target words were available while reading. However, very little information is provided about how target words were taught in the learning phase; raw scores on an explicit test that asked participants to translate the learned words were not reported. According to Webb (2009), while many studies investigating the effects of pre-learning vocabulary on reading comprehension in L1 have been conducted, only a few widely known SLA studies focusing on comprehension of pre-learned words in context have been completed (i.e., Carlo et al., 2004; Johnson, 1982; Webb, 2009). Therefore, the present study aimed to explore how L2 learners retrieve the meaning of previously learned words, which they encounter in a different context.

2. Purpose

This study focuses on learners’ retrieval process of word meanings. Assuming that the most effective and economical method of vocabulary learning is the combination of intentional
vocabulary learning and further contextual input, empirical study is necessary to answer the
following question: Can learners apply what they previously learned to new contextual input?
Based on the research reviewed in the previous section, this study identified two research
questions (RQs) as follows:

RQ1: To what extent can learners retrieve meanings of newly learned words when they encounter
the words again in the context of a new sentence?
RQ2: How does the imageability of example sentences for learning affect retrieval of word
meanings?

RQ1 is the most fundamental question asked in this study. Considering previous research
(Webb, 2009), one might expect that around 70% of newly learned words would be
comprehended appropriately if the new sentences are presented immediately after the learning
phase. However, as proposed in transfer-appropriate processing theory, it may be difficult for
learners to apply their knowledge when it is tested in a situation different from the learning
situation.

Furthermore, during retrieval of target word meanings in new contexts, learners have to
recall the word that matches the situation described in the given context. As explained in
dual-coding theory, such a process would be enhanced by activating mental images of what is
pictured in the context. Therefore, based on transfer-appropriate processing, the degree of
similarity of encoding and retrieval modes is slightly higher when learners generate mental
imagery from example sentences during the learning phase; as for RQ2, the effect of imageability
could possibly be observed in retrieval test scores.

3. Method

3.1 Participants

Participants were 84 undergraduates (44 females and 40 males, aged 18–20) majoring in
education at a Japanese university. They had studied English as a foreign language for more than
six years and were assumed to have low-intermediate English proficiency (around Grade 2 of the
STEP Eiken test; see also Section 3.3). Data were collected in the participant’s regular classrooms;
each participant gave informed consent. They were asked to participate in two sessions in different
weeks, as described in Section 3.3. However, two students were absent from the second (i.e.,
delayed) session and their data were excluded from analysis. Therefore, all analyses were based
on the remaining participants ($N = 82$).
3.2 Materials

As in past studies of intentional learning of L2 vocabulary such as Elgort (2011) and Webb (2007), participants in this study learned a list of target words in L2 (English) with translations in their L1 (Japanese) and example sentences. Each target word was learned using three typical translations and an example sentence.

3.2.1 Target words

This study used 10 low-frequency words: *don, esplanade, gloaming, indite, mosey, reminisce, repast, sanatorium, tram,* and *visage.* These words were used in the same sense as Webb’s (2008) 10 pseudowords (i.e., disguised word forms paired with meanings); however, the use of pseudowords was avoided for pedagogical reasons in this study. None of the target words were listed in the standard EFL vocabulary list *JACET 8000* (Committee of revising the JACET basic words, 2003). Considering the author’s prior research using the same target words (Hasegawa, 2014a), it was assumed that none of the words were familiar to the current participants.

3.2.2 Translations

With reference to an English-Japanese dictionary (Konishi & Minamide, 2001), three typical translations were prepared for each target word. For example, three Japanese translations for *visage* were (a) *kao* [a face], (b) *kaotsuki* [what the face looks like], and (c) *yobo* [physical appearance]. Three alternative translations, rather than a single translation, were used to reduce the effect of translation familiarity (Tagashira, Kida, & Hoshino, 2010). Furthermore, the order of presenting translations was shuffled among participants: For each participant, the order of the three translations was either (a)-(b)-(c), (b)-(c)-(a), or (c)-(a)-(b).1

3.2.3 Example sentences

The example sentences were the same as those in Hasegawa (2014a). Initially, three sentences were prepared for each target word. Of the three sentences, one was used only in the testing phase and the other two were for learning. Each sentence was composed of around 10 words, including a target word (*M* = 10.33, *SD* = 0.71). Except for the target words, the 3,000 most frequent words in *JACET 8000* were used, so that all participants could comprehend the sentences easily.

Two example sentences per target word were prepared, so that the imageability effect of example sentences could be considered; it was much easier to evoke mental imagery for one of the example sentences than the other. For example, the more and less imageable sentences for the target word *indite* were *Ann bought a sheet of paper to indite a long letter* and *Then they asked me, “Why don’t you indite another one?”* respectively. Compared to the less imageable sentences, the more imageable sentences included more concrete words and readers could imagine the situation...
described more easily. Therefore, based on dual-coding theory, learners activate their imagery processors while reading more imageable sentences. Through a pilot study with 28 undergraduates at a low-intermediate proficiency level, the ease of evocation of mental imagery of these sentences was rated on a 7-point Likert scale (7 = easy to imagine the situation described; 1 = difficult to imagine anything about the context). As a result, ratings were significantly higher for more imageable contexts (M = 5.07, SD = 0.62) than for less imageable contexts (M = 3.56, SD = 0.47), t(9) = 10.95, p < .001. In the learning phase, half of participants received a 10-words list consisting of don, gloaming, mosey, repast, and tram with more imageable sentences and esplanade, indite, reminisce, sanatorium, and visage with less imageable sentences; the remaining participants were given a list with the opposite pattern (see also Section 3.3).

3.3 Procedure

This study’s outline is visualized in Figure 1. The experimental sessions included vocabulary learning and two post-learning tasks.

![Figure 1. Study outline.](image.png)

Before the main experimental sessions, participants were randomly divided into six groups to counterbalance the presentation order of three translations and to compare the more and less imageable sentences (see Figure 2). An English lexical proficiency test composed of vocabulary items from the first subsection of the STEP Eiken test (Grades Pre-1, Pre-2, and 3; Society for Testing English Proficiency [STEP], 2010) was conducted (Cronbach’s α = .701). There was no significant difference in correct answer rates among the groups (M = .67, SD = .11), F(5, 76) = 1.62, p = .165, η² = .01. Therefore, data from the six groups were not distinguished in subsequent analyses.

![Figure 2. Description of the six study groups.](image.png)
3.3.1 Learning phase
Participants were asked to learn a list consisting of the 10 target words and translations along with example sentences within five minutes. A preannouncement about the post-learning task was given to draw learners’ attention to the presented materials.

3.3.2 Interpretation task (immediate)
The first post-learning task was given immediately after the word lists for the learning phase were removed. The participants received a list of 10 new sentences including the target words. For example, the test sentence for indite was *He is young, but he can indite it by himself*. They were asked to write the meaning of each whole sentence in Japanese. No time limit was set; this task was finished within 10 minutes.

3.3.3 Recall task (delayed)
The second task was conducted one week after the learning phase; participants were not informed of this delayed task. They were given a list of the 10 target words, and then asked to write the meaning of each word in Japanese. Then, they were asked to write the content of example sentences they had learned. In this task, participants were encouraged to write any fragment of information they could remember. Japanese was selected as the language of recall because it was assumed that use of L1 would reduce task complexity.

3.4 Scoring and Data Analyses
For the interpretation task, one point was given for each response that included a correct interpretation of the target word that matched the context. Because this study’s focus was on the retrieval of target word meanings, minor mistakes involving interpretation of context, such as confusing *himself* with *herself*, were permitted. As for interpretation of the target word, the most typical response was to reproduce one of the three translations included in the learning list. Taking *visage*, for example, any of the three given translations, (a) *kao* [a face], (b) *kaotsuki* [what the face looks like], and (c) *yobo* [physical appearance], as well as other expressions referring to the correct meaning of *visage* (e.g., *hyojo* [facial expressions]), were regarded as correct interpretations, as long as the entire sentence meaning was comprehensible.

Scoring of recall task performance provided two types of data. First were recall rates of the target word meaning. For example, a proper translation that did not fit well in the learning context could be a correct response (e.g., *yosu* [situations] for *visage*). In scoring, minor mistakes such as misspellings were not a determining factor, as long as the response could be clearly understood (Webb, 2007). Second were rates of recalled information of the example sentences presented in the learning phase. One point was given when the recalled information correctly matched the target word. Both perfect and partial (approximately 50% or more) reproductions of a sentence
were regarded as correct responses, because the present study focused on the probability of retrieval, rather than the amount of information.

To analyze the imageability effect of example sentences, this study used the Wilcoxon signed rank test, a non-parametric method of statistical hypothesis testing, with a 5% alpha level. This test can be used with paired data collected from the same population. In addition, effect size ($r$) was calculated based on $z$ scores and sample size. With reference to Mizumoto and Takeuchi (2008), criteria for small ($r > .10$), middle ($r > .30$), and large effect sizes ($r > .50$) were determined. Prior to the current analysis, effect size was calculated using data from the author’s prior experiment (Hasegawa, 2014a), comparing the more and less imageability conditions ($n = 26$ and 28, respectively). The imageability effect on recall performance of word forms cued by example sentences was moderate (Cohen’s $d = .52$). On the other hand, for immediate translation performance cued by word forms in the same study, almost no effect was obtained (Cohen’s $d = .11$). Considering these prior data, the effect size of sentence imageability in this study was expected to be small or moderate at most.

4. Results

4.1 Interpretation Task

The results of the interpretation task are summarized in Table 1, and suggest that learners are not always able to apply pre-learned word meanings to a new context. When scores were compared between items learned with more and less imageable example sentences using the Wilcoxon signed rank test, the difference was not statistically significant, $z = -0.74$, $p = .458$, $r = .08$.

<table>
<thead>
<tr>
<th>Example sentences</th>
<th>$M$</th>
<th>95% CI</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>More Imageable</td>
<td>.57</td>
<td>[.51, .63]</td>
<td>.28</td>
</tr>
<tr>
<td>Less Imageable</td>
<td>.55</td>
<td>[.48, .62]</td>
<td>.29</td>
</tr>
<tr>
<td>Overall</td>
<td>.56</td>
<td>[.51, .62]</td>
<td>.26</td>
</tr>
</tbody>
</table>

4.2 Recall Task

The results of the recall task, including recall rates of word meanings and example sentences, are summarized in Table 2. First, when scores for meaning recall were compared between more and less imageable items using the Wilcoxon signed rank test, there was a statistically significant difference, $z = -2.07$, $p = .038$, $r = .23$. Also, comparison of scores for sentence recall showed a statistically significant difference, $z = -2.23$, $p = .026$, $r = .25$. The
imageability of sentences presented in the learning phase had a small but significant effect on recall performance one week later.

Table 2
Correct Answer Rates for the Recall Task

<table>
<thead>
<tr>
<th>Example sentences</th>
<th>Word meanings</th>
<th></th>
<th></th>
<th>Example sentences</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$M$</td>
<td>95% CI</td>
<td>$SD$</td>
<td>$M$</td>
<td>95% CI</td>
<td>$SD$</td>
</tr>
<tr>
<td>More Imageable</td>
<td>.24</td>
<td>[.18,.29]</td>
<td>.26</td>
<td>.06</td>
<td>[.02,.10]</td>
<td>.18</td>
</tr>
<tr>
<td>Less Imageable</td>
<td>.19</td>
<td>[.14,.24]</td>
<td>.23</td>
<td>.02</td>
<td>[.00,.04]</td>
<td>.08</td>
</tr>
<tr>
<td>Overall</td>
<td>.21</td>
<td>[.17,.26]</td>
<td>.21</td>
<td>.04</td>
<td>[.01,.06]</td>
<td>.12</td>
</tr>
</tbody>
</table>

4.3 Relationships of Task Scores

The results described in the previous two sections showed that L2 learners may have difficulty applying what they have just learned to a new context. However, these analyses did not indicate anything about the relationship between participants’ interpretations and retention of target words. To examine relationships of task scores, all data across tasks were analyzed using Nation and Webb’s (2011, pp. 99–104) method. Each task’s data for the 10 items obtained from the 82 participants were classified in terms of whether each response was correct or incorrect ($N = 820$). Frequencies of observed cases for each category are displayed in Table 3.

Table 3
Frequencies of Correct/Incorrect Answers Across Tasks

<table>
<thead>
<tr>
<th>Interpretation</th>
<th>Meaning Recall</th>
<th>Sentence Recall</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>0</td>
<td>330 (40.24%)</td>
</tr>
<tr>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0 (0.00%)</td>
</tr>
<tr>
<td>0</td>
<td>1</td>
<td>0</td>
<td>27 (3.29%)</td>
</tr>
<tr>
<td>0</td>
<td>1</td>
<td>1</td>
<td>2 (0.24%)</td>
</tr>
<tr>
<td>1</td>
<td>0</td>
<td>0</td>
<td>314 (38.29%)</td>
</tr>
<tr>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0 (0.00%)</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>0</td>
<td>120 (14.63%)</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>1</td>
<td>27 (3.29%)</td>
</tr>
</tbody>
</table>

*Note.* The frequency of each task was calculated based on all scores for the 10 items obtained from 82 participants ($N = 820$). $1 =$ correct; $0 =$ incorrect. For example, the fifth row shows that there were 314 cases where a target word had been correctly interpreted in context but its meaning or contextual information was not recalled later.
Two findings are drawn from this table. First, most correctly recalled words were correctly interpreted in context. In fact, correct recall rates of word meanings of correctly interpreted items and missed (or misinterpreted) items were 31.89% and 8.08%, respectively. Second, if participants remembered the content of an example sentence used in the learning phase, they also recalled the meaning of the word paired with that example sentence. Correct recall rates of word meanings between items for which example sentences were correctly recalled and missed (or incorrectly recalled) were 100.00% and 18.58%, respectively.

5. Discussion

The present study proposed two RQs. As to the probability of successful retrieval of the meanings of newly learned words in a new context (RQ1), the overall rate of correct interpretation was only 56%. Considering the 95% CI, it is safer to state that low-intermediate L2 learners can apply 50–60% of pre-learned vocabulary meaning to a new context. Teachers should know that retrieval of pre-learned word meanings is difficult for students when they encounter the words in context. However, the ability to apply newly learned word meanings to a new context may lead to better retention of form-meaning mapping. Most of the correctly recalled words one week after learning were those correctly interpreted in context. This relationship between task performances was revealed by Nation and Webb’s (2011) method of displaying data from several tasks; as a research implication, this method should be encouraged, because it can be more informative than calculating correlation coefficients.

In this study, ease of evoking mental imagery of example sentences was also considered (RQ2). Imageable example sentences used in the experiment were more meaningful than other example sentences; this kind of quality of context has rarely been considered in studies of intentional vocabulary learning (Hasegawa, 2014a). The results showed that although the effect size was small, vocabulary learning may be more effective when imageable contexts are provided during learning. In fact, imageable sentences were retained approximately 5% better in the recall task than less imageable sentences. This was consistent with the prediction of bilingual dual-coding theory (Paivio & Desrochers, 1980; Paivio, 2006). In the current data, if an example sentence was recalled correctly, a word meaning that had been learned in that context was also always recalled. Thus, word meanings that had been paired with more imageable sentences were retained approximately 5% more often. However, imageability of example sentences did not affect the immediate interpretation task. In accordance with dual-coding theory, activation of mental imagery during learning mostly relates to long-term retention.

Transfer-appropriate processing theory (Morris et al., 1977) and other related theories such as the TOPRA model (Barcroft, 2002, 2003) expect that better test performance is led by pre-learning that involves the same cognitive processes as those required in the testing phase. If teachers hope that their students will be able to comprehend taught words in different contexts in
the future, it is advisable to teach new words together with some contextual information. This study found that pre-learned vocabulary knowledge cannot always be applied to a new context even immediately after the learning phase. However, lexical knowledge that has been correctly applied to the new context can be retained better. Therefore, instead of teaching new words with translation and example sentences only once, presenting multiple contexts that urge students to rethink pre-learned vocabulary should be encouraged (Ushiro et al., 2013). Assuming that learners’ knowledge of newly learned words is first episodic and gradually changes to procedural memory, and that a variety of contextual input is key to lexical development, the opportunity to interpret pre-learned words in various contexts should be promoted. Learners’ experiences of transforming lexical knowledge into a new context may positively transfer to future language use.

From a pedagogical point of view, this study was primarily motivated by the fact that L2 learners often experience difficulty in reading a new text containing new vocabulary in classrooms even if they have learned the vocabulary in advance. Although English classes in Japanese high schools are conducted in English in principle (Ministry of Education, Culture, Sports, Science and Technology, 2009), pre-learning new vocabulary using translation before the class seems still popular. For the pedagogical purposes of this paper, this study chose experimental procedures that can be conducted in a regular class. One of the most unique points of this study was that a post-learning task required students to interpret the target words in context; this task should have an additional learning effect. Given the current result that lexical knowledge that had been properly applied to a new context was retained better, opportunities to relearn word meanings should be provided in instructed vocabulary acquisition. Therefore, an effective vocabulary instruction method might be the combination of deliberate instruction or intentional learning of new words and a mini test that asks learners about learned words in a different context.

Despite these findings and suggestions, some limitations should be noted. Most importantly, this study used only single sentences as materials for the interpretation task, as in Webb (2009). Thus, learning and testing conditions were similar in that a sentential context was given per target word. However, it is necessary to expand measures of meaning retrieval in new contexts to include interpretation tasks such as reading paragraphs. Reading a longer passage seems to be a more authentic learning situation; therefore, more complicated factors may be involved. Based on transfer-appropriate processing theory, the cognitive processes involved in interpretation are more complicated than in a single sentence, because of the larger difference between learning and testing situations. On the other hand, when reading a longer passage, more clues are available to guess the meaning of target words. Careful replications are required in future studies. Another limitation was that only low-intermediate L2 learners were involved in this study. Hasegawa (2014a) suggested learners’ sensitivity to context type is related to their proficiency level. The effect of imageability of example sentences requires further investigation with learners at other proficiency levels. Since retrieval of pre-learned word meanings is important for further lexical
development, future research should reveal how vocabulary learned intentionally is comprehended and used later by learners.

Notes

1. Results of this study showed that the probability of the first, second, and third translations being used in the learning task were 46.95%, 26.59%, and 11.71%, respectively; the remaining 14.75% could not be labeled as any of the translations.

2. The proficiency test items were identical to those used in Hasegawa (2014a). Based on the mean scores, the current participants’ English lexical proficiency was assumed to resemble the “low-intermediate” group in the prior study.

3. To check which translation each learner adopted to each target word, participants were asked to write down the meaning of example sentences in Japanese. The finding reported in Note 1 above was based on this while-learning task.

4. According to Hulstijn (2005), the most typical situation of intentional learning can be created when the learner’s attention is placed on the memorization of a list of words and when the learner is aware that there will be a test on the material learned.

5. The total correct answer rates obtained in this study were lower than previous study’s translation tests from L2 word forms into L1 (e.g., the “low-intermediate” group in Hasegawa, 2014a; Webb, 2007) and sentence recognition tests (Webb, 2009; see Section 1.3).

6. \( \frac{120 + 27}{314 + 0 + 120 + 27} = 31.89\% \); \( \frac{27 + 2}{330 + 0 + 27 + 2} = 8.08\% \).

7. \( \frac{2 + 27}{0 + 2 + 0 + 27} = 100.00\% \); \( \frac{27 + 120}{330 + 27 + 314 + 120} = 18.58\% \).

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