The Reading Matrix: An International Online Journal
Volume 16, Number 2, September 2016

How do Learners of Japanese Read Texts When They Use Online Pop-up Dictionaries?

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ABSTRACT

There is a lack of research which examines the effects of online pop-up dictionaries in the context of less commonly taught languages including Japanese as a second and foreign language (JSL and JFL), despite the growing popularity of such tools. This qualitatively -oriented study is an attempt to fill this void. The study investigates differences in how learners of Japanese at different proficiency levels read a target text when using an online pop-up dictionary. Participants' think-aloud protocols were analysed to investigate their reading processes. A reading comprehension test examined their text understanding. A previous vocabulary knowledge test, a form recognition test, and a vocabulary translation test assessed participants' vocabulary learning. A delayed vocabulary translation test examined how well the participants retained newly learned words. The overall findings demonstrate that learners of Japanese need to reach a certain proficiency level before they can strategically conduct online reading using pop-up dictionaries in order to deeply interact with their target texts. Regarding vocabulary learning, the results of the form recognition test as well as the immediate and delayed vocabulary translation tests suggest that this type of reading as a method of vocabulary learning can be beneficial.

INTRODUCTION

Reading in a second/foreign language (L2) can be demanding because learners often do not have automatic word recognition and syntactic parsing skills as efficient as those of L1 readers. L2 readers have a much smaller vocabulary than L1 readers. Bernhardt's (2005) compensatory model demonstrated that L2 language knowledge accounts for 30% of the variance of L2 reading proficiency. In L2 language knowledge, an important portion is vocabulary. This portion is even bigger in the variance of L2 Japanese reading proficiency. Koda (1989) claimed that vocabulary knowledge accounts for 55% of the variance in L2 Japanese reading proficiency, while Komori, Mikuni and Kondoh (2004) reported 47% and Noguchi (2008), 40%.

Language teachers, therefore, take various approaches to rendering L2 texts comprehensible for their learners. One approach is to include glosses. Various authors have contended that the context-free word knowledge provided by marginal glosses helps to increase reading comprehension (e.g., Barnett 1986; Davis 1989; Jacobs, Dufon, & Fong, 1994)

"The WWW has brought the world to the fingertips of each learner" (Brandl 2002, p. 88) along with the advances of information technology. It has also turned the eyes of language teachers and researchers toward a new type of glosses: online annotations.

Findings about the benefits of online annotations have been inconsistent. Roby (1999) reported that there was no difference in reading comprehension between traditional and computer dictionaries, although computer dictionaries reduced participants' reading time compared to reading time supported by traditional dictionaries. Ariew and Ercetin (2004) demonstrated that intermediate learners' reading comprehension was negatively influenced by pop-up annotations. The negative influence of multi-feature annotations was also reported by Sakar and Ercetin (2005). In relation to the relative benefits of differing types of online annotation, while Chun and Plass (1996) reported that words annotated both visually and verbally were remembered better, Davis and Lyman-Hager's (1997) study showed that participants preferred definitional glosses, and that English (L1) definitions of words accounted for 85% of the information the participants accessed. Their findings did not correspond with those of Sakar and Ercetin (2005) whose participants preferred visual annotations significantly more than the other types of annotations. Lomicka (1998) confirmed that multi-feature glossing was more effective than limited-glossing (i.e., L1 translation and L2 definitions) or no glossing for reading comprehension. Laufer and Hill (2000) and Chun and Payne (2004) found weak correlations between word searches and the rate of target word learning. These two studies' findings were supported by Yoshii's (2006) study, which examined vocabulary learning during online reading.

In terms of vocabulary learning facilitated by glossing, participants of a study by Hulstijn, Hollander and Greidanus (1996) demonstrated learning of 25% of the words for which they had looked at the glosses, which is a higher rate than Waring and Takaki (2003) found for their participants' vocabulary learning from one -hour of pleasure reading.

Although numerous studies have been conducted in the context of more commonly taught languages, many fewer studies have been conducted to examine the benefits of online annotations for learners of Japanese. Mikuni, Taniguchi, Iwashita, Kawasaki, Choo and Iwamoto (2011) found the use of online pop-up dictionaries to be one of the most popular internet learning activities among learners of Japanese. Japanese online pop-up dictionaries include Popjisyo (http://www.popjisyo.com/WebHint/Portal_e.aspx), and rikaichan (https://addons.mozilla.org/en-US/firefox/addon/rikaichan/). Reading with the use of these online resources tends to be treated as a self-study activity, and thus not to be carefully monitored by teachers. However, it is important for teachers to ensure that learners are competent with such reading activities, which can contribute to ongoing learning after learners end their formal education. As Hegelheimer and Tower (2004) suggested, it is a teacher's role to ensure that learners develop L2 reading skills and L2 reading motivation, and one possible way that teachers can do this is to facilitate their students' ability to read authentic texts with the help of online pop-up dictionaries.

This study, therefore, attempts to examine how learners of Japanese process authentic Japanese texts, while using online pop-up dictionaries. It investigates whether or not learners read authentic texts more easily when L1 definitions are instantly available in the form of online pop-ups. It also investigates whether or not learners actually learn new vocabulary through this reading activity.

METHODOLOGY

Approach taken in this study

The study takes a qualitative approach with a small sample size in order to delve into the main research question: How does each participant process a given Japanese text when using an online pop-up dictionary? The study takes this approach in response to calls for more qualitative research on this topic (Kern, 2006; Yoshii, 2006).

Participants

Eleven university students of Japanese participated in this study. Their levels were from intermediate to super-advanced. The average length of their Japanese study was 7.5 years. No participant had L1 character-reading experience (e.g., an L1 Chinese background). Table 1 below shows the details of the participants and the results of the conducted tasks.

Instrument and Procedure

Previous vocabulary knowledge test – The participants first took a previous vocabulary knowledge test. This test simply asked the participants to circle words which they did not know or they did not think that they knew. In order to stop the participants from remembering target words prior to reading, semantically- and syntactically- similar distractors were included. There were 58 target words and 25 distractors.

Think-aloud procedure – The participants first practiced the think-aloud procedure, using an authentic Japanese text with the help of an online pop-up dictionary, *Popjisyo*. They then conducted the think-aloud procedure with a different target text, using the same pop-up dictionary. The target text was an expository text which described tips to make teeth white. It was chosen because the author judged that no specialized knowledge would be required to understand its content. The difficulty of the text was not taken into consideration in the process of choosing it since learners randomly choose texts online in a real life situation. The think-aloud procedure is considered one of the few methods which enable researchers to examine readers' mental processes (Ericsson & Simon, 1987; Kucan &Beck, 1997; Tabata-Sandom, 2013; Tateoka, 1996).

Comprehension test – After reading, the participants took a comprehension test. This test had seven open-ended questions and three multiple choice questions. It was constructed by the author and a teacher with a post graduate degree in Japanese linguistics.

Form recognition test and immediate vocabulary translation test – After the comprehension test, the participants took a form recognition test, and a vocabulary translation test. The previous vocabulary knowledge test was used again as the form recognition test. In the form recognition test, the participants had to circle words that they thought they had seen in the text. The motive to include this test was to examine whether or not L2 readers' mental representation of a text is influenced by exposure to the L1 coming from L1 pop-up dictionaries. Hypothetically, it is possible that L2 readers are not able to retain forms or other information

well from encountering L2 words during reading if L1 input coming from online annotations interferes with their reading process. After completing the form recognition test, the participants took the translation test, in which they were asked to give the meanings of target words.

Table 1. Participants' Background Information and Results

Name and JLPT level if known[1]	Gender	Length of studying Japanese	Length of staying in Japan[2]	Recognized target words (TWs)[3]	Mistakenly recognized words[3]	Un-known TWs (out of 58)	Learned TWs after reading	Retained TWs in the delayed test	Reading time (minutes: seconds)	Word search numbers[4] (out of 293)	Reading compre-hension test scores (out of 10)
Sean (N1)	M	8	6 months	58	0	3	3	3 out of 3	4:18	3	6.15
Matt (N2)	M	4	1 year	54	1	21	13	6 out of 13	11:40	20	3.1
Declan	M	8	1 year	54	2	23	15	7 out of 15	13:07	32	6.92
Liam (N3)	M	4	1 year	47	1	25	11	5 out of 11	19:50	39	6.15
Sabrina	F	8	No	54	0	17	8	6 out of 8	12:50	44	7.69
Basil (N3)	M	4	No	50	0	12	5	2 out of 5	10:57	56	3.85
Nicole	F	8	3 months	56	1	29	23	9 out of 23	19:40	60	8.46
Michael	M	8	3 months	55	2	25	19	11 out of 19	12:01	62	6.15
Hannah	F	4	No	29	0	36	7	6 out of 7	19:27	71	7.69
Lara	M	7	No	57	8	34	10	6 out of 10	20:30	88	7.69
John	M	8	No	53	4	33	8	5 out of 8	29:37	All	5.39

Notes:

1. All the names are pseudonyms. JLPT: Japanese Language Proficiency Test. N1: Level 1, N2: Level 2, N3: Level 3.
2. This excludes short trips to Japan.
3. The same vocabulary list was used for the previous vocabulary knowledge test and the form recognition tests. In the list there were 58 target words (TWs) and 25 distractors. "Recognized TWs" are the words that were contained in the target text and correctly recognized by the participants, whereas "Mistakenly recognized words" are words that did not appear in the target text, but the participants thought they saw in the target text.
4. The researcher sat next to each participant during his/her think-aloud procedure, and thus was able to count the number of word searches from close observation. There were 293 pop-ups available in the target text.

Delayed vocabulary translation test – One and a half months later the participants took a delayed vocabulary translation test. In this test, the participants tried to translate words which they had not known previously but had learned during the online reading, according to the immediate post-tests.

Semi-structured interviews – After all the procedures/tests were completed, the author interviewed each participant individually.

ANALYSIS

First, in order to examine the participants' vocabulary learning, the participants' scores on the five tests/procedure were calculated:

- The proportion of unknown words to all target words (TWs, hereafter)
- The proportion of newly learned words against the whole unknown words
- The proportion of retained words in the delayed vocabulary translation test to the words known immediately after reading
- The proportion of word searches to all available pop-ups
- The proportion of correctly answered questions in the reading comprehension test

Please refer to Table 1 for gained raw scores and full scores of the five tests/procedure.

Secondly, the participants' think-aloud protocols were qualitatively analyzed. Other studies using think-aloud protocols obtained from L2 Japanese learners' reading with hard copy texts have categorized their processing into three types: bottom-up processing, top-down processing, and metacognitive processing (e.g., Everson and Kuriya 1998; Tabata-Sandom 2013; Tateoka, 1996). This categorization follows traditional reading models. The current study employed such a traditional categorization, and at the same time it created unique categories for unique phenomena emerging during online reading.

RESULTS

Descriptive statistics – Table 2 below shows that the participants differed more among themselves in terms of the numbers of the words they learned and words they searched for than in terms of the numbers of words they did not know and words they retained or their reading comprehension scores.

Table 2. Descriptive Statistics

	N	Min.	Max.	Mean	SD
Unknown words (%)	11	5.00	62.10	42.1818	15.94006
Learned words (%)	11	19.40	100.00	53.4727	25.32616
Retained words (%)	11	39.10	100.00	59.8727	19.77463
Word searches (%)	11	1.00	100.00	27.5273	28.89184
Comprehension test scores (%)	11	31.00	84.60	62.9455	16.72844
Valid N (listwise)	11				

Table 3 below shows that only two variables correlate: the proportions of unknown words and word searches, unlike studies by Laufer and Hill (2000) and Chun and Payne (2004). This corresponds with our intuitions: the more unknown words, the more frequent the word searches. However, the reality was not so simple. One significant learner characteristic that probably created this complex reality will be explained in the discussion of "Two types of reading processes".

Table 3. Nonparametric Correlations of Variables

			Unknown Words (%)	Learned Words (%)	Retained Words (%)	Word Searches (%)	Comprehension Test Scores (%)
Kendall's tau_b	Unknown Words (%)	Correlation Coefficient	1.000	-.440	-.037	.624**	.253
		Sig. (2-tailed)	.	.061	.876	.008	.299
		N	11	11	11	11	11
	Learned Words (%)	Correlation Coefficient	-.440	1.000	-.127	-.418	.019
		Sig. (2-tailed)	.061	.	.586	.073	.937
		N	11	11	11	11	11
	Retained Words (%)	Correlation Coefficient	-.037	-.127	1.000	-.018	.135
		Sig. (2-tailed)	.876	.586	.	.938	.577
		N	11	11	11	11	11
	Word Searches (%)	Correlation Coefficient	.624**	-.418	-.018	1.000	.135
		Sig. (2-tailed)	.008	.073	.938	.	.577
		N	11	11	11	11	11
	Comprehension Test scores (%)	Correlation Coefficient	.253	.019	.135	.135	1.000
		Sig. (2-tailed)	.299	.937	.577	.577	.
		N	11	11	11	11	11

**. Correlation is significant at the 0.01 level (2-tailed).

Can learners learn new vocabulary by reading an authentic Japanese text while using online pop-up dictionaries? – Due to the qualitative nature of the current study, answers to this question are inconclusive. While much more quantitative research on this topic is necessary, this study can nevertheless suggest some implications based on two important observations.

1. The participants' successful form recognition of the TW – In the form recognition test, the participants circled words that they thought were in the text. The test contained 58 words that were actually in the text, and 25 words that were not. Ten participants–that is, all but the lowest proficiency participant–recognized more than 86% of the words correctly. Eight participants–that is, all but the three least proficient participants–recognized more than 93% of the words correctly. The four advanced participants did not recognize any word incorrectly. Therefore, it is fair to claim that the participants retained the forms of the TWs relatively successfully, even though they were exposed to L1 English definitions consistently during their online reading supported by a pop-up dictionary.

2. Potential of online reading using a pop-up dictionary for vocabulary learning – One and a half months later, the delayed translation test examined how well the participants had retained the meanings of words they had learned. The mean score was 59.87% (*SD* = 19.77), with the lowest

being 39.1%, and the highest being 100%. Unfortunately, there is no exactly comparable data in the context of L2 Japanese online reading research. Yoshii (2006) reported that his participants (L2 English university students, $N = 48$) retained 27.6% of words on an immediate test, and 21.4% of words on a delayed test (two weeks later). Waring and Takaki (2003) found more conservative results from pleasure reading instruction. They concluded that "on average, the meaning of only one of the 25 items will be remembered after three months, and the meaning of none of the items that were met fewer than eight times will be remembered three months later" (p. 130). Because these studies conducted delayed tests at different intervals and with different procedures than the current study, the results of the three studies cannot be compared in absolute terms. Nevertheless, it is fair to say that the retention rate found by the current study is relatively high.

Did the participants comprehend the text satisfactorily? – As Table 2 shows, the mean score of the reading comprehension test was 62.9%. This is not very high. That is probably because some of the questions contained in the current comprehension test tended to tap into the participants' memory rather than measure their general text comprehension (Nation & Macalister, 2010). However, all the participants correctly answered the question: What was the text about? The text was about how to have healthy, white teeth. The participants also correctly remembered that the text explained five methods. This indicates that the participants were able to get the gist of the text.

According to Lomicka (1998, p.45), "think-aloud may offer a different approach to questions of comprehension." In the current study, the think-aloud procedure revealed phenomena which were not detected by the comprehension questions, as reported in the next sections.

The overview of the participants' think-aloud protocols – The term "entries" was used to describe the parts of the think-aloud protocols that the author counted as belonging to specific categories and as noteworthy in terms of portraying how the participants processed the authentic Japanese text using the pop-up dictionary.

The following conventions were used in presenting entries:

- Pronunciations of the Japanese words/phrases that the participants are decoding are italicized.
- When possible, the sentence/clause that a participant was trying to process is also presented in Japanese with an English translation
- When necessary, observation notes (ONs) clarify the situation.

Due to the nature of the obtained protocols, not all of the entries presented below are perfectly comprehensible. Reflecting this fact, only a few example entries are included in the body of this paper to avoid distracting readers. Please refer to Table 4 for representative entries in each category. Participants' names used below are pseudonyms; capital letters indicate their proficiency level *within* the current group which was determined from their course grades and the Japanese Language Proficiency Test[1]: L is lower -level, M is middle -level, and A is advanced.

Table 4. The Overview of the Participants' Think-aloud Protocols

Categorizations of entries	Number of entries	Examples
1. Top-down processing	21	Matt (A) "Dairy products. Well, they contain calcium, don't they? It's not said in the text. But, you'd better eat them because they contain calcium."

2. Bottom-up processing	15	John (L) "I find it hard because it's kind of, like, this, seems to be an adjective to me."
3. Metacognitive processing	23	Basil (M) "Oh, I have learned this word, but I didn't know the *kanji*[2]."
4. Pop-ups' bad definitions	5	Michael (M) "Pigmentation (laughs). Really? This is a story about teeth, not skin, but 'pigmentation' is for skin, isn't it?" (ON: Michael [M] is not convinced with a definition of *Popjisyo.*
5. Tendency not to use pop-ups	28	Liam (A) "お口の(*okuchi no*, Trans.: of the mouth), けん，けん，けんきゅう? (*ken, ken, kenkyuu*?) Aha, けんこう！ (*kenkoo*, Trans.: health)" (ON: Only after testing his knowledge of a word, 健康 [*kenkoo*, Trans.: health], he opened a pop-up.)
6. Overwhelmed by long sentences	3	Hannah (M) "口の中が酸性，酸性に，かたよる，かたよると，虫歯の原因になりますが，チーズはアルカリ，せい? (*kuchi no naka ga sansei, sansei ni, katayoru, katayoru to, mushiba no, gen'in ni narimasu ga, chiizu wa, arukari, sei*?) Aha, アルカリ性で，これを中和してくれるのです (*arukarisei de kore o chuuwa shitekureru nodesu*). Oh, that's such a long sentence!" (ON: She is reading two sentences. The translation of the sentences is: when the inside of the mouth tends to be acidic, that causes cavities. However, cheese, being alkaline, neutralizes it.)
7. Struggling in *katakana*[3]	10	Liam (A) "歯は，歯の表面を守る，コーテング，コーテング，コーテング，コーテン，コーテング，コーテング，コーティング? (*ha wa, ha no hyoomen o mamoru, kootengu, kootengu, kootengu, kooten, kootengu, kootengu, koothingu*? " (ON: Here he is struggling to decode a *katakana* word, コーティング [*kootingu*, Trans.: coating], and tries to pronounce it seven times.)
8. Confusion caused by multiple definitions	4	Liam (A) "I don't know because there are too many different definitions for 評判 (*hyooban*, Trans.: reputation) ... I can't get my head around it with this sentence." (ON: He is confused with multiple definitions of 評判 given by *Popjisyo*.)
9. Pop-up's bad definition	14	John (L) "口の中が, (*kuchi no naka ga*, Trans.: the inside of the mouth), the acidity of the mouth, the acidity of the mouth, is 'ONE-SIDED'? (ON: He gave up on this sentence.)"

10. Happiness gained from correct guessing	4	Sabrina (M) "Yes, I knew it!" Basil (M) "What, what? Can I work out its meaning? Well, inside of the body? Yes!"
11. Participants' mental representation which are entangled with English and Japanese	6	Liam (A) "口の中が，酸性, acidity, にかたよる，と, cavity, 虫歯, source, 原因，原因? になりますが，　チーズは，　アルカル，　アルガリ性, alkaline, で，これを，ちゅうき，ちゅうき，ちゅうわ，してくれるのです. (*kuchi no naka ga sansei* acidity *ni katayoru to* cavity, *mushiba,* source, *gen'in gen'in? ni narimasu ga chiizu wa arukari arugari* alkaline *de kore o chuuki chuuki chuuwa shitekureru nodesu*)" (ON: He is reading aloud a sentence. The meaning of the sentence is: when the inside of the mouth tends to be acidic, that causes cavities. However, cheese, being alkaline, neutralizes it. Japanese and English are intertwined in his protocol as can be seen.)
12. Overwhelmed by difficult syntax	10	John (L) "I don't find *kanji* that much of a problem because they usually come with *furigana*[4]. The problem is putting together large sentences. Because they are written with nouns, certain adjectives, verbs, I get confused."
Total	143	

How did the participants read the text using the online pop-up dictionary?

1. The participants' use of top-down processing and bottom-up processing – Similar to think-aloud protocol data from studies in which participants read paper texts, the current participants' protocol data demonstrate that the lower-level participants tended to be limited to bottom-up processing, whereas the advanced participants could utilize top-down processing. That is, provision of L1 definitions by online pop-ups failed to enable less proficient learners to deeply interact with the target text.

John (L) was the least capable participant, and opened all the pop-ups. His reading process was restricted because of his excessive attention to textual features:

> I find it hard because it's kind of, like, this, seems to be an adjective to me. (He was puzzled because with a suffix of 性 [*sei,* Trans.: tendency of], a word of アルカリ性 [*arukarisei*, Trans.: alkaline] seemed to be an adjective to him rather than a noun as designated by *Popjisyo*.)

2. Two types of reading processes - Table 1's descriptive statistics demonstrate that the more unfamiliar words the participants encountered, the more word searches they conducted. Again, this finding fits our intuitions. However, the difference in the number of word searches was larger than the difference in the two groups' vocabulary knowledge.

The tendency not to use the pop-up dictionary was detected during close observation of the advanced-level participants' think-aloud procedures. All four advanced-level participants demonstrated this tendency. In fact, they often chose not to use the pop-ups even when they encountered unfamiliar words. Alternatively, they tended to either first test their vocabulary

knowledge, or try to guess the meaning of unfamiliar words before opening a pop-up. These four participants opened pop-ups four times, 20 times, 32 times, and 39 times, respectively, which is much less than some of the more struggling participants. Most of the 28 entries in Category 5 ("Tendency not to use pop-ups" in Table 4) came from this group, along with only one middle-level participant.

The following is what the four advanced-level participants said during exit interviews to respond to the question: "Do you use a dictionary/pop-up dictionary?"

- Sean (A) "I don't use dictionaries much. If it's a crucial word, I do. If I use a dictionary, I can't be engaged with the story."
- Declan (A) "It (using dictionaries) takes too much time…I want to try just reading it through once, and try to get most of the meaning."
- Liam (A) "The flow of reading is important. I have that (an online dictionary) on my own computer, and I can use it, so I can understand every word, and I can put them together. But it just takes so long. It just takes so long…it might take an hour to read a paragraph and it becomes boring."
- Matt (A) "If I use dictionaries, it slows down my reading."

These advanced-level participants put more importance on an effortless and speedy reading process with flow than on the possible benefits they could gain from using dictionaries.

In contrast, the lower proficiency participants tended to open pop-ups immediately and excessively. As mentioned above, John (L) opened all the pop-ups just as some of the participants in Ariew and Ercetin's (2003) study did, and two other participants, Lara (L) and Hannah (M) did so 88 and 71 times, respectively. This was the first time that John had used a pop-up dictionary. During his exit interview, he mentioned that the pop-up dictionary lessened the difficulty of reading the target text, commenting, "there was a lot of *kanji*, so, at first, it was quite intimidating, um, but if you have something like this to back up, it's not as scary anymore, at least it's possible." Hannah admitted that pop-up dictionaries helped her to get a general understanding of texts. Lara commented, "definitely my *kanji* handling improved (with the help of this online tool)." Although these less-proficient participants still struggled to understand the target text used, they found the online pop-up dictionary to be supportive in some aspects.

Table 5 below supports the findings in this section by demonstrating the disparity of proportion of top-down processing entries and bottom-up processing entries according to the participants' proficiency levels.

Table 5. Proportion of Top-down Processing and Bottom-up Processing According to Proficiency Levels

Category	Advanced-level	Middle-level	Low-level
1. Top-down processing (35.6%)	10	7	4
2. Bottom-up processing (25.4%)	1	4	10

Effects of insufficient grammar knowledge on the efficiency of pop-up usage – This study confirms the findings of some previous studies (e.g., Chun 2001; Ercetin 2003; Uzawa 2000; Yoshii 2006) which have found that L2 readers need to master basic grammatical structures

sufficiently to be able to conduct syntactic parsing automatically in order to maximize the benefit of online dictionaries.

Popjisyo, the online pop-up dictionary used in this study, sometimes segments words incorrectly and presents contextually -erroneous definitions. Some of the less proficient participants were negatively affected by such definitions, because they lacked competence to decode words correctly. The following sentence from the text posed such difficulty:

歯にいい簡単な習慣や食べ物、見逃さないで！

("Please do not overlook easy habits and foods which are good for teeth!")

The end of this sentence 見逃さないで (*minogasanaide*), which means "do not overlook" is a verbal negative request form. It is most usefully explained as one intact component. But *Popjisyo* incorrectly segments it and provides contextually -erroneous definitions as: 見 (*mi*, Trans.: view) ＋逃 (*nogasu*, Trans.: escape) ＋さない (*sanai*, Trans.: Chinese shawm) ＋で (*de*, Trans.: at, in).

The less proficient participants did not know this verb, 見逃す (*minogasu*, correct Trans.: to overlook). Neither did they know that 見逃さないで(*minogasanaide*, correct Trans.: Do not overlook.) is a shorter, more colloquial form of 見逃さないで下さい (*minogasanaide kudasai*). Lacking knowledge of this verb phrase, the less proficient participants were puzzled when encountering *Popjisyo*'s incorrectly segmented and thus contextually -erroneous definition. In contrast, the more capable participants noticed the incorrect segmentation because of their higher syntactic knowledge even if they did not know the verb.

Even when *Popjisyo* segments words correctly, it sometimes provides too many definitions, and its definitions sometimes do not fit the context, which also puzzled the less proficient participants who relied excessively on this online tool. Here is one such case:

> In your mouth, the acidity in your mouth, 'to be one-sided'? 'incline,' 'partial,' 'prejudices,' 'lean,' 'be biased'? Oh, so many… (Nicole [M] is reading all the definitions in a pop-up.)

The participants' struggle in processing difficult grammar structures – The expected readership of texts available online is usually L1 adult readers. Therefore, such texts are likely to have linguistic characteristics different from those of texts contained in language textbooks. Here, I refer to this difference as "naturally occurring syntax" versus "pedagogically modified syntax." In the text used in this study, the second paragraph was more or less composed in naturally occurring syntax, whereas the fifth paragraph's syntax is similar to pedagogically modified syntax. Many participants struggled in reading the second paragraph despite the provision of L1 English definitions given by online pop-ups. On the other hand, they much more easily read the syntactically easy fifth paragraph.

According to the Learning Item Analysis System of the Student Center at the University of Tsukuba (2012), the second paragraph contains 48 grammar items. Forty-two of them are intermediate- or advanced-level items, and the remaining six are elementary-level items. This makes the second paragraph difficult. In contrast, the Learning Item Analysis System detects 14 grammar items all of which are elementary-level in the fifth paragraph. Therefore, the syntactic structure of the latter paragraph is closer to that of pedagogically modified syntax.

DISCUSSION

Davis (1989) and Martinez-Lage (1997) suggested that glosses facilitate fluent reading, and thus enhance text comprehension. In this study, all of the participants understood the gist of the given text, although the text was authentic and unmodified. Therefore, to some extent, their comprehension was enhanced by online pop-ups which are a type of gloss. However, most of the less-proficient participants' reading did not seem to be fluent. Factors including naturally occurring syntax and problematic pop-ups (in terms of segmentation, definitions, and overwhelming content) offset the benefits created by the L1 definitional pop-ups.

These factors affected the lower-level participants more than the advanced participants. The lower-level participants' grammar knowledge was not good enough to notice the online dictionary's incorrect segmentation. Obtaining definitions of numerous unfamiliar words from pop-ups did not compensate for their inability to understand difficult naturally occurring syntax. They were puzzled by the omission of case-marking particles, subjects, copulas, and sentence enders. These difficulties were also experienced by the participants in Wake's (2013) study. Her L2 Japanese participants similarly struggled with the syntactic complexity of noun-modifying clauses. Grabe (2009) asserted that grammatical difficulty has a strong influence on the reading process, saying that "more complex and ambiguous syntactic structures have a consistent measurable impact on reading processing time" (p. 30).

The current study also shows that there is a discrepancy in terms of efficient use of the pop-up dictionary between the less proficient and the more advanced participants. The former relied on pop-ups excessively as reported above, and as found in studies by Chun (2001), Ercetin (2003), and Yoshii (2006), as well. In contrast, the latter did not overly rely on the pop-up dictionary, but maintained the flow of reading by trying not to use the tool too much. This corresponds with the findings of Uzawa (2000): advanced learners of Japanese who did not have character-orthography L1 backgrounds were able to read L2 texts accurately and quickly without being distracted by the use of a dictionary; they seemed able to maintain the flow of reading because their high level of vocabulary and syntactic knowledge kept them from using the dictionary inefficiently or excessively.

Regarding vocabulary learning, this study's findings suggest that reading with the help of online pop-up dictionaries may be helpful. The participants recognized the forms of the TWs well, and they retained the meaning of 59.87% (on average) of the learned words one and a half months later. Taking into consideration that vocabulary gains from pleasure reading and extensive reading can be fragile as well as the fact that these methods are not time -efficient (Nation 1997; Waring and Takaki 2003), reading with pop-up dictionaries may have important potential as an ecological vocabulary learning method.

CONCLUSION AND PEDAGOGICAL IMPLICATIONS

This study illustrates the discrepancy in efficiency between less proficient and more advanced learners in terms of how they were able to utilize and benefit from the online pop-up dictionary. The advanced participants were able to read without letting their flow be disturbed by the use of the online dictionary, and they seemed to utilize top-down processing, as shown in their use of background knowledge. In contrast, the lower-level participants were adversely influenced by the online pop-ups. Their laborious reading process was similar to that of participants in

Bowles's (2004) study of online reading: " (the participants) seemed to be processing the targeted words at a low level of awareness…participants read the glosses aloud as they read the passage: they did not attempt to derive the meanings of unknown words based on prior knowledge" (p. 549). When L2 readers process texts in such a shallow manner, they merely translate and paraphrase texts "in order to achieve a minimal level of comprehension" (Lomicka 1998, 49).

In short, the current findings imply that the availability of L1 definitions of unknown words from online pop-ups may not enable developing L2 Japanese readers to deeply interact with authentic online texts when such texts are lexically and syntactically too demanding. Taylor (2010) suggested that it may be necessary "to identify a L2 reading threshold at which glosses may become a hindrance to comprehension" (p. 354). The current study strongly implies that identifying the threshold at which learners of Japanese are usefully supported by online pop-ups is significant in Japanese language pedagogy (see also Brandl 2002, and Uzawa 2003 for studies in the L2 Japanese context.)

Furthermore, learners' vocabulary knowledge and grammar proficiency need to be developed to such a threshold in explicit instruction so that they are competent enough not to be misled by problematic pop-ups and the difficulty of naturally-occurring syntax. Omoto, Fukai, and Schneider (2005) suggested that if learners are incapable of utilizing some aspects of a technology, teachers have to give learners instruction in those aspects before embarking on a course of teaching that relies on the new technology.

Another approach that teachers of Japanese might take to online reading is to modify the texts they use. Yoshii (2006) claims that to maximize online reading practice's potential as a method of incidental vocabulary learning, the texts used may need to be modified in order to reduce learners' cognitive burden and to draw their attention to the TWs. Text modification can also ease the difficulty of the naturally occurring syntax of online authentic texts.

Furthermore, teachers of Japanese can guide students to assess Japanese texts available online before they choose to read them. Cobb (2005, p. 82) claimed that "the Internet is lacking in very few types of texts, but one of the few is simplified materials for language learners." Thus, selecting suitable texts is very important. Two online tools, i.e., the Learning Item Analysis System of the Student Center at the University of Tsukuba (2012) and J-LEX (Suganaga & Matsushita, 2013), can help learners of Japanese to find suitable texts by assessing the syntactic and lexical difficulty of Japanese texts.

The ultimate goal for L2 Japanese reading teachers is the same as what Nuttall (1996) envisaged as the goal of all second/foreign language reading teachers: "to enable students to enjoy (or at least feel comfortable with) reading in the foreign language, and to read without help unfamiliar authentic texts, at appropriate speed, silently and with adequate understanding" (p. 31). Teachers of Japanese require a cautious approach when employing online -reading with pop-up dictionaries to reach this ultimate goal.

FUTURE DIRECTIONS

In the context of L2 Japanese reading research, more studies that explore learner preferences among the different types of online annotation presentations would be valuable. Such studies ideally would have a large enough sample size to conduct a quantitative analysis, although securing a large sample size is difficult in the context of L2 Japanese education. Future studies also need to examine aspects of learners' affect toward online reading without blindly assuming

that the new technologies and new types of reading are unanimously welcomed by the young L2 learners of the IT generations.

NOTES

1. The Japanese Language Proficiency Test (JLPT) is the only internationally recognized proficiency test for L2 Japanese learners.

2-4. Three writing systems are used in Japanese texts: *kanji* (logograph), *katakana* (syllabary), and *hiragana* (syllabary). *Furigana* is ruby annotation attached to *kanji* to show pronunciation usually written in *hiragana*.

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