

# Japanese University Learners' Self-Initiated Dictionary Use in EFL Reading

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## Abstract

This study investigated the types of mobile devices language learners used as dictionaries in a reading task and explored the relationship between learners' dictionary choices on the one hand and their proficiency, look-up behavior, and reading comprehension on the other. Participants comprised 75 Japanese university students learning English as a foreign language, who were instructed to engage in a reading comprehension task. While reading, they were free to use their mobile devices and were instructed to circle the looked-up words on the task sheet. After finishing the task, they reported the types of mobile devices they had used, if any, and the time they spent on the task. Analysis of the students' responses revealed that smartphone-based dictionaries (i.e., Google Translate and Weblio) were the most commonly used tools in the reading task. Further analysis found no significant relationship between learners' dictionary choices on the one hand and their proficiency, the number of lookups, and reading comprehension on the other. Task completion time varied depending on the presence or absence of dictionaries. These results were discussed relative to the authors' previous findings on a vocabulary task to provide insights into learners' dictionary use in various decoding tasks.

*Keywords:* mobile learning, dictionary apps, look-up behavior, reading comprehension, EFL learners

## I. Introduction

Technology-enhanced second and foreign language (L2) learning has proliferated over the last decade, and researchers have shown an increasing interest in the application of mobile devices, such as smartphones in L2 teaching and learning (e.g., Ko, 2019; Rashid, Howard, Cunningham, & Watson, 2021). As information technology has advanced, learners' dictionaries have also evolved from paper dictionaries to pocket electronic dictionaries (pocket E-dictionaries), online dictionaries, and

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smartphone/tablet dictionary applications (apps). The evolution of dictionaries is likely to have an impact on learners' preferences and patterns of dictionary use. Although pocket E-dictionaries gained popularity about a decade ago, particularly among Asian English as a foreign language (EFL) learners (Chen, 2010), Hubert (2017) found that Japanese university students are increasingly utilizing their smartphone as their primary dictionary resource. Although researchers have been exploring the patterns and effects of pocket E-dictionary use (e.g., Chen, 2010; Koyama & Takeuchi, 2003, 2007), investigations into smartphone-based dictionaries are scarce. Few studies have examined the differences in effects between smartphone dictionary apps and pocket E-dictionaries across different L2 tasks. Furthermore, researchers have yet to extensively examine learners' voluntary dictionary use in real L2 learning settings, as opposed to experimental conditions. To address these gaps, Koyama and Yabukoshi (2019a, 2019b) investigated Japanese college learners' self-initiated dictionary use in a vocabulary task. The present study sought to learn more about these learners' dictionary use in various L2 decoding tasks by exploring their voluntary dictionary use in a reading comprehension task. As Prichard and Atkins (2021) suggested, L2 readers employ vocabulary coping strategies (i.e., dictionary use, inferring meaning from context, ignoring unknown words) to deal with unknown lexica while reading.

## II. Literature Review

### 1. Paper Dictionaries and Pocket E-Dictionaries

Empirical studies have been conducted on the use of paper dictionaries and pocket E-dictionaries in experimental settings, where learners were often assigned to one of the dictionary groups (i.e., paper dictionary group, pocket E-dictionary group, or no-dictionary group) and instructed to use specific dictionaries while engaging in L2 learning tasks. One of the earliest empirical studies is Luppescu and Day (1993), who suggested the complex processes of bilingual dictionary use while reading a short story. The participants were Japanese university EFL students who were assigned to either a dictionary or no-dictionary group. The findings demonstrated that the dictionary group marked significantly higher scores on a vocabulary test than the no-dictionary group, suggesting that the use of a dictionary while reading could improve "indirect or incidental vocabulary learning" (Luppescu & Day, 1993, p. 271). Regarding reading comprehension, the researchers claimed that the use of dictionaries might help learners clarify the meaning of a word that could not be inferred completely from the context and comprehend reading texts. However, the study also found negative aspects of dictionary use, as the dictionary group took nearly twice as long as the no-dictionary group to read the story and had lower reading speed. The researchers claimed

that “the use of a dictionary in some cases may be misleading or confusing,” if students are unable to locate the appropriate meaning from the large number of dictionary entries (Lupescu & Day, 1993, p. 273).

Koyama and Takeuchi (2003) conducted one of the first contrastive studies by comparing the use of paper dictionaries to that of pocket E-dictionaries. An experiment involving Japanese high school EFL students found that the pocket E-dictionary group tended to look up more words than the paper dictionary group did when reading an English text, but also found no significant differences in search time and rates of recall and recognition of the words searched between the two groups. In another experimental study, Koyama and Takeuchi (2007) investigated Japanese college EFL learners' dictionary use while reading. The findings indicate that pocket E-dictionaries are likely to enhance learners' look-up frequency and shorten the time to complete the reading task relative to paper dictionaries. However, the study found no significant difference in reading scores between the two dictionary groups. The results of Koyama and Takeuchi (2003, 2007) suggest that learners' look-up frequency may not be proportional to their search time, word retention, or degree of reading comprehension. Similarly, Chen (2010) conducted an experimental study with Chinese college EFL students and compared the effects of paper dictionaries and pocket E-dictionaries on English vocabulary acquisition. The study found no significant differences in word comprehension, production and retention test scores between the two dictionary groups, although the pocket E-dictionary group showed significantly less time used for task completion than the paper dictionary group. Overall, such previous studies showed that pocket E-dictionary users did not display greater reading comprehension and vocabulary acquisition, despite their higher look-up frequency and/or quicker task completion relative to paper dictionary users.

## 2. Mobile Devices as Dictionaries

In today's advanced information society, L2 learners have easy access to mobile devices, such as smartphones and tablet computers, with relatively high-quality wireless Internet connections. Along with the extensive permeation of the Internet and mobile technology, dictionary use among university students appears to be changing significantly. Collins (2016) examined Japanese college EFL students' usage of dictionaries inside and outside the classroom using a questionnaire and follow-up interviews. The results showed that the smartphone-based dictionary was the most frequently used dictionary type in both learning contexts, followed by the E-dictionary. Collins argued that Japanese university EFL students are “in a transitional phase,” moving away from E-dictionaries (p. 46). More recently, Ma (2019) conducted a survey with Hong Kong university L2 students, focusing on their use of mobile dictionary apps. The analyses of the questionnaire responses

showed that most of the students (91%) installed one or more dictionary apps on their mobile devices. Based on the high rate of dictionary app installation, Ma suggests that mobile dictionary apps have become a learning tool frequently used by L2 learners.

The questionnaire surveys reviewed above have provided a general picture of learners' dictionary choices in L2 learning. However, these surveys examined learners' dictionary use in general rather than for specific language tasks. Furthermore, they did not report on learners' actual use of dictionaries but on their perceptions of dictionary use. To fill these gaps, Koyama (2019) investigated learners' actual use of mobile dictionary apps. The study compared Japanese college EFL learners' use of a smartphone dictionary and their use of a tablet dictionary in word definition and reading comprehension tasks. Comparing the time and scores of the two types of devices using the same dictionary apps, she found that, while the learners looked up more words when using a tablet dictionary, they marked higher scores on the reading comprehension task and showed a higher rate of word retention when using a smartphone dictionary. Koyama argued that, while a different dictionary interface (i.e., different screen sizes) may influence learners' look-up frequency, a larger number of lookups may not contribute to better L2 learning outcomes.

A review of the literature suggests that L2 learners have increasingly used smartphones as dictionaries. However, few studies have compared effects between smartphone dictionary apps and other dictionaries (i.e., pocket E-dictionaries) across different L2 tasks. Furthermore, researchers have yet to extensively examine learners' self-initiated dictionary use in real L2 learning settings, as opposed to experimental conditions. As suggested by Collins (2016, p. 36), "in the age of free online dictionaries," learners have a variety of options, including E-dictionaries, online dictionaries, and smartphone dictionary apps. Learners' dictionary use might change as dictionary technology evolves. Thus, we need to update our understanding of the types of dictionary technology L2 learners actually and voluntarily select to use in this technological era.

### 3. Self-Initiated Use of Mobile Devices as Dictionaries

Koyama and Yabukoshi (2019a, 2019b) investigated Japanese college EFL learners' self-initiated dictionary use in a vocabulary task over two years. Koyama and Yabukoshi (2019b) conducted a pilot study with 98 freshmen in the 2017 academic year. A replication study was then undertaken by Koyama and Yabukoshi (2019a) with 73 freshmen in the 2018 academic year. The participants of the two studies were comparable in terms of their educational backgrounds (i.e., academic year, major, EFL proficiency). The vocabulary task consisted of 15 items that were retrieved from Part 5 (incomplete sentences) of an official TOEIC® Listening & Reading Preparation Workbook. The participants were free to use their mobile devices (i.e., smartphones, pocket

E-dictionaries, tablets) to answer the quiz. They were instructed to circle the looked-up words on the task sheet during the task. After finishing the task, they reported the types of mobile devices and the names of the dictionaries they had used, if any. Koyama and Yabukoshi (2019a) also examined the time the participants spent on the vocabulary task. The findings of the two studies showed that: (1) the most of the students (approximately 80%) chose to use smartphone-based dictionaries, such as Weblio and Google Translate, to look up unknown words in the vocabulary task; (2) the use of pocket E-dictionaries became less popular, with its proportion dropping from 18.4% to 9.6% of the participants in each study over two years; and (3) the students increasingly chose not to use dictionaries in the vocabulary task, with this proportion increasing from 5.1% to 9.6% of the students over two years. Further analyses revealed that: (a) there seemed to be no relationship between students' dictionary choices and their English proficiency levels; (b) the number of lookups differed significantly in terms of the students' dictionary choices, with the pocket E-dictionary users looking up more words than the smartphone dictionary users in the task; but (c) no significant differences were observed either in the time taken to complete the task or in the vocabulary test scores between the smartphone, pocket E-dictionary, and no-dictionary user groups.<sup>1</sup>

To gain further insights into learners' self-initiated dictionary use in various L2 decoding tasks, the current study turned to investigate Japanese college EFL learners' choices and use of dictionaries in a reading comprehension task.

### III. Methodology

#### 1. Research Objectives

This study aimed to (a) investigate the types of mobile devices Japanese university EFL learners voluntarily use as dictionaries when they encounter unknown words while reading English passages and (b) explore the relationship between learners' dictionary choices on the one hand and their proficiency, look-up behavior, and reading comprehension on the other. The study addressed the following research questions (RQs):

RQ1. What kinds of mobile devices and dictionaries/dictionary apps do Japanese college EFL learners voluntarily use to look up unknown words in a reading comprehension task?

RQ2. Is there any relationship between learners' dictionary choices and English proficiency levels?

RQ3. Does look-up behavior (i.e., look-up frequency and task completion time) differ according to learners' dictionary choices?

RQ4. Do reading comprehension scores differ according to learners' dictionary choices?

The results of the study will be discussed relative to the authors' previous findings on a vocabulary task (Koyama & Yabukoshi, 2019a, 2019b) to provide insights into learners' dictionary use according to L2 task type.

## 2. Participants

Overall, 75 undergraduate students (37 men and 38 women) participated in the study. They were all freshmen, aged around 18 to 19 years, majoring in health and sports at a university in western Japan. They were enrolled in a compulsory English reading and writing course and had been learning English in formal settings for over six years. Their English proficiency levels ranged from false beginner to intermediate EFL learner, based on 45-item pre-class cloze test scores ( $M = 18.40$ ,  $SD = 4.26$ ). They were comparable to the participants of the authors' previous studies (Koyama & Yabukoshi, 2019a, 2019b) in terms of their educational backgrounds (i.e., academic year, major, EFL proficiency).<sup>2</sup>

## 3. Procedures and Materials

The participants' self-initiated dictionary use was investigated in the English reading and writing class at the beginning of a semester in the 2019 academic year. Each participant was given a reading comprehension task drawn from Part 7 (Reading Comprehension) of an official TOEIC<sup>®</sup> Listening & Reading Preparation Workbook (Educational Testing Service, 2016). The participants were instructed to read five passages (i.e., an advertisement, e-mail, report, notice, text message chain) and answer 14 multiple-choice questions. Each passage included two to five questions. These materials were reviewed by their English teacher, and she confirmed that the materials were likely to contain several words and phrases that were unknown or unfamiliar to the participants.

During the reading task, the participants were free to use their mobile devices (i.e., smartphones, tablets, pocket E-dictionaries) to look up unknown words and phrases. The choices and use of devices and dictionaries were left to each individual. Thus, the participants spontaneously consulted dictionaries to comprehend the texts and answer the questions. They were instructed to circle the looked-up words on the reading task sheet. After finishing the task, they were asked to report on the types of mobile devices and the names of the dictionaries/dictionary apps they had

used, if any, at the bottom of the task sheet. There was no time limit for performing the reading task. The participants were told to take as much time as they needed to read the passages and answer the questions. They reported on the time when they had started to read and the time when they had finished the task on the task sheet.

#### 4. Data Analyses

To address RQ 1, the 75 task sheet answers were examined to identify the types of mobile devices and names of the dictionaries/dictionary apps they had utilized during the reading task. To address RQs 2, 3, and 4, the study focused on the use of major smartphone dictionary apps and pocket E-dictionaries. The study also examined those who chose not to use dictionaries. A total of 56 students' dictionary use was analyzed. They were assigned to the Google Translate Group ( $n = 25$ ) if they had used Google Translate on a smartphone, the Weblio Group ( $n = 15$ ) if they had used Weblio on a smartphone, the Pocket E-Dictionary Group ( $n = 4$ ) if they had mainly used a pocket E-dictionary, or the No-Dictionary Group ( $n = 12$ ) if they had not used any dictionary. These dictionary groups were also investigated in the authors' previous studies (Koyama & Yabukoshi, 2019a, 2019b). 19 students were excluded from the data analyses: 15 of them did not properly mark the words they had looked up on the task sheet, two of them reported using only minor smartphone dictionary apps (i.e., LINE, ALC Eijirō), one of them reported using both Google Translate and Weblio, and one of them reported using Google Search without mentioning the specific websites he/she had consulted.

The study examined four variables: (a) English proficiency assessed by the 45-item pre-class cloze test, (b) the number of lookups marked on the reading task sheet, (c) the time spent on the task reported on the task sheet, and (d) reading comprehension measured using the reading task of the TOEIC Part 7. Each variable was examined in terms of learners' dictionary groups. Due to the small and unbalanced sample sizes of the four dictionary groups, a Kruskal–Wallis test, a non-parametric method for comparing three or more groups of median values, was performed to determine if there were significant differences in these test scores and look-up behavior between the four dictionary groups. The tests were followed by post-hoc testing using Mann–Whitney U tests with Bonferroni corrections.

## IV. Results

### 1. Mobile Devices and Dictionaries

Tables 1 and 2 show the types of mobile devices and the names of dictionaries/dictionary

apps reported by the participants in the reading task. As shown in Table 1, most participants (78.9%) chose to use smartphones as dictionaries. Among the various smartphone dictionary apps, Google Translate and Weblio were particularly popular (Table 2). These two apps are free dictionary/translation applications available in both web-based and offline versions. Google Search was the third most popular tool: 15 students reported using it in the reading task. Only four participants (5.3%) reported using pocket E-dictionaries in the reading task. Finally, 12 students (15.8%) chose not to use any dictionaries in the reading task.

Table 1. Number and Percentage of Mobile Devices Used

Mobile Device	<i>n</i>	%
Smartphones	60	78.9
Pocket E-dictionaries	4	5.3
No dictionaries	12	15.8
Total	76 <sup>a</sup>	100

<sup>a</sup> One student reported using a smartphone and a pocket E-dictionary.

Table 2. Number of Dictionaries/Dictionary Apps Used

Mobile Device	Dictionary/Dictionary app	<i>n</i>
Smartphones	Google Translate	32
	Weblio	23
	Google Search	15
	LINE	3
	Yahoo	1
	ALC Eijirō	1
	Pocket E-dictionaries	<i>Genius Dictionary</i>
	Others <sup>a</sup>	2

*Note.* Multiple answers were allowed.

<sup>a</sup> Others include *Wisdom English-Japanese Dictionary* and an unknown dictionary.

## 2. English Proficiency

The study further examined learners' English proficiency in terms of their dictionary choices, focusing on four dictionary groups (i.e., Google Translate, Weblio, Pocket E-Dictionary, No-Dictionary). According to Table 3, the No-Dictionary group scored slightly higher on the cloze test than the other three dictionary groups. However, the result of the Kruskal-Wallis test did not suggest any significant difference in cloze test scores between the four dictionary groups ( $H(3) = 5.94, p = .12$ ).



Table 3. Cloze Test Scores of Four Dictionary Groups

Group	<i>n</i>	<i>M</i>	<i>SD</i>	<i>Median</i>
Google Translate	25	17.56	4.45	18.00
Weblio	15	19.47	2.97	20.00
Pocket E-Dictionary	4	18.25	3.50	18.50
No-Dictionary	12	20.83	3.49	21.50
All	56	18.82	3.96	20.00

*Note.* Maximum score of the cloze test is 45.

### 3. Look-up Behavior

#### 3.1 Lookups

The participants' look-up behavior (i.e., number of lookups and time required to complete the task) was examined in terms of their dictionary choices. Table 4 lists the number of words consulted by the three dictionary groups. The Google Translate group looked up more words than the other two dictionary groups. However, these differences were not statistically significant. The Kruskal-Wallis test showed no significant difference in the number of lookups between the three groups ( $H(2) = 2.11, p = .35$ ).

Table 4. Number of Lookups of Three Dictionary Groups

Group	<i>n</i>	<i>M</i>	<i>SD</i>	<i>Median</i>
Google Translate	25	11.00	8.19	8.00
Weblio	15	9.00	9.56	6.00
Pocket E-Dictionary	4	6.75	5.56	4.50
All	44	9.93	8.44	7.00

#### 3.2 Time Required to Complete the Task

Table 5 shows the time spent on the reading task by the four dictionary groups. As shown in the table, the No-Dictionary group took less time to complete the task than the other three dictionary groups. The result of the Kruskal-Wallis test showed a significant difference in task completion time between the four dictionary groups ( $H(3) = 8.66, p = .03$ ). The post-hoc Mann-Whitney  $U$  tests with Bonferroni corrections (corrected  $p$  value:  $.05/3 = .016$ ) did not show significant differences between any two groups. The results showed no significant difference between the No-Dictionary and Pocket E-Dictionary groups ( $U = 5.00, p = .021$ ), with a large effect size ( $r = .58$ ), between the No-Dictionary and Weblio groups ( $U = 49.50, p = .047$ ), with a medium effect size ( $r = .38$ ), or between the No-Dictionary and Google Translate groups ( $U = 87.00, p = .040$ ), with a medium effect size ( $r = .34$ ). However, given the medium to large effect sizes, the No-Dictionary group was likely to complete the

reading task sooner than the other three dictionary groups, particularly the Pocket E-dictionary group.

Table 5. Time Required to Complete the Tasks of Four Dictionary Groups

Group	<i>n</i>	<i>M</i>	<i>SD</i>	<i>Median</i>
Google Translate	25	34.48	6.51	37.00
Weblio	15	35.20	5.21	34.00
Pocket E-Dictionary	4	40.00	4.16	40.00
No-Dictionary	12	28.92	8.44	30.00
All	56	33.88	7.02	35.00

#### 4. Reading Comprehension

Table 6 presents the reading comprehension scores of the four dictionary groups measured by the TOEIC Part 7 task. The result of the Kruskal-Wallis test showed no significant difference in reading test scores between the four groups ( $H(3) = 2.94, p = .40$ ).

Table 6. Reading Test Scores of Four Dictionary Groups

Group	<i>n</i>	<i>M</i>	<i>SD</i>	<i>Median</i>
Google Translate	25	7.72	2.44	8.00
Weblio	15	9.00	2.67	9.00
Pocket E-Dictionary	4	8.75	0.96	8.50
No-Dictionary	12	7.92	1.68	8.50
All	56	8.18	2.31	8.00

*Note.* Maximum score of the reading test is 14.

## V. Discussion

This study investigated Japanese college EFL learners' self-initiated dictionary use in a reading comprehension task drawn from the TOEIC Part 7. The results will be discussed in relation to those obtained in the authors' previous studies on learners' dictionary use in a vocabulary task drawn from the TOEIC Part 5 (Koyama & Yabukoshi, 2019a, 2019b). This study's participants and those of the earlier studies were comparable in terms of their educational backgrounds (i.e., academic year, major, EFL proficiency).

### 1. Learners' Dictionary Choices

The current study found that smartphone-based dictionaries were used extensively by many participants (78.9%) in the reading comprehension task. That high proportion is similar to the

results of the authors' previous studies on the vocabulary task. The percentage of smartphone dictionary users was 80.8% in Koyama and Yabukoshi (2019a) and 75.5% in Koyama and Yabukoshi (2019b). These findings indicate that Japanese college students tend to use smartphone devices as dictionaries in their EFL learning, as suggested by Collins (2016) and Hubert (2017). Regarding smartphone dictionary apps, while the authors' previous studies reported that Weblio was the most popular dictionary app for the vocabulary task (Koyama & Yabukoshi, 2019a, 2019b), the present study found that Google Translate was the most commonly used tool in the reading task. Weblio appears to provide more detailed features of target words (i.e., word definitions, phonetic transcriptions, word classes, examples) than does Google Translate, which typically provides word, phrase, and sentence translation as well as a pronunciation guide. The students of the present study might have chosen Google Translate to simply look up the meanings of unknown words in the TOEIC Part 7 reading task. On the other hand, the students involved in the previous studies might have chosen Weblio rather than Google Translate in order to obtain other information in addition to the meanings of the target words (i.e., word classes, idioms) to complete the TOEIC Part 5 vocabulary task.

This study found that only a few students (5.3%) reported using pocket E-dictionaries in the reading task. This proportion of pocket E-dictionary users is lower than what was found in the authors' previous studies. Koyama and Yabukoshi (2019a) reported that 9.6% of the students utilized pocket E-dictionaries in the vocabulary task in the 2018 academic year, and Koyama and Yabukoshi (2019b) reported that 18.4% used them in the 2017 academic year. Moreover, the present study found that 15.8% of the students did not utilize any dictionaries in the reading task. This proportion is larger than what was found in the authors' previous studies; 9.6% of the students reported not using any dictionaries in the vocabulary task in the 2018 academic year (Koyama & Yabukoshi, 2019a), and only 5.1% reported not using them in the 2017 academic year (Koyama & Yabukoshi, 2019b). This difference might occur because some students may have managed to infer the meaning of unknown words in the reading passage of the TOEIC Part 7 task, which provides richer contextual information than do the single sentences of the TOEIC Part 5 task.

## **2. Proficiency, Look-up Behavior, and Learning Outcomes**

The current study explored the relationship between learners' dictionary choices in the reading task on the one hand and their proficiency levels, look-up behavior, and reading comprehension on the other. The results showed that the cloze test scores did not differ significantly between the four dictionary groups (i.e., Google Translate, Weblio, Pocket E-dictionary, and No-Dictionary). These findings are in line with those of the authors' previous studies on vocabulary

tasks (Koyama & Yabukoshi, 2019a, 2019b). Thus, it seems that there is no relationship between learners' dictionary choices in such L2 decoding tasks and their English proficiency levels.

The present study also investigated learners' look-up behaviors in the reading task. The study found no significant difference in number of lookups between the three dictionary groups (i.e., Google Translate, Weblio, and Pocket E-dictionary). These findings differ from the authors' previous studies, which found that the E-dictionary group consulted dictionaries more frequently than the other two smartphone groups in the vocabulary task (Koyama & Yabukoshi, 2019a, 2019b). More in-depth analyses revealed that this study's Pocket E-dictionary group looked up much fewer words in the reading task ( $M = 6.75$ ,  $SD = 5.56$ ,  $n = 4$ ) than it had in the previous studies on the vocabulary task ( $M = 33.57$ ,  $SD = 10.94$ ,  $n = 7$  in Koyama and Yabukoshi [2019a];  $M = 32.83$ ,  $SD = 22.52$ ,  $n = 18$  in Koyama and Yabukoshi [2019b]). The differences in findings between the current study and the previous studies may be due to task differences, as discussed in Section V.1. It appears that some of this study's participants may have worked out the meanings of unknown words contextually in the TOEIC Part 7 reading task and thus managed to answer the reading comprehension questions without looking up every single unknown word in a dictionary. By contrast, the TOEIC Part 5 vocabulary task generally requires learners to understand several information of the target words (i.e., definitions, word classes, idioms) more precisely with less contextual information than the TOEIC Part 7 reading task does. Such task differences may have induced different look-up frequencies in these two tasks. Another possible factor is the small sample size of the Pocket E-dictionary groups, particularly in the present study ( $n = 4$ ). The lopsided focus on particular individuals might have affected the studies' results.

The time spent on the reading task was also examined as a look-up behavior in this study. The results indicate a significant difference in time between the four dictionary groups (i.e., Google Translate, Weblio, Pocket E-dictionary, and No-Dictionary). The No-Dictionary group completed the reading task more quickly than the other three dictionary groups, although this difference was not statistically significant. Luppescu and Day (1993) found that a dictionary group took longer to read a story than a group that did not use dictionaries. The researchers argued that the use of dictionaries while reading may be confusing in some cases with a large number of entries under the headword, which will reduce reading speed. On the other hand, the findings of the present study are not consistent with those of the authors' previous study (Koyama & Yabukoshi, 2019a), which found no significant difference in the time used for the vocabulary task between the four dictionary groups. This discrepancy could be explained in terms of task differences again. While the vocabulary task of the TOEIC Part 5 requires learners to read each single short sentence and choose an appropriate word or phrase to complete the sentence, the reading task of the TOEIC Part 7 requires learners to

read a variety of passages, rather than a single sentence, and locate the part that is relevant to each comprehension question. It appears that finding suitable definitions may take longer for people reading long passages than it does for people reading single sentences. Such task differences could have affected the participants' search times, leading to the inconsistent results between the two studies.

Despite the differences in the time spent on the task, the learning outcomes measured by the reading task did not differ in terms of learners' dictionary choices. Although the three dictionary groups (i.e., Google Translate, Weblio, and Pocket E-dictionary) looked up unknown words and took more time to finish the task, their scores on the reading comprehension test were not significantly higher than those of the No-Dictionary group. These results agree with the authors' previous studies on the vocabulary task (Koyama & Yabukoshi, 2019a, 2019b), which found no significant differences in vocabulary test scores between the dictionary groups, which varied in their look-up frequencies. Similarly, Koyama and Takeuchi (2007) reported that, although the pocket E-dictionary group looked up more words in a shorter period of time than the printed dictionary group, reading comprehension of the text did not differ between the two groups. Therefore, L2 learning outcomes may not vary according to learners' dictionary choices and look-up behavior, such as the number of lookups and time spent on a task. With reference to Koyama and Takeuchi's (2009) qualitative findings, Koyama and Yabukoshi (2019b) argued that strategies for dictionary use (i.e., guessing meaning from the context before actual lookups, checking usage examples of the target word) may affect learning outcomes. Prichard and Atkins' (2021) eye-tracking study also demonstrated that L2 readers employed various strategies to cope with a lack of receptive vocabulary when encountering unknown words. These strategies include not only dictionary use but also inferring meaning from the context and ignoring unknown words that are irrelevant to the reading task. These insights warrant more in-depth investigation into L2 learners' dictionary use to clarify the links between dictionary use, L2 proficiency, and learning outcomes in L2 learning tasks.

## VI. Conclusion

The present study investigated Japanese college EFL learners' self-initiated dictionary use in a reading task and explored the relationship between their dictionary choices on the one hand and their look-up behavior and English test scores on the other. The difference across the dictionary groups' sample sizes is one of the methodological limitations of the study. Due to this imbalance, a nonparametric procedure (i.e., Kruskal-Wallis test) was used for the data analyses, which is less robust than a parametric one (i.e., one-way independent ANOVA). However, the use and choice of

dictionaries were left to the individual learners in the current study. The unbalanced sample size is thus likely to reflect Japanese EFL college learners' real learning situation, in which most students use their smartphone as a dictionary. A comparison between this study's findings and those of the authors' previous studies (Koyama & Yabukoshi, 2019a, 2019b) suggested that learners' dictionary choices and look-up behavior are likely to be affected by task differences. However, the studies produced virtually identical findings on L2 learning outcomes, suggesting that they (i.e., reading and vocabulary test scores) may not vary according to learners' dictionary choices as well as look-up behavior (i.e., number of lookups, time spent on a task). These findings have important implications for researchers, instructors, and learners. Researchers should conduct a more in-depth exploration into individual's look-up behavior to elucidate the factors contributing to better learning outcomes and effective dictionary use, and thus more successful EFL learning. In particular, the use of smartphones as dictionaries warrants further investigation, given their popularity among EFL learners. Moreover, not only researchers but also EFL instructors should develop a better understanding of the effective use of smartphones as dictionaries for EFL learning and consider how to incorporate such mobile devices inside and outside the classroom. Offering pedagogical guidance on the effective use of mobile devices as dictionaries may provide EFL learners with a more positive learning experience and allow them to learn English more efficiently and autonomously.

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### Notes

- \* This is a revised version of the paper presented at the 3rd JAAL in JACET Conference held on December 5, 2020.
- 1. No-dictionary users' test scores were not examined in Koyama and Yabukoshi's (2019b) pilot study.
- 2. The results of one-way independent ANOVA indicated that there was no significant difference in the cloze test scores between the participants of the current study and those of the authors' previous studies ( $F(2, 244) = .72, p = .49, \eta^2 = .01$ ).

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