The Effect of Dictionary/App Usages in M/C Vocabulary Task

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1. Background

Together with the evolution of technology, dictionaries continue to evolve. Hartmann pointed out by quoting the proposition concerning the 'communicative shift' theory in McArthur, who has posited in 1986 as follows:

> . . . four major stages in the development of human interaction, . . . , each of which is associated with a different reference technology, from 'oral' and 'script-based' to 'printed' and 'electronic' dictionaries, with numerous subshifts and subtypes.
>
> (Hartmann 41)

While the time migrates from analog to digital, the forms of dictionaries have gradually changed. The advent of pocket electronic dictionaries was a kind of an epoch-making event, as was described in detail by Sekiyama, especially in Japan. Koyama and Takeuchi summarized its popularity, and examined the relationship between college students' lookup behavior and the retention of looked-up words or reading comprehension of English passages in using printed and pocket electronic dictionaries. In their series of studies, they found that pocket electronic dictionaries not only promoted learners' look-up frequency more than printed dictionaries did, but also could reduce the time for L2 (Second/Foreign Language) reading. In spite of these advantages, however, it appears that this higher look-up frequency does not necessarily guarantee better reading comprehension nor retention of looked-up words.

While its popularity has been growing, Tono has already predicted in 2009 that "The future of pocket electronic dictionaries would be more integrative in nature. There will be a fuzzier boundary between PDAs, palm-top PCs, mobile phones and pocket electronic dictionaries." (65). And his prediction has turned out somewhat to be true. Hubert reported that Japanese university students were switching to smartphone use as their primary dictionary resource from pocket electronic dictionaries. Collins's description also supported this finding.

In line with the tendency, Koyama and Yabukoshi conducted a pilot study to explore Japanese college students' use of gadgets and apps when they need to access lexical information in EFL classes, and examine the relationship with test scores. They especially focused on multiple-choice vocabulary quiz to perform their experiment. In the study, they found 1) most of students utilized a free apps with their smartphones; 2) pocket electronic dictionary users looked up more words than the users of smartphone apps; and 3) there were no statistically significant differences in English test scores in term of dictionary types. Their attempt, however, had some limitations such as the relatively small number of participants included in each group.

2. The study

2.1 Purposes

The current study aimed to investigate Japanese university EFL students' dictionary use in a decoding task or a multiple-choice vocabulary task. In order to replicate the pilot study and examine if there are any differences in dictionary use over the two years, our findings will be discussed in comparison with Koyama and Yabukoshi, which had been conducted a year before the present study. We address the following two research questions:

RQ 1 *What types of devices and dictionary apps are used by Japanese university students to look up unknown words in a multiple-choice vocabulary task?*

RQ 2 *Are there any differences in: (a) look-up behavior (i.e., the num-*

ber of lookups and the time spent on the task); (b) learning outcomes; and (c) English proficiency levels in terms of students' dictionary choices?

2.2 Participants

A total of 73 college students (aged 18–19) participated in the study. They majored in health and sports sciences and were enrolled in a compulsory English reading and writing course at a university in the western part of Japan.

Table 1 The results of cloze test scores[1)]

	N	*M*	*SD*
The present study	73	18.96	4.55
Koyama and Yabukoshi	97[2)]	18.10	4.94

Their English proficiency levels ranged from beginner to intermediate, which was similar to those in Koyama and Yabukoshi (Table 1). The results of *t*-test showed that there were no significant differences in the cloze test scores between the participants of the two studies (t (168) = 1.16, p =.25, d = .18).

2.3 Procedure

At the beginning of the semester, the participants took part in the experiment that was carried out in the same manner in Koyama and Yabukoshi. They were asked to answer 15 multiple-choice vocabulary questions, which were retrieved from the Part 5 of an official TOEIC® workbook. These materials seemed to include several unknown or unfamiliar words to the participants. Then, during the task, we allowed the participants to use their mobile devices, such as smartphone apps and pocket electronic dictionaries, to look up unknown words where necessary. They were instructed to circle the looked-up words on the task sheet. After completing the task, they were asked to specify the types of mobile devices, apps, and/or dictionaries they had used. There were no time constraints imposed during the session. Additionally, the supplemental background survey was administered

to the participants to obtain information on their usual dictionary use, rather than the specific dictionary use at the time of the current experiment. The survey included questions as to the types of devices students possessed, dictionary apps they installed, online-dictionaries they accessed, and so on.

2.4 Data analyses

Analyses were conducted to answer the two research questions. First, students' responses to the question as to what mobile devices and dictionary apps they had used during the vocabulary task were analyzed. Then, the results of the present study and those in Koyama and Yabukoshi were compared to examine if there were any differences in preference of dictionary tools between the two years. To address the second research question, the participants were divided into four groups (i.e., three major dictionary groups and no dictionary group which did not utilize any dictionaries) based on the findings for the first research question. Regarding the look-up frequency, the number of words circled on the task sheet by the students of each group was counted. Then, due to the small sample size and the inequality of each group's sample size, Kruskal Wallis test, a non-parametric test, was conducted to examine if there were significant differences in the number of lookups among the three dictionary groups. As for the time to complete the task and the English test scores, Kruskal Wallis tests were performed to examine if there were significant differences in the time spent on the task and English test scores among the four groups. If significant differences were found by a Kruskal Wallis test, a post-hoc test (Mann-Whitney *U* test) was run to closely examine which group's mean was significantly different from each other. The results of the present study were, then compared with those in Koyama and Yabukoshi.

3. Results

3.1 Devices and dictionary apps

The current study found that most of the participants (80.8%) of the

study utilized smartphone dictionary apps and a handful of them (9.6%) used pocket electronic dictionaries to look up unknown words in the vocabulary task. As shown in Table 2, the use of smartphone dictionary apps has become more popular while pocket electronic dictionaries less popular, compared with Koyama and Yabukoshi. According to the supplemental background survey, all participants of the current study have their own smartphones. The survey also revealed that most of the participants (82.2%) also possess their own pocket electronic dictionaries. Based on the data we collected, the authors presume that students might not bring their pocket electronic dictionaries to the EFL classroom or prefer smartphones to pocket electronic dictionaries when looking up unknown words. The present study also revealed that 9.6% of the students did not rely on any dictionaries to complete the vocabulary task. That proportion has increased by 4.5% from the previous year.

Table 2 Comparison of the number and percentage of mobile devices

Devices	The present study		Koyama & Yabukoshi	
	n	%	*n*	%
Smartphone dictionary apps	59	80.8	74	75.5
Pocket electronic dictionaries	7[3)]	9.6	18[4)]	18.4
Unspecified	0	0	1	1.0
No dictionaries	7	9.6	5	5.1
Total	73	100	98	100

Regarding the types of dictionary apps, the results showed that the students utilized various smartphone dictionary apps. Weblio and Google Translate were the top two dictionary apps (Table 3). Weblio, free online 563 dictionaries with encyclopedia provided by GRAS Group Corporation, currently includes more than 9,860,000 entries in both English-Japanese and Japanese-English dictionaries. Weblio users can perform a bulk search on such multiple dictionaries, obtaining information about word definitions, pronunciations, and examples. Google Translate is a free translation service offered by Google. It

provides word-, phrase-, and sentence-level translations as well as its pronunciation guidance for each translation. Both Weblio and Google Translate have introduced a website interface and a mobile app for iOS and Android, so both services are available with a mobile phone in either online or offline mode. According to the background survey, most of the participants of this study had ever accessed the websites (79.5%) to search the meaning of a target word, and 17.8% of them had installed such dictionary apps in their smartphones. As for pocket electronic dictionaries, *Genius English-Japanese Dictionary*, which is one of the best-selling dictionaries among EFL learners in Japan, was commonly used by the pocket electronic dictionary users. Comparing the results of the present study and Koyama and Yabukoshi (Table 3), similar dictionary apps were used by the students in both studies. The following sections report on the use of the top three dictionaries (i.e., Weblio, Google Translate, and pocket electronic dictionaries) and its relationship with English test scores.

Table 3 Comparison of the number of dictionary apps used

		The present study	Koyama & Yabukoshi
Devices	Dictionary apps[5)]	*n*	*n*
Smartphones	Weblio	35	34
	Google Translate	29	31
	Google	4	5
	LINE	1	4
	Yahoo	0	3
	ALC Eijirō	3	3
	Others[6)]	1	7
Pocket electronic dictionaries	*Genius English-Japanese Dictionary*	7	15
	Others[7)]	0	4

3.2 The number of lookups

This section reports on the look-up frequency of the top three dictionary users (i.e., Weblio, Google Translate, and pocket electronic

dictionary users). Those who reported using both pocket electronic dictionaries and smartphone dictionary apps were included in the pocket electronic dictionary group due to their minimum use of smartphone devices according to their English instructor's observation. Those who reported using both Weblio and Google Translate were excluded from the data analysis. Table 4 shows the number of lookups by the three dictionary groups of the present study and Koyama and Yabukoshi. A Kruskal Wallis test revealed that there were significant differences in the number of lookups among the three groups of this study ($H(2) = 14.07$, $p = .001$). The post-hoc test (Mann-Whitney U test) showed that the pocket electronic dictionary users looked up more words than the Google Translate users ($U = 9.00$, $p < .001$, $r = .65$) and the Weblio users ($U = 19.00$, $p = .001$, $r = .55$). There was no significant difference in the look-up frequency between the Google Translate and Weblio users ($U = 218.50$, $p = .176$, $r = .20$). These results support the findings in Koyama and Yabukoshi that there were significant differences in the number of lookups among the three dictionary groups and, in particular, that the pocket electronic dictionary group significantly looked up more words than the Google Translate group.

Table 4 Comparison of the number of lookups

	The present study				Koyama & Yabukoshi			
	The number of lookups				The number of lookups			
Group	*n*	*M*	*SD*	*Median*	*n*	*M*	*SD*	*Median*
Weblio	27	14.41	11.77	11.00	27	22.00	14.37	17.00
Google Translate	21	11.05	10.87	9.00	16	16.13	22.49	10.00
Pocket Electronic Dictionary	7	33.57**	10.94	35.00	18	32.83*	22.52	30.00
All	55	15.56	13.21	12.00	61	23.66	20.03	16.00

* $p < .05$, ** $p < .01$

3.3 The time to complete the task

Another look-up behavior that was investigated in this study was the time to complete the vocabulary task, which was not examined in

Koyama and Yabukoshi. The participants were divided into four groups including the three major dictionary groups (Weblio, Google Translate, and pocket electronic dictionary groups) and one group that did not use any dictionaries (No Dictionary group). As shown in Table 5, the pocket electronic dictionary group took a little longer time than the other three groups, and the No Dictionary group completed the task a little sooner than the other three dictionary groups. However, no statistical differences were confirmed in the time to complete the task among the four groups ($H(3) = 4.53$, $p = .21$).

Table 5 Comparison of the time to complete the task

		Time to complete the task		
Group	*n*	*M*	*SD*	*Median*
Weblio	27	28.41	6.08	29.00
Google Translate	21	29.14	7.15	28.00
Pocket Electronic Dictionary	7	33.86	8.82	34.00
No Dictionary	7	24.43	6.93	25.00
All	62	28.82	7.08	28.50

All values are n.s.

3.4 Learning outcomes

The four dictionary groups' learning outcomes were measured by the vocabulary task. Results of this study showed that the pocket electronic dictionary group seemed to gain higher scores on the word task than the other three groups, and that the No Dictionary group marked a slightly lower scores than the other three dictionary groups (Table 6). However, the statistical analysis did not confirm significant differences in the vocabulary quiz scores among the four groups of the present study ($H(3) = 6.03$, $p = .11$). These findings are almost consistent with those in Koyama and Yabukoshi, suggesting that, despite the frequent lookups by the pocket electronic dictionary group, there were no major differences in the task performance in terms of students' dictionary choices.

Table 6 Comparison of the vocabulary task scores[8)]

Group	The present study				Koyama & Yabukoshi			
	Vocabulary task				Vocabulary task			
	n	*M*	*SD*	*Median*	*n*	*M*	*SD*	*Median*
Weblio	27	6.63	1.94	7.00	27	6.30	2.60	6.00
Google Translate	21	6.48	2.36	7.00	16	6.44	1.93	6.50
Pocket Electronic Dictionary	7	8.00	2.38	8.00	18	6.78	2.65	6.50
No Dictionary	7	5.29	1.60	5.00	*NA*[9)]	*NA*[9)]	*NA*[9)]	*NA*[9)]
All	62	6.58	2.16	7.00	61	6.48	2.43	6.00

All values are n.s.

3.5 English proficiency

The participants' English proficiency levels were assessed by the cloze test. In the present study, the Weblio group seemed to obtain higher scores on the cloze test than the other three groups (Table 7). The results of a Kruskal Wallis test revealed that there were no significant differences in the cloze test scores among the four groups of this study ($H(3) = 1.55$, $p = .67$). These findings were supported by those in Koyama and Yabukoshi. Based on the research evidence, there seems to be no relationship between students' dictionary choices and their English proficiency levels.

Table 7 Comparison of the cloze test scores[1)]

Group	The present study				Koyama & Yabukoshi			
	Cloze test				Cloze test			
	n	*M*	*SD*	*Median*	*n*	*M*	*SD*	*Median*
Weblio	27	19.93	3.15	20.00	27	17.44	5.24	18.00
Google Translate	21	17.71	5.73	19.00	16	20.25	3.22	20.50
Pocket Electronic Dictionary	7	18.43	2.88	19.00	18	17.11	5.50	16.50
No Dictionary	7	17.57	5.65	20.00	*NA*[9)]	*NA*[9)]	*NA*[9)]	*NA*[9)]
All	62	18.74	4.48	19.00	61	18.08	4.97	19.00

All values are n.s.

4. Discussion

The aim of the present study was to replicate and examine the findings in Koyama and Yabukoshi, which had investigated Japanese university EFL students' dictionary use in a vocabulary task a year before the present study. The findings of the present study are discussed and compared with those in Koyama and Yabukoshi in order to see if students' dictionary use has changed across the two years.

RQ1. What types of devices and dictionary apps are used by Japanese university students to look up unknown words in a multiple-choice vocabulary task?

The current research demonstrated that most students (80.8% of the participants of the study) reported using free dictionary apps, such as Weblio and Google Translate, in order to look up unknown words in the vocabulary task. The proportion of smartphone dictionary users has slightly increased compared to that (75.5%) in Koyama and Yabukoshi (20). These results may reflect the high permeation of the mobile devices in the society (MIC) and people's expectation of free access to online dictionaries (Dziemianko 5). Similarly, based on their three-year survey, Koyama and Yamanishi indicated that using free online translation such as Google Translate has become increasingly popular than paid dictionary apps. These findings suggest that Japanese college students would simply and effortlessly utilize such free translation tools that they have already owned and used since they were in high school, rather than bothering to choose and download a paid specific dictionary app. Regarding the use of pocket electronic dictionaries, only a handful of the students of the present study (9.6%) brought and consulted them to complete the word task even though almost all the students possessed such dictionaries at home (82.2%). The proportion of pocket electronic dictionary users has declined compared to that (18.4%) in Koyama and Yabukoshi (20). Moreover, 9.6% of the students in this study completed the word task without access to any dictionaries. That proportion has slightly increased in comparison to that (5.1%) of the finding in Koyama and Yabukoshi (20). These results may reflect

the tendency that students are less likely to depend on authentic dictionaries in L2 learning than before. In sum, the present study found that: (1) the students commonly preferred to use free online dictionary apps; (2) fewer students consulted pocket electronic dictionaries; and (3) the proportion of no dictionary users slightly increased from the previous year.

RQ2. Are there any differences in: (a) look-up behavior (i.e., the number of lookups and the time spent on the task); (b) learning outcomes; and (c) English proficiency levels in terms of students' dictionary choices?

Regarding the number of lookups, we found that the pocket electronic dictionary group consulted dictionaries more frequently than the Weblio and Google Translate groups. This finding is similar to Koyama and Yabukoshi (21), confirming that look-up frequency significantly differs in terms of students' dictionary choices. Despite the higher look-up frequency by the pocket electronic dictionary users, however, there were no significant differences in the time to complete the vocabulary task, learning outcomes assessed by the task, and English proficiency levels measured by the cloze test among the four dictionary groups (i.e., the three dictionary groups and the No Dictionary group). As for the time to complete the task, it was somewhat surprising that the two smartphone groups and the No Dictionary group took relatively as long as the pocket electronic dictionary group to complete the word task even though there were significant differences in the number of lookups. Regarding the smartphone users, Dziemianko (11) argued that the presence of advertisements displayed on the online dictionaries distracted the dictionary users and prolonged their search time in a receptive task. Similar findings were reported by Koyama (60), who examined the impact of dictionary interface (i.e., a smartphone dictionary or a tablet one) on look-up behavior and retention of the looked-up words. She conducted the experiment using both a smartphone and a tablet equipped with the same authentic dictionary, and found that the students looked up more words in a shorter period of

time when using a tablet dictionary as compared with using a smartphone. In light of these findings, it could be assumed that the dictionary interface would not relate directly to the time spent on a language task, rather affecting search time and the number of lookups. As for the No Dictionary group, even though this group did not use any dictionaries, they took roughly the same amount of time as the other dictionary groups. This might be because no dictionary users had to infer the meanings of unknown words based on their lexical, syntactic and background knowledge to complete the task instead of looking up unknown words in dictionaries.

With respect to the relationships between dictionary choices and English test scores, no significant differences were found in the vocabulary task and the cloze test scores among the four dictionary groups. These findings indicate that students' learning outcomes and English proficiency levels did not differ in terms of their dictionary choices, despite the higher lookups by the pocket electronic dictionary group. In other words, a larger number of lookups using pocket electronic dictionaries does not appear to ensure higher scores on the vocabulary task. These results are in line with those in Koyama and Yabukoshi (22–24) and also supported by Koyama (59–60), which found that the frequent lookups using a tablet dictionary did not result in better performance on vocabulary and reading comprehension tasks. The empirical evidence thus suggests that there seem to be no immediate connections between students' dictionary choices and L2 learning performance. As Koyama and Yabukoshi (24) argued, other than individuals' dictionary choices or look-up frequency, their reference skills, strategies for dictionary use might bear a close link to learning outcomes as suggested by several previous studies (Koyama and Takeuchi; Mavrommatidou et al.). Investigating EFL learners' pocket electronic dictionary use, Koyama and Takeuchi (140–141) revealed that successful learners were good dictionary users, employing several strategies (i.e., using example search or idiom search to find further information, and/or looking up in more than two dictionaries), in contrast to less successful learners. More recently, a large-scale survey by

Mavrommatidou et al. (400) demonstrated that experienced dictionary users reported a higher degree of dictionary strategy use (i.e., familiarity with different types of electronic dictionaries and the conditions of their use, strategies for lemmatization and acquaintance with dictionary convention, and navigation strategies) than less experienced counterparts. In light of these findings, students' reference skills should warrant further investigation to shed light on critical factors contributing to better dictionary use and learning performance in L2 tasks.

5. Conclusion

The present study was conducted to replicate and examine the findings in Koyama and Yabukoshi and to investigate Japanese university students' dictionary choices and use in a vocabulary task over two years. The findings of this study in comparison to those in Koyama and Yabukoshi study suggested that: (1) smartphone dictionary apps (i.e., Weblio and Google Translate) have remained popular, pocket electronic dictionaries have become less popular, and the proportion of no dictionary users has slightly increased over the two years; (2) look-up frequency significantly differed in terms of dictionary choices — the pocket electronic dictionary users looked up more words than the other smartphone dictionary users; but (3) there were no significant differences in (a) the time to complete the word task, (b) learning outcomes assessed by the task, and (c) English proficiency levels measured by the cloze test, in terms of dictionary choices. These results provide evidence that frequent lookups using pocket electronic dictionaries are not likely to ensure better performance in the vocabulary task.

The present study as well as Koyama and Yabukoshi, however, was limited in their scope as they examined only the number of lookups and the time spent on a task as students' look-up behavior. Follow-up studies will be needed to further explore individuals' look-up behavior by means of qualitative methods (i.e., interviews, think-aloud protocols, and detailed analyses of video data) to obtain insights into how learners utilize dictionaries, particularly smartphone dictionary apps.

This line of research is promising because these gadgets have been commonly used by Japanese college EFL learners, but their effective use in L2 learning has remained insufficiently explored.

NOTES

* This article is a revised version of the paper presented by the authors at the FLEAT 7, 2019 in Tokyo, Japan.

1) The maximum score is 45.
2) A total of 98 students (aged 18–19) participated in the previous study. One of them was absent from the first session of the course, and his/her cloze test score was not available.
3) Among seven pocket electronic dictionary users, five of them used both electronic and smartphone dictionaries.
4) Among eighteen pocket electronic dictionary users, four of them used both electronic and smartphone dictionaries.
5) Multiple answers were allowed.
6) Others include a word navigation app, a translation app, an unknown dictionary app and so on.
7) Others include *English-Japanese Dictionary for the General Reader*, *O-LEX English-Japanese Dictionary*, a thesaurus, and an unknown dictionary.
8) The maximum score is 15.
9) No Dictionary group was not included in Koyama and Yabukoshi.

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