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著者	Koyama Toshiko, Takeuchi Osamu
journal or publication title	Language Education & Technology
volume	46
page range	131-150
year	2009-06
URL	http://hdl.handle.net/10112/4793

How effectively do good language learners use handheld electronic dictionaries: A qualitative approach

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The present study is an attempt to clarify effective use of handheld electronic dictionaries (hereafter ED) for language learning in Japanese EFL context. For this purpose, we examined EFL learners' look-up behavior with ED through the think-aloud technique, and found some strategies for efficient use of ED, particularly by analyzing look-up behavior. Five postgraduate students of a graduate school took part in the study as good language learners (hereafter GLLs). To compare their look-up behavior with that of false beginners (hereafter FBs), five college students also participated. The experiment was conducted with one participant at a time on an appointment basis. No time constraint and no limit on the number of target words to be looked up were set in the experiment. After transcribing their verbal descriptions, some strategies for effective ED use were extracted. The analysis of the qualitative data suggested the possibility that the ED's functions had provided not only GLLs but also FBs with scaffolding for EFL learning. Also, the results revealed that GLLs were good ED users.

1. Introduction

Dictionaries are vast treasure troves of information, and are generally considered to be an indispensable tool for foreign language learning (e.g., Jackson, 2002; Wingate, 2002). The types of dictionaries in Japan, however, have changed considerably during the last two decades (Tono, 2006). In fact, the number of ED users has been rapidly expanding, and some empirical studies conducted how the difference in ED and printed dictionaries (hereafter PD) has affected EFL learners' look-up behavior, retention of looked-up words, and reading comprehension of texts (e.g., Koyama & Takeuchi, 2003; 2004a; 2004b, 2005; 2007; Osaki & Nakayama, 2004; Shizuka, 2003). Koyama and Takeuchi have conducted a series of empirical studies, and the experimental data in their studies revealed that ED promoted learners' look-up frequency more than PD did. In addition, the ED could reduce the time for FL reading. In spite of these advantages, it appears that this higher look-up frequency does not necessarily guarantee better reading comprehension nor retention of looked-up words. Then, how could we lead these advantages of ED to better comprehension or retention?

In the field of second/foreign language acquisition research, a large number of empirical studies on the learning strategies of good language learners (GLLs) have been conducted. This is because their strategies might help us understand the learning process of second/foreign language (Griffiths, 2008; Takeuchi, 2003a, 2003b). Tono (2001) claimed that this approach was applicable to the study of dictionary users. He reported on a series of

empirical studies on dictionary users, and showed how research into dictionary use could contribute to the improvement of dictionary design. One of his studies focused on the characteristics of good dictionary users. On the basis of the detailed analysis by means of observations and a learner' profile questionnaire, he clarified the relationship between language proficiency and dictionary skills. Wingate (2004) reported on an introspective study of intermediate learners of German using dictionaries for reading comprehension. She asserted, based on her findings, that the participants lacked basic strategies which were crucial for successful dictionary consultation. Nyikos and Fan (2007) reported that "successful and unsuccessful look-up macro-strategies may be related to the language proficiency of students" (p. 265) by citing some related studies. Yamanishi (2005) also conducted a protocol analysis to examine individual differences in dictionary use by Japanese high school students. He found some tendencies in their look-up behavior among three different proficiency groups (advanced, intermediate, and basic writers), and divided them into seven categories. He suggested that the strategy found in his study could be used for guidance on how to use dictionaries in the English composition class for Japanese EFL learners.

All studies described above analyzed a look-up process of FL learners, including GLLs, by adopting qualitative techniques which can reveal an invisible inner process of the human mind. This is because dictionary consultation is considered to involve quite a complicated cognitive process (e.g., Nation, 2001; Tono, 2001), and thus, concurrent verbal reports have been regarded particularly as an effective method to analyze cognitive processes of learners in specific tasks (Ericsson & Simon, 1993; Hartman, 2001; Schramm, 2008). Based on these theoretical and methodological perspectives, EFL learners' look-up behavior with the ED through the think-aloud technique are examined to find some strategies for efficient use of the ED, particularly by analyzing GLLs' look-up behavior.

2. The Study

2.1 Purposes

The purposes of the present study were: 1) to analyze the GLLs' look-up behavior, and compare it with that of FBs; 2) to classify the GLLs' look-ups into categories; and 3) to find some strategies for effective ED use.

2.2 Participants

Two groups of participants who had a different educational background in EFL were selected for the study. One group (GLLs) consisted of five postgraduate students who had just completed their master's degree in EFL education and research or in SLA studies. They have already had some English teaching experience when they took part in the experiment. In addition, all of them had secured comparatively high marks in TOEIC[®] or TOEFL[®] tests, and had overseas studying experience. Their ages ranged from 25 to 40. The other group (FBs) was made up of five college students. Although they were studying English in the

college, their English proficiency level was rather low, and were considered to be false beginners (FBs) based on the first author's teaching experience. To investigate their proficiency levels in advance, the same 45-item cloze test administered was also used. Table 1 shows the results of the test given to the participants of each group. According to a non-parametric statistical analysis¹, the English proficiency level of the participants in the GLL group was significantly higher than that in FB group (Mann-Whitney $U = .000$, $p < .009$; $r = -.84$). The result of an interview held one week before the experiment revealed that each participant in the present study had his/her own ED for daily use.

Table 1. Breakdown of Participants

Group	<i>n</i>	Cloze Test Scores	
		<i>M</i>	<i>SD</i>
GLL	5	30.00	2.550
FB	5	17.80	3.271

(Full marks: 45)

2.3 Dictionary and Material Used

A CASIO XD-H9100 (a hand-held electronic dictionary) was used in the present study. This ED contains several dictionaries², and has some useful functions such as "Word history" and "Jump to multiple dictionaries."

Taking proficiency levels of both groups into account, the text used in the study was carefully selected from an article designed for college students (See Appendix 1). This text was 220 words long, and did not contain syntactically difficult sentences. Its Flesch Reading Ease was 61.3 and Flesch-Kincaid Grade Level was 7.7, both of which are regarded as comparatively easy for students with high proficiency level. However, some unfamiliar words and phrases even to the participants of the GLL group were included in the text.

2.4 Procedure

Several studies indicated that, in the introspective method of thinking-aloud, researchers need to provide participants with precise methodological report procedures beforehand to obtain accurate verbal reports (e.g., Pressley & Afflerbach, 1995; Wingate, 2004). Pressley and Afflerbach (1995) assert that, "it is essential that every effort be made to portray exactly how participating readers were informed about what they were to do, even if that is only to provide an indication of the range of re-explanations that were used by the experimenter in reaction to participant difficulties"(p.121). Thus, in the present study, careful attention was paid both to the instructions for the participants and to practices before the actual think-aloud task. For example, the think-aloud task was demonstrated by the researcher before the experiment. The participants were instructed to verbalize their thoughts while performing a task, not to describe or explain what they were doing. They were also told to perform the task

in Japanese, since the experiment should be conducted in their L1. After the full explanation of the think-aloud task was made, they were asked to practice thinking-aloud during their daily English study at home until the experiment.

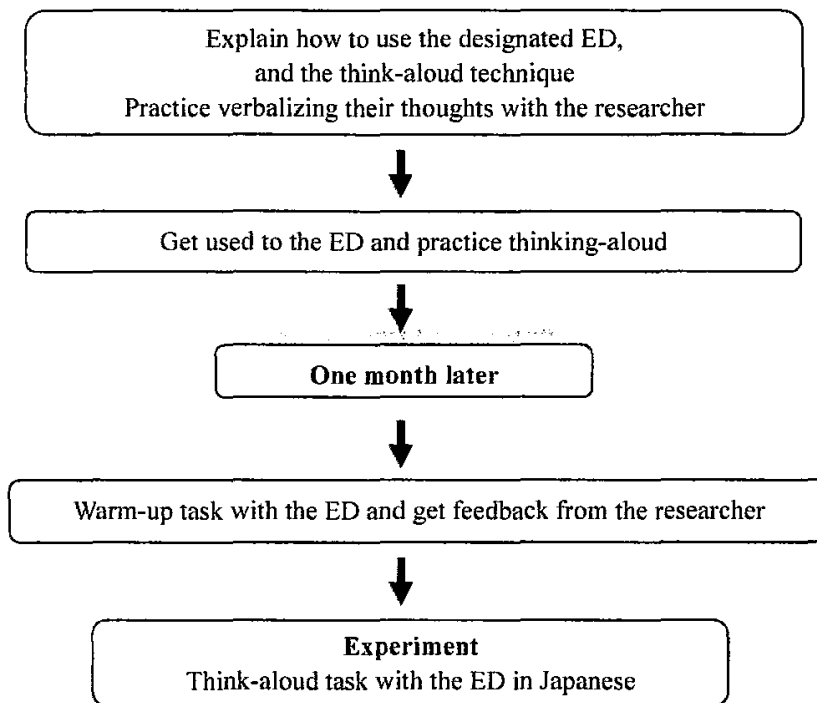


Figure 1. Procedure of the Experiment

The procedure of the experiment is summarized in Figure 1. First, approximately one month before the experiment, all the participants were provided with the designated ED with a user's manual, so that they could sufficiently get used to using them. The experiment was conducted with one participant at a time on an appointment basis. Before going on the actual task, each participant was given a part of a short essay, and was assigned a warm-up task with the designated ED. At that time, they received feedback from the first author. Each participant was, then, given the text and performed the think-aloud task with the ED. Neither a time constraint nor limit on the number of target words to be looked up was set during this session. Since the participants were just told to verbalize their thoughts while reading the text, none of them were forced to consult the ED. A decision of whether to use it or not, therefore, was completely up to each participant.

All the verbal descriptions of each participant were recorded on a portable MD recorder with a cardioid microphone during the session. A DV camera with built-in microphone was also set up near the participants as a visual back-up (See Figure 2).

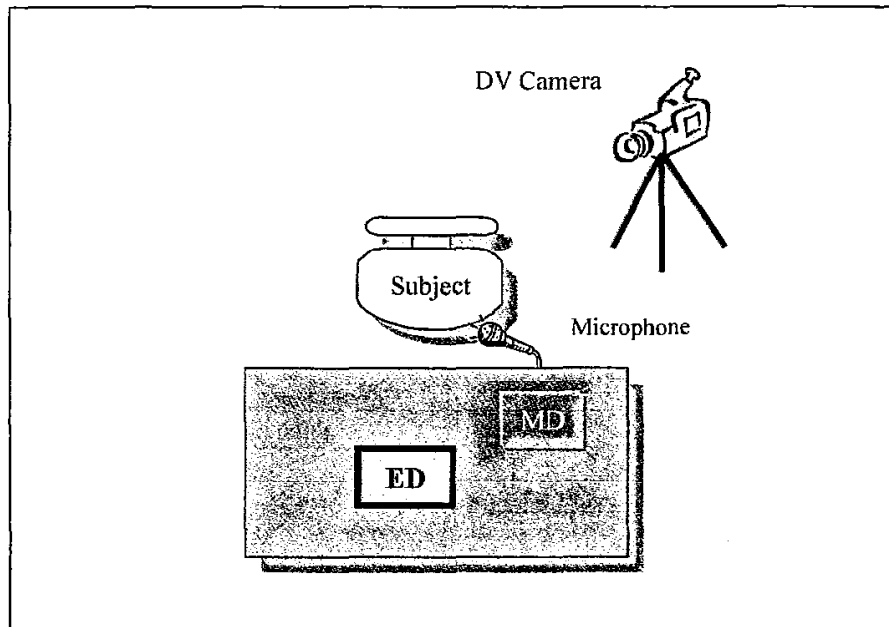


Figure 2. Schematic Depiction of the Experiment

The verbal descriptions of their cognitive processes while looking up the ED were carefully transcribed. The visual back-up was also checked and used depending on the situation. First, all the transcriptions of the participants were coded into each segment. This procedure of the segmentation was introduced based on the model of verbalization by Ericsson and Simon (1993). They added the following assumptions of their verbalization model to the analysis made by McNeill (1975): 1) units of articulation will correspond to integrated cognitive structures; and 2) pauses and hesitations will be good predictors of shifts in processing of cognitive structures. When a segment was fragmentary such as “Well” and “Oh...,” the segment was attached to another segment in order to remove ambiguity (See an example in Figure 3).

After the completion of segmentation, some of the segments were jointly encoded into each protocol-unit on the basis of the participants’ behavior: look-up behavior (Look-up) and the other. “Look-up” was defined here as a sequence of consulting behavior. It started when a participant noticed a word unknown or unfamiliar to him/her in one sentence, and ended when the participant comprehended the target sentence after consulting the ED. One protocol-unit of “Look-up”, in other words, consists of several segments concerning look-up behavior of the participants. “Others” indicates the segments which did not include the verbal descriptions related to the participants’ look-up behavior.

<GLL-A-12>	[Pause]
1. Both parents have 18-inch “scars” that run from their chest to their back...	[Reading aloud a sentence in the text.]
2. Oh...no...	
3. “Scars”...this means that her parents have “scars” from their chest to their back...	[Thinking while reading]
4. ...18-inch “scars” are left...	
5. Well...	
6. “Scar”...let me confirm its meaning in <i>GENIUS</i> (the name of the dictionary)...	[Looking up “scar” in the dictionary <i>GENIUS</i>]
7. “KIZU”.. Yes, that’s what I thought....	[Watching the screen of the ED]
8. Then...	[Continue to read the next sentence]

Encoding into Protocol-unit

<GLL-A-12>
12-1. Both parents have 18-inch “scars” that run from their chest to their back...Oh...no...
12-2. “Scars”...this means that her parents have “scars” from their chest to their back...
12-3. ...18-inch “scars” are left...
12-4. Well...“Scar”...let me confirm its meaning in <i>GENIUS</i> ...
12-5. “KIZU”...Yes, that’s what I thought.

(Translation ours)

Figure 3. An Example of Encoding Process

Figure 3 shows a process of encoding a protocol-unit which is a part of the verbal report of Participant A in the GLL group (GLL-A-12). This five-segment protocol-unit indicates that Participant A was looking up a word (“scar”) in the ED while thinking of its meaning relevant to the context. In encoding, one fourth of the whole segments were randomly selected and checked by another researcher to confirm consistency. The inter-coder agreement was approximately 80%, which is considered to be sufficiently high.

The encoded protocol-units concerning look-up behavior in the GLL group were then classified into some groups according to the KJ method³ (Kawakita, 1967, 1970, 1986) to find the strategies for effective dictionary consultation. Here, again, another researcher confirmed the consistency of classification. The inter-coder agreement was 86%.⁴

2. 5 Results

2. 5. 1 Analysis of Segments and Protocol-units

Tables 2 and 3 report the number of the segments and the protocol-units of the participants in each group. For instance, the number of the protocol-units related to look-up

behavior of Participant A in the GLL group was seven, which was composed of 59 segments, while Participant D in the FB group produced 30 protocol-units made up of 98 segments. “Segments / Protocol-units” in each table indicates the ratio of the segments to the protocol-units.

Table 2. Number of Look-ups of Each Participant in GLL Group

Participant	Segments		Protocol-units		Segments/Protocol-units (Look-ups)
	Look-ups	Others	Look-ups	Others	
GLL-A	59	20	7	8	8.4
GLL-B	157	32	17	13	9.2
GLL-C	50	21	8	13	6.3
GLL-D	31	6	5	5	6.2
GLL-E	199	43	27	9	7.4
<i>Average</i>	99.2	24.4	12.8	9.6	7.5

Table 3. Number of Look-ups of Each Participant in FB Group

Participant	Segments		Protocol-units		Segments/Protocol-units (Look-ups)
	Look-ups	Others	Look-ups	Others	
FB-A	121	8	34	4	3.6
FB-B	172	19	50	17	3.4
FB-C	66	1	24	1	2.8
FB-D	98	5	30	2	3.3
FB-E	113	8	36	3	3.1
<i>Average</i>	114.0	6.2	34.8	5.4	3.2

Compared with the number of protocol-units related to look-up behavior in FB group, those in GLL group are considerably small (Mann-Whitney $U = 1.000$, $p < .016$). On the other hand, the number of segments per unit in the GLL group is approximately twice as large as those of the FB group. This means that the participants in the GLL group spent more time to look up and comprehend the target words. This difference can be seen in Excerpts 1 and 2.

Excerpt 1 <FB-B-28>

- 28-1. "...using lobes..." I don't know this meaning, too. Let me see... l-o-b-e-s...Whoops! No headword is in *READERS* (the name of the dictionary)...
- 28-2. Oh, is 's' not necessary? Let me delete 's'...
- 28-3. Here comes. "*MIMITABU* (ear lobe)" or "*KUKIBUKURO* (air bag)"...but, there aren't any idioms and phrases.
- 28-4. Anyway, they use "lobe" of the donor....

(Translation ours)

Excerpt 2 <GLL-E-22>

- 22-1. OK. What do The Plums use? "...using lobes of the lung from living donors"
- 22-2. ...Let me see...oh, three lobes came out as entries in *GENIUS* (the name of the dictionary).
- 22-3. The first "lobe" means "*MIMITABU* (ear lobe)"...Oh, give me a break!
- 22-4. The second "lobe" is "*SHIKAKU HOGEN* (an uneducated spelling)... what's this? This is not a suitable meaning...
- 22-5. The third one is "*TAIKUTSUNAYATU* (bore)"...mmm, it's difficult...
- 22-6. But, wait a minute... I'm checking the meaning of "lobes of the lung". The lung doesn't have any ear lobes, right?
- 22-7. Then, here is Japanese "*HAIYOU*" in the first entry of "lobe", which means a dissection term.
- 22-8. Mmm...this is a technical term, isn't it? A part of the lung?
- 22-9. All right. They use "*HAIYOU*" of their lungs. I don't know "*HAIYOU*" itself well, but anyway, they use them.

(Translation ours)

In Excerpts 1 and 2, each participant in the GLL and the FB groups was looking up "lobe" in the dictionary. Some L1 equivalents to "lobe" appeared in the dictionary *GENIUS*, and "*HAIYOU*", which was the appropriate L1 equivalent to the context, seemed to be an unfamiliar word to most of Japanese learners. In spite of this unfamiliarity, all the participants in the GLL group, including Participant E in this example, made a successful consultation. Based on these findings, we can conjecture that GLLs might spend time in deriving information from the context in which the target words are used.

In the case of the FB group, the number of look-ups in the units was not identical with that of their actual look-ups. As shown in Excerpt 3 below, Participant C in the FB group looked up two words in one sentence in the dictionary without pausing. Her behavior is deemed to result from a lack of vocabulary. It should be noted here that this participant just rushed and consulted a dictionary when she encountered unknown words in the text, and did not deeply think of the word meaning relevant to the context. In short, she repeated to search

an appropriate L1 equivalent that could replace each unknown or unfamiliar L2 word in the reading text. This tendency was observed in almost all the protocol-units concerning look-ups of the FB group, and it has been also noted in other related studies (e.g., Neubach & Cohen, 1988; Tono, 2001; Wingate, 2004).

Excerpt 3 <FB-C-3>

3-1. Although... “KEREDOMO”...

3-2. “their effort”... dictionary... “DORYOKU”

3-3. “failed”... dictionary... “SHIPPAISURU”... Oh, “failed”, then, “SHIPPAISITA”...

(Translation ours)

In comparison with the GLL group, the successful consultations by the participants in the FB group were relatively low (See Tables 4 and 5). This result was in accordance with the findings in Koyama and Takeuchi (2005), which claimed that learners’ proficiency was somewhat related to the use of retrieval strategies. As shown in Table 1-5, however, the rate of FBs’ successful look-ups reached more than 80%, despite the fact that the appropriate L1 equivalent did not necessarily appear at the beginning of the entry in the present study. Besides, their verbal data reveal that none of the participants in the FB group gave up their look-ups halfway through. These results show that the participants in the FB group, regardless of their low EFL proficiency, could usually successfully locate the L1 equivalents in the dictionary in the present study.

Table 4. Rate of Successful Look-ups in GLL Group

Participant	Look-ups	Successful Look-ups	Success Rates (%)
GLL-A	7	7	100
GLL-B	17	17	100
GLL-C	8	8	100
GLL-D	5	5	100
GLL-E	27	27	100

Table 5. Rate of Successful Look-ups in FB Group

Participant	Look-ups	Successful Look-ups	Success Rates (%)
FB-A	34	28	82
FB-B	50	42	84
FB-C	24	21	88
FB-D	30	25	83
FB-E	36	31	86

This finding seems to be inconsistent with that in Wingate (2004), which reported more than half of the whole consultations were failed, unless appropriate L1 equivalents were listed first in the entry. Also, according to Scholfield (1982), many dictionary users generally give up too soon if they cannot find L1 equivalents at the beginning of the entry. This is considered to be a noticeable tendency among low proficiency learners, as frequent consultations to find appropriate L1 equivalents are a troublesome work for them. One possible explanation for the discrepancy between the present study and that of Wingate is the difference of the dictionary type: the dictionary used in the present study was an ED; and that in Wingate was a traditional PD. As has described in Koyama and Takeuchi (2007), the superior search functions (e.g., *Real-time search*, *Jump to multiple dictionaries*) of an ED might enhance the participants' look-up frequency even in the FB group, and, as the result, they could find the appropriate L1 equivalents without giving up. Therefore, it may be presumed that the use of an ED in reading comprehension might be somewhat advantageous even for learners whose English proficiency is relatively low.

2. 5. 2 Analysis of Retrieval Strategies of GLLs

Table 6 summarizes major strategies used by the participants in the GLL group while looking up the dictionary.⁵ Figures in the table indicate the number of their protocol-units. When a unit contained more than two retrieval strategies, it was counted separately in the table.

Table 6. Retrieval Strategies for ED use in the GLL Group

Strategies	Protocol-units
<i><Strategies in standard skills></i>	
Get information from the context where the word occurred.	64
<i>Guessing meanings from the context / Confirming meanings</i>	31
Find the dictionary entry.	64
<i>Checking pronunciation / Paying attention to pronunciations</i>	9
Choose the right sub-entry.	20
Relate the meaning to the context and decide if it fits.	64
<i>Checking examples of usage</i>	15
<i><Strategies in specific skills for ED></i>	
<i>Using "Example search" or "Idiom search" to find further information</i>	3
<i>Using "Word history" or "Jump to multiple dictionaries"</i>	4
<i>Looking up in more than two dictionaries</i>	3

An example of categorizing process of GLLs' retrieval strategies appears in Excerpt 4. Participant A in Excerpt 4 was guessing the meaning of "bronchitis" from the context while reading, and estimated that it was a name of the disease. Therefore, he used "*Guessing*

meanings from the context” strategy at the moment after getting information from the context. He, then, looked up the word and found the dictionary entry. At that time, he repeated its pronunciation four times and confirmed the stressed syllable. This indicates the use of “*Paying attention to pronunciations*” strategy. In this way, most of the protocol-units in the GLL group contained more than two strategies as shown in Excerpt 4, and it means that GLLs in the present study concurrently used several strategies.

As shown in Table 6, the “*Guessing meanings from the context*” strategy before actual look-ups was obviously used the most among the participants in GLL group. Note the strategies in bold and italic letters in the table. These retrieval strategies which were categorized in each protocol-unit based on the KJ method (Kawakita, 1967, 1970, 1986) also corresponded to the GLL strategies reported in Takeuchi (2003a).

Excerpt 4 <GLL-A-4>

- 4-1. ...and “Last New Year’s Eve, Alyssa took to bed with symptoms that suggested bronchitis...”
- 4-2. Ah? Is this a name of the disease? ...yes, I’m sure.
<Guessing meanings from the context strategy>
- 4-3. This is a little difficult term, isn’t it?
- 4-4. Well, Alyssa must have died from a disease...
- 4-5. All right, *GENIUS!* ...**bronchitis**... pronunciation... **bronchitis**...
- 4-6. It’s complicated! ...**bronchitis**... The accent is on ‘i’.
- 4-7. **bronchitis** *<Paying attention to pronunciations strategy>*
- 4-8. “*KIKANSHIENTO SHINDAN SARETE* (So, she was diagnosed with bronchitis)...”
- 4-9. “*DE...BYOINNI ITTA* (...and was sent to the hospital)”

(Translation ours)

It is interesting that the conventional strategies in Scholfield (1982) such as “Find the dictionary entry” or “Choose the right sub-entry” were confirmed in the back-up DVCs, but could not be distinctively found in the protocol-units of GLLs (See the strategies not in bold letters of Table 6). All the GLLs seemed to use these conventional strategies for look-ups, and to decide the words to be looked up in their reading processes (See Excerpt 5). Their behavior is in contrast to that of FBs which can be seen in Excerpts 1 in 2.5.1. FBs in the present study merely scanned the dictionary entry to replace the unknown L2 word in the text, and never guessed the meanings of the target words from the context.⁶

Excerpt 5 <GLL-C-15>

- 15-1. "Less than four weeks later,"
15-2. Well..."YONSYUKANMO TATANAIUCHINI"
15-3. "Cindy underwent the procedure"... As "underwent" is the past form of "undergo"...then, *SONO TETSUZUKIWO FUNDA?* (Did she go through the procedure?)
15-4. Then I'm going to check the meaning of this "underwent" by looking up "undergo" in the dictionary.
15-5. Well, "*KEIKENSURU* (experience)?"... "*KOUMURU* (undergo)?"
15-6. ..."*SONO procedure WO FUMU?*"
15-7. ..."*TAERU* (endure)?"
15-8. Maybe, she experienced the same thing...because another one was failed.

(Translation ours)

According to Koyama (2004), this "*Guessing meanings from the context*" strategy before actual dictionary consultations is regarded as effective for better retention of words (e.g., Fraser, 1999), and it furthermore promotes the incidental vocabulary learning (e.g., Hulstijn, Hollander, & Greidanus, 1996). Since all the participants in the GLL group studied FL education or SLA, they should have known the theoretical background behind the strategy⁷, and they thus could apply it to the ED use.

Excerpt 6 <GLL-E-11>

- 11-1. ...and "*ARISAHA* (Alyssa)..." "*KYONENENO OOMISOKA* (Last New Year's Eve)..."...took to bed... "*BYOSYONI TSUITANYA* (She was sick in bed)."
11-2. All right. Then, what was her condition?
11-3. OK! I'm going to look up this "bronchitis" with my favorite *GENIUS*.
11-4. b-r-o-n-c-h-i-t-i-s...Search!!
11-5. **bronchitis...** what's this? ...**bronchitis...** If I don't read aloud its pronunciation correctly, I can't remember it...
11-6. **bronchitis... bronchitis...** "*KIKANSHIEN*"... **bronchitis...**
11-7. OK. She had bronchitis and stayed in bed. This is a technical term, isn't it?
11-8. "*KIKANSHIEN*"...Ms. Yamada knows this kind of medical words well, doesn't she?
11-9. But, it doesn't matter... **bronchitis...**OK, next!

(Translation ours)

It is important to note that most of the participants in the GLL group used "*Paying attention to pronunciations*" strategy when they found unknown or unfamiliar dictionary entries. The participants in the GLL group had a high level of interest in pronunciation.

Besides, they not only vocalized those words, but also repeated them until they themselves felt satisfied. This tendency, which was not observed in the FB group, is shown in Excerpts 6 and 7.

Excerpt 7 <GLL-B-9>

- 9-1. All right. Then, next... “Last New Year’s Eve...” “*IBUNI*...”
- 9-2. “Alyssa took to bed with symptoms that suggested...” “?... I don’t know this word.
- 9-3. This “bron”... “bron”...well, I’d like to pay attention to its pronunciation...
- 9-4. Well, “bronchi” is the plural form of “bronchus”...OK.
- 9-5. **bronchitis... bronchitis... bronchitis... bronchitis...**
- 9-6. Mmm... “*KIKANSHIEN*” is its equivalent.

(Translation ours)

Since this behavior found in Excerpts 6 and 7 require time to comprehend the text, it can be regarded as unnecessary if they try to make their look-ups more efficient. According to several research reports in the realm of cognitive psychology (e.g., Baddeley, 1990; 2003), however, phonological information, as well as repetition, is deemed to produce a beneficial effect upon retention of words in SL/FL learning. Also, this behavior can be recognized as successful learners’ strategies (Takeuchi, 2003a). The GLLs holding masters’ degree in FL education or SLA studies might have known the effect of vocalizing and rehearsing on vocabulary acquisition⁸. They, therefore, could apply this strategy to their look-up behavior.

Excerpt 8 <FB-B-5>

- 5-1. “the limits of...” “the limits of...” This seems to be an idiom. Let me see... ‘limit’ means *KYOKUGEN*, right?
- 5-2. ...How about an idiom? ...Oh...not here..., then, going back...
- 5-3. Let me check a phrase. ...mmm, nothing...
- 5-4. Well, this word has ‘s’... What should I do?
- 5-5. All right. Let me see an example...Oh, finally, I found it! ...“the limits of...” means *KYOKUDONO GENKAI NI TASSURU*.

(Translation ours)

It should be emphasized that GLLs in the present study frequently use “*Checking examples of usage*” strategy. This tendency can be seen obviously in the number of the protocol-units in Table 1-6. It is also interesting that they used this strategy not in the process of relating the meaning to the context and decided if it fitted, but in the process of searching for further information of the target words. In fact, some of the protocol-units in the FBs group contain “*Checking examples of usage*” strategy in the process of look-up behavior. Unlike GLLs, however, FBs just used it to obtain necessary information of the target word

(See the example in Excerpt 8).

As has been described in Koyama and Takeuchi (2004a), since an ED has “hierarchical nature of data display”, EFL learners have to scan a different screen of the ED to see an example of usage, and additionally take time to read the examples. In spite of these inconveniences, GLLs were very conscious of how the target words could be used in different contexts, and frequently checked the examples. Two distinctive examples are shown in the following excerpts (Excerpts 9 & 10).

In Excerpt 9, Participant B did not know a L1 equivalent for “pneumonia”, so she looked it up in the dictionary. Before finding the entry, she guessed its meaning somewhat retrospectively. She vocalized it several times, and noticed ‘p’ was silent. Lastly, she confirmed examples of “pneumonia” in the dictionary. Consequently, she used three types of strategies: “*Guessing meanings from the context*”, “*Paying attention to pronunciations*”, and “*Checking examples of usage*” in the process of consulting. On the other hand, Participant E in Excerpt 10 attempted to confirm how “within” used in other contexts, though he has already known its rough meaning. He therefore used only the “*Checking examples of usage*” strategy. He not only scanned several examples of “within” but also found some usages of the word in the different context. What needs to be emphasized about his behavior is that he made the most of some functions equipped with ED such as “Idiom search” and “Example search” in the look-up process.

Excerpt 9 <GLL-B-12>

- 12-1. “Two days later, Alyssa was at her doctor’s office with...?” ...Oh, I don’t know this!
- 12-2. ...with what? ...with...pneu...monia...
- 12-3. I may know this word...I’ve heard of it somewhere...
- 12-4. Oh... “*HAIEN* (pneumonia)”!
- 12-5. This word must be in a glossary for TOEFL...
- 12-6. **pneumonia... pneumonia... pneumonia...**
- 12-7. ‘p’ is not pronounced.
- 12-8. Well...let me see an example of usage...
- 12-9. “He has acute...”...oh, I see.
- 12-10. Let me jot down its equivalent... “*HAIEN* (pneumonia)”

(Translation ours)

There also exists a similarity between the behavior of Participants B and E. Participant B obviously checked the examples not for comprehending the text, but for eliciting further information on the target words from the dictionary. Participant E confirmed the “known” word in order to find its usage. In either case, both participants were able to learn how to use the words in other contexts and repeatedly see it in different contexts as a result of their behavior. This repeated exposure to the target word with related information is considered to

be one of the most important factors in the enrichment of vocabulary in FL learning (Hulstijn et. al., 1996; Laufer & Hulstijn, 2001). Nation (2001, p.219) also states that most vocabulary learning requires repeated attention to the vocabulary item based on Baddeley's theoretical account in cognitive psychology (1990, 2003). GLLs in the present study, therefore, seemed to maximize opportunities to learn vocabulary through their look-up behavior.

Excerpt 10 <GLL-E-16>

- 16-1. ...Well, "Within days" ...I'm going to confirm the use of this word, too.
- 16-2. Of course, I know a rough meaning, though...Let me check it in *GENIUS*.
- 16-3. 'within'... 'within'... well...information here is not satisfactory to me...then, let me use idiom search...
- 16-4. 'within & days...'...whoops, no hits.
- 16-5. All right! How about an example search? ...Oh, here comes!
- 16-6. 'within seven days' means "*NANUKA INAIDE*"
- 16-7. That's what I thought. 'within' means "*INAIDE*"...Then, in case of 'within two days' means "*FUTSUKA INAIDE*"
- 16-8. OK... "*NANNICHIKA INAIDE (within days)*"...

(Translation ours)

Another important point to be noted here is that some strategies in specific retrieval strategies for an ED were found in GLLs' protocol-units such as "*Using word history or Jump to multiple dictionaries*", "*Using example search or idiom search to find further information*", and "*Looking up in more than two dictionaries*". It is interesting that these strategies were also found in the FBs' verbal data. They utilized these specific strategies for the ED to confirm the word meanings which they had looked up before. Their behavior might result from a lack of acquired vocabulary (See Excerpt 11).

As was mentioned, Excerpt 10 contains "*Using example search or idiom search to find further information*" strategy. Another example was shown in Excerpt 12. Participant A was interested in the usage of "from", so that he searched an expression of "turn from" in the *GENIUS Dictionary* by the use of "*Example search*". Since he was not be satisfied with what he had found, he checked its definition in another dictionary, *LONGMAN*, by using "*Jump to multiple dictionaries*". Consequently, he used three kinds of specific strategies for the ED use, i.e., "*Using word history or Jump to multiple dictionaries*", "*Using example search or idiom search to find further information*", and "*Looking up in more than two dictionaries*".

Excerpt 11 <FB-E-33>

- 33-1. ...OK. Let me see the history...
- 33-2. 'suffer' means "*KURUSHINDA*", doesn't it?

(Translation ours)

Excerpt 12 <GLL-A-8>

- 8-1. ...Well, although she was in the doctor's office... "Within days, her skin turned blue..."
- 8-2. "*SANSO NO KETSUJYO NIYORI AOZAMETA*" I can understand 'turn blue', but I'm just wondering whether 'from' indicates *GENIN* (a cause) or not...
- 8-3. All right. Let me check an idiom 'turn A from B'. Example search in *GENIUS*...
- 8-4. Mmm...'turn from...' '...turn from O'... No, this information is not what I want.
- 8-5. Then, how about *LONGMAN*? '...from' '...from'
- 8-6. We'd better look up the use of preposition in an English-English dictionary...
- 8-7. The first explanation is 'where sb/sth starts...starting at a particular place...' Well, it's a sort of prototype...
- 8-8. What about the next...?All right...go down...
- 8-9. Oh, 'origin'...that's what I thought!
- 8-10. "'turn blue' *NI NATTA* 'origin' *GA* 'lack of oxygen' (the cause of turning blue was lack of oxygen)"

(Translation ours)

According to Takeuchi (2003b), successful language learners have a voracious appetite for knowledge of the language and maximize opportunities to use the language in general. It would be reasonable to think that GLLs in the present study had also their strong motives for further information of the language. At the same time, it is an indisputable fact that these various functions pertaining to the ED made their look-up behavior possible. Based on these findings, we can claim that superior functions of an ED provided GLLs with scaffolding⁹ for learning.

3. Conclusion and Implications

The qualitative data derived from the study described above reveal the following. First, the results of the analysis of segments and protocol-units indicated that GLLs spent a lot of time to derive information from the context in which the target words were used. This means GLLs never rush, and always carefully think of the word meaning relevant to the context. Their behavior contrasts clearly with those of the FBs, who repeatedly search for L1 equivalents that could simply replace the unknown L2 words in the reading text. This finding also corresponded with GLLs' strategies found in Takeuchi (2003a). Another important finding is that, unlike the previous studies using PD (e.g., Scolfield, 1982; Wingate, 2004), the rate of FBs' successful consultation was relatively high in the present study. This indicates that the difference of the dictionary type might affect the result. According to Koyama and Takeuchi (2007), ED seems to encourage the learners' look-up behavior more than PD does. Based on this finding, ED's search functions, such as "*Real-time search*" or "*Jump to multiple dictionaries*", might enhance FBs' look-ups and lead them to successful

consultations. We thus can conjecture that the use of ED may be advantageous to low English proficiency learners in reading comprehension. In short, it's perfectly possible that the ED's functions will provide not only GLLs but also FB with scaffolding for EFL learning. Third, the analysis of retrieval strategies indicates that GLLs were also successful ED users. They never looked up words thoughtlessly. Before starting actual look-ups, they obtained full information from the context where the word occurred and were "*guessing meanings from the context*". In the look-up process, they were "*paying attention to pronunciation*" of the target words, and were also "*checking examples of usage*" to obtain further information of the target words. These strategies GLLs used in the present study are supported by both empirical and theoretical accounts for effective FL learning (Takeuchi, 2003a).

What needs to be emphasized is that GLLs skillfully took advantage of the superior search functions of the ED, which helped overcome the arduous task (Koyama & Takeuchi, 2007), and induce their "*mental effort*" (Hulstijn, 1992). To put it briefly, they maximized opportunities to learn vocabulary even when consulting ED. EFL instructors, therefore, should have a true appreciation for the usefulness of ED, and need to encourage their students to make the maximum use of the various functions available on ED, which are useful for better learning and help learners of different proficiency levels.

*This article is a revised version of the paper presented by the authors at 4th Asia TEFL International Conference in Fukuoka, Japan.

Notes

1. The Mann-Whitney *U*-test is applicable to a small number of participants, i.e. five participants and more (Siegel & Castellan, 1988).
2. The ED used in this chapter contains four large English/Japanese dictionaries including *The Kenkyusha Dictionary of English Collocations (COLLOCATIONS)*, *Reader's English/Japanese Dictionary (READERS)*, *Readers Plus, Unabridged Genius English/Japanese Dictionary (GENIUS)*, as well as English/English dictionaries, *Longman Advanced American Dictionary (LONGMAN)*.
3. The KJ method is widely used to classify human behavior in specific task into some categories.
4. The entire protocol-units were examined to confirm the consistency.
5. "Reading Aloud" was not included in the strategies in the present study, since it is not directly related to reference skills. However, all the participants in GLL group read aloud every sentence in the text, while none of the participants in FB group read it.
6. None of the participants in the FB group used "*Guessing meanings from the context*" strategy.
7. "*Guessing meanings from the context*" strategy is widely recognized as an effective method to acquire new vocabulary in SL/FL environments (e.g., Clarke & Nation, 1980; Schmit, 1997), while it is regarded as inapplicable to learners with low proficiency level (Knight, 1994). More studies, therefore, should be conducted on how to apply this strategy appropriately to learners with different proficiency levels.
8. Several models of an ED have already been equipped with a speaking function of phonetic symbols, and have provided learners who do not know how to read dictionary entries with correct pronunciation.
9. van Lier (1996) indicates that "scaffolding" is support or a help to learners who attempt to tackle a more difficult task.

Acknowledgements

This research is partially supported by the Grant-in-Aid for Scientific Research (C), No. 20520543, awarded to the first author of this article in the fiscal year of 2008 - 2010. The authors would like to express their gratitude to Professor Thomas Robb of Kyoto Sangyo University for his valuable comments on the earlier version of this article. The authors also thank CASIO Computer Co., Ltd. for its support on the experiment.

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Appendix 1

これから、お渡しする英文を指定した辞書を自由に使って読み、内容を理解するようにしてください。ただし、英文読み始めから終わりまでの間、自分が頭の中に浮かんだことのすべてを声に出してください。特に辞書を引いているとき（キー入力をしているときや目的の単語がなかなか見つけれないときなども含めて）頭の中であれこれ考えていることを、すべて発話してください。 [Translation: Read the text below with the designated dictionary. Do not fail to verbalize your thoughts while reading the text. Especially verbalize all kinds of thoughts when searching words with the dictionary.]

Two Parents Offer Their Daughter the Breath of Life — to No Avail

Time

Did Cindy and Roger Plum of Coon Rapids, Minnesota, overstep the limits of parental sacrifice to try to save their 9-year-old daughter Alyssa? Although their efforts failed, both parents say they would do it again—and again.

Last New Year's Eve, Alyssa took to bed with symptoms that suggested bronchitis. Three months later, she was rushed to a hospital emergency room with a high fever. Doctors suspected a virus, but sent her home. Two days later, Alyssa was at her doctor's office with pneumonia. Within days, her skin turned blue from lack of oxygen. By mid-April she was on a list for lung transplant.

The Plums, who had read about transplant surgeries using lobes of the lung from living donors, decided to volunteer. Alyssa successfully received a piece of Roger's lung. Then her other lung failed. Less than four weeks later, Cindy underwent the procedure. This time Alyssa died of heart failure. Both parents have 18-inch scars that run from their chest to their back. Cindy's sleep is still interrupted by pain. Roger suffers from muscle weakness. Even though the couple have a son, Travis, six, who risked losing a parent, they never had doubts about their actions. "If I didn't give Alyssa a chance at life," says Cindy, "I didn't know if I could live with myself."

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