Comparing Electronic Dictionary Functions and Use

JOHN PAUL LOUCKY
Seinan JoGakuin University

ABSTRACT
The aim of this study is to review general findings about the changing use of electronic dictionaries (EDs) by Japanese college students of English as a foreign language. Subjective survey feedback from students using such computerized dictionaries is reviewed, and records of their objective performance on various vocabulary lookup and learning tasks are compared. This study presents a descriptive survey of Japanese freshmen students’ use of various electronic dictionaries, a brief survey of graduate students’ use of online dictionary, reading and vocabulary sites, and a comparison with other research studies investigating learners’ degree of use of EDs. Many overall trends are clearly discernable by comparing these findings that can help us improve language learning by means of more precise and effective guidance and recommendations concerning the use of EDs. Based on these findings, practical recommendations for improving both vocabulary learning and systematic strategy training in the effective use of electronic dictionaries are given. Finally, suggestions for further research are provided to help raise learners’ awareness of various useful functions within their EDs. In this paper, research done over the years on EDs relative to their impact on second language vocabulary acquisition will be discussed first. Next, a two-part study of graduate versus undergraduate Japanese college students’ use of EDs will be discussed, together with outcome and implications. Finally, suggestions for further research will be offered.

KEYWORDS
Digital Lexicography, Electronic Dictionaries (EDs), Portable Versus Online Dictionaries, L1 and L2 Glossing, Hypermedia Annotations, Vocabulary Learning Strategies

INTRODUCTION
This article will review some developments in the field of lexicography, the making of dictionaries or lexicons, to closely examine some of their new functions and their language learning potential when using both portable and online electronic versions. A detailed review of how Japanese college students use various electronic dictionaries (EDs) and their functions is needed to help shed further light on earlier studies done in this field.

In this review several studies including our own compare Japanese college students’ patterns of using both portable and online EDs and how these patterns differ depending on each student’s major and level of English language proficiency. These comparisons allow a clearer picture of changing patterns of use that can help raise both teacher and learner awareness of the relative advantages of EDs over print dictionaries, especially when reading online and having access to one’s portable or cell phone dictionary.

RESEARCH QUESTIONS
By reviewing several surveys of ED use, this study aims to investigate student awareness of different useful functions in their EDs because they might not be using them to their full potential. In addition, such a review can help us to identify areas where students could benefit from systematic and explicit strategy training in vocabulary learning and dictionary use. This study’s aims and research questions were similar to those of Bower and McMillan (2007), whose study sought to “be of benefit to teachers who may not be completely familiar with the various capabilities of modern EDs, and who may wish to incorporate EDs into their lessons, or to give advice to students on ED selection” (p. 4). Research questions addressed in this study followed the same pattern as those investigated by Bower and McMillan (2007).

1. What proportion of Japanese Engineering students uses EDs versus paper dictionaries?
2. In what situations and how often do students use their EDs?
3. To what extent do learners make effective use of their ED functions?

LITERATURE REVIEW
Most studies of dictionary use have examined print rather than EDs. A major overview was that of Tono (2001), who investigated the role of dictionary use in vocabulary learning, reading comprehension, and L2/L1 translation. Included in his overview are some studies of learners’ look-up strategies using print dictionaries and suggestions for improving their content and design to make them more user friendly.

Since surveys of learners’ preferences have shown that bilingual dictionaries are preferred by most learners (Nation, 2001), and since the vast majority of Japanese college students still seem to be using bilingual dictionaries (Baxter, 1980; Nakao, 1998), the study presented here examines the changing patterns in ownership and use of EDs by Japanese EFL learners. Wescler and Pitts (2000) conducted an insightful experiment using electronic dictionaries with EFL students. As stated by McAlpine and Myles (2003), “the electronic medium has opened up new possibilities with respect to what can be put into dictionaries, how their contents are organized, and how dictionaries can be tailored to serve the needs of ESL users” (p. 72).

Studies of EDs
The hypermedia annotations found in EDs have several advantages. Research carried out by some scholars (e.g., Abraham, 2008; Boers, Eyckmans, & Stengers, 2004) has provided evidence of an overall beneficial role for computer-mediated text glosses that provide lexical support for comprehending authentic L2 readings and learning vocabulary. A seminal study was that of Al-Seghayer (2001), who stated that “Researchers were inspired by the premise that a variety of glosses for words in various modalities, such as printed text, graphics, dynamic video, and sound, might have differing capacities to facilitate vocabulary acquisition and retention.” (p. 203).

Loucky (2002a) assessed the potential of computerized bilingual dictionaries (CBDs) for enhancing English vocabulary learning, including comparative charts of Japanese college students’ performance when using four such devices, as compared to print dictionaries. That study also compared over 40 portable and online computerized bilingual dictionaries and provided a systematic “vocabulary learning checklist” by which a clear taxonomy of vocabulary
learning steps, skills, and strategies can be applied for more rapid and systematic vocabulary development.

Loucky (2002b) also examined the accessing speed of several kinds of ED devices as well as software, giving both objective and subjective feedback from students using them. Overall, both students and language teachers were impressed by the versatile functions and broad potential of EDs, but they often lacked training and knowledge about how specific functions could be used most effectively in a systematic sequence so as to maximize language development. For the three levels of learners tested, Loucky found that an assistive reading pen scanner called Quickionary (which also pronounces target words) was the fastest, followed by the Brother translation software dictionary, EDs, cell phone lexicons with internet connections, and finally bilingual print dictionaries. It should be noted that both cell phone and internet speeds have greatly improved since that time.

Nation (2001) noted that in the case of Japanese students of English, "Baxter's (1980) survey of his Japanese university students showed that the students overwhelmingly used bilingual rather than monolingual dictionaries" (p. 294). This finding is further supported more recently by this writer's formal and informal surveys at seven colleges in Kyushu (Loucky, 2002a). Nation (2001) further stated that “Surveys of learners’ preferences and use indicate that bilingual dictionaries are the preferred option for most learners” (p. 291). He also advised that since various dictionaries have different kinds of information, it is appropriate to ask three questions when evaluating them: (a) What kinds of information does each dictionary type provide? (b) What do (your particular) learners prefer and actually use? And (c) What are the effects of using each type of dictionary on text comprehension, language production, or understanding of dictionary entries?

McAlpine and Myles (2003) recently clarified the role of dictionaries in basic language learning. Regardless of the type of dictionary, whether it is used electronically, on-line or in print form, [its purpose] is to help learners expand their vocabulary and increase their awareness of common grammar errors (Summers, 1988; Tang, 1997). In fact, it has been shown that the use of the dictionary positively affects incidental vocabulary learning, that is, the retention of words that have been ‘picked up’ during listening and reading activities .... An on-line dictionary of English phraseology that illustrates common collocations with sentence examples can help advanced learners to improve their writing skills in English and expand their passive [receptive] and active vocabulary ... (p. 72)

Though Kobayashi (2007) did not find any significant difference in the use of EDs over print dictionaries in terms of learners’ use of a few lexical processing strategies (guess/infer, ignore, or look up) in word retention or reading comprehension, she admitted this was probably due to lack of user experience. She acknowledged that “Many of the ED users had relatively limited experience with an ED, while they had extensive experience with PDs before using an ED. Therefore, they may have carried over their PD use habits to their use of EDs.” (p. 17).

According to her analysis, Kobayashi (2007) believes that those using EDs may consult their dictionaries more often than print dictionaries, which could impede their frequency of inferring, though she could find no statistically significant differences to support this assumption. What is more likely is that less proficient language learners are less experienced and less proficient users of EDs and that more proficient learners have less need to consult dictionaries as frequently as less proficient learners. They also know more words, so that they can guess
and infer new unknown words more successfully than learners with smaller vocabularies. As usual, “the rich get richer, more quickly,” meaning that more advanced students can infer and learn more new words more quickly and thus make more rapid progress.

Lenders (2008) recently asked whether using electronic glossing was worth the effort. The main result of his study is that language learners view electronic glosses as useful and appropriate. Learners are also more motivated to use glosses when they see them as being important and relevant to their majors and future careers. Lenders concluded that glossing can facilitate active vocabulary learning when authentic texts are used along with accompanying tasks that require language use. Other researchers, such as Luppescu and Day (1993) have studied the potential benefits for enhancing students’ vocabulary acquisition by using bilingual dictionaries in a consistent and appropriate manner. When used systematically and appropriately, EDs do indeed have a strongly positive impact on both vocabulary learning and reading development.

Fauss (2001) reported on an informal study comparing five types of portable devices used by Japanese-English translators that presented a number of features to keep in mind when selecting which type of computerized bilingual dictionary might be best in specific situations for different types of learners. His selection criteria were based on the functions and abilities of computerized devices designed to help advanced, adult Japanese learners of English. Fauss also summarized major features and different functions of five major Japanese brands (Canon, Casio, Seiko, Sharp, and Sony) whose prices vary considerably, depending on the product’s functions (see summary in Appendix A).

Some of the features attracting Japanese and other nationalities to the use of EDs are their portability, quick search time, and their growing array of technical and multimedia features designed to help improve language learning. Bower and McMillan (2007) found that Japanese students of English have been buying EDs in ever increasing numbers and that a rising percentage of both high school and university students are bringing EDs to their English classes. This finding accords with observations of this writer at about 10 Japanese colleges over the past two decades as well. Findings of this kind, anecdotal evidence, and rising sales figures for EDs all suggest that EDs have become popular among Japanese EFL students in the past decade.

Despite this clear trend towards the increased use of portable and online EDs, research is lacking as to specific learner usage patterns. As Bower and McMillan (2007, p. 1) pointed out, “there has been little attention paid to how and when Japanese university students use the various learning tools contained within their EDs, little is known about when and how students are using them as tools for language learning." Okuyama and Igarashi (2007) used a think-aloud protocol, combined with a survey and test, to determine dictionary use by advanced learners of Japanese. They found that while learners’ purposes were similar, the combination of their use of media (print, online, and portable electronic) and the search strategies they used differed greatly. They noted clear connections between learners’ proficiency levels and their subsequent levels of efficiency in selecting both appropriate dictionaries and relevant search strategies needed to achieve their purposes.

Bower and McMillan’s (2007) study quantified ED usage patterns of English language students at Kanda University of International Studies, showing that ED ownership was almost universal among these students (1,047 out of 1,076 surveyed; 97%) and that the majority of students were active ED users. Since Kanda University is known for training students in foreign languages, it is not surprising that EDs have become almost ubiquitous among its students. How-
ever, a broader study of non-language majors is needed to get a better picture of the overall situation of Japanese students’ views and use of such tools by Japanese students in general.

Despite the very high rates of ED ownership at Kanda University, Bower and McMillan (2007) also found that many students seemed unaware of several potentially useful functions in their EDs. No usage or very low rates of usage were reported for ED memory and search history records, as well as of other functions such as collocation dictionaries, voice functions, meaning for pronunciation symbols, and recording one’s own voice to try to match given pronunciations (see Web-Japan, 2006). Bower and McMillan also offered excellent suggestions for more detailed research into ED usage, recommendations to give learners when selecting portable EDs, and useful ideas for learner training.

More studies comparing language learners at varying proficiency levels and in different regions of the world are needed, as well as studies like the present one, which can help us to compare students’ learning when using monolingual versus bilingual dictionaries, as well as print versus electronic versions (e.g., see Kent, 2001; Svendson, 2006; Hayati & Fattahzadeh, 2006).

**METHOD**

**Participants**

Fifty-nine Japanese college freshmen Engineering students in three classes at the Kyushu Institute of Technology naturally divided themselves into four groups, depending on what type of dictionary they owned and customarily used. Twenty-four of the students (41%) owned and used various kinds of EDs; the other students used print dictionaries. Forty-one percent ownership of EDs is a marked improvement over the past few years. Loucky (2002a, 2002b) previously found that only 14% of the students owned EDs at this same institution. In addition, 38 graduate Engineering students at the same school were surveyed during their online reading class. The freshmen Engineering students had completed 6 years of secondary English classes, and the graduate Engineering students had completed an extra year of English at the university.

**Procedure**

This study examined the ways in which the students used dictionaries with the 15 low-frequency words that Laufer and Hadar (1997) studied. The current study differs in scope from Laufer and Hadar’s because it assesses the proficiency level of the students more rigorously and included computerized dictionaries. The study largely confirmed Laufer and Hadar’s findings but also provides additional findings from the comparative use of print dictionaries versus EDs, rather than just printed dictionaries alone. Since the study also assessed both receptive and productive vocabulary knowledge, it offers some pedagogical implications of using more versatile EDs, both online and offline, for helping students develop vocabulary knowledge in both skill areas.

In addition, to investigate the ways in which Japanese college students used specific educational features and technical functions of their EDs, the author reviewed Fauss’s (2001) survey and then designed three surveys based on Fauss’s. These surveys were distributed to the students described above to determine their awareness, or lack thereof, of both technical functions and educational features of their various EDs.
DATA COLLECTION
The researcher timed how long it took for the students to look up the 15 low-frequency words in Laufer and Hadar (1997) in the various kinds of dictionaries they were using (print dictionaries and EDs). He then calculated the mean look-up time for four groups of students: students who were using (a) a fully bilingualized ED (both L1 and L2 definitions), (b) a bilingual ED (L1 definitions), (c) a bilingual print dictionary (L1 definitions), and (d) monolingual print dictionary (L2 definitions). The researcher also measured the students’ vocabulary knowledge on receptive and productive skills tests (see tests based on Laufer and Hadar’s study in Appendix B). Finally, after students completed the surveys, the researcher tabulated the results of their responses.

RESULTS
Before considering how students used their EDs, the percentage of ED ownership among the students was first investigated. Just over one third of the students (21/59; 35.59%) were using fully bilingualized EDs with both monolingual and bilingual lexicons in them. Again, just over one third of the students (20/59; 33.89%) were using bilingual print dictionaries. About one fourth of the students (15/59; 25.42%) were using L2 monolingual print dictionaries (either owned or borrowed from the teacher). Finally, only a few students (3/59; 5.08%) were using less expensive EDs that had only a single bilingual lexicon in them. Since these were non-English majors, these rates probably more accurately reflect typical usage among the general Japanese college population.

Table 1 presents the results of the students’ use of the various kinds of dictionaries. The table shows the students’ accessing speed for looking up the 15 low-frequency words and their average scores on the vocabulary knowledge in receptive and productive skills tests.

<table>
<thead>
<tr>
<th>Group</th>
<th>Mean Accessing Time</th>
<th>Mean Receptive Vocabulary Score</th>
<th>Mean Productive Vocabulary Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>fully bilingualized ED (both L1 and L2 definitions) (n = 21)</td>
<td>18.26 s</td>
<td>80.76%</td>
<td>89.92%</td>
</tr>
<tr>
<td>bilingual ED (L1 definitions) (n = 3)</td>
<td>15.00 s</td>
<td>80.00%</td>
<td>45.00%</td>
</tr>
<tr>
<td>bilingual print dictionary (L1 definitions) (n = 20)</td>
<td>19.70 s</td>
<td>82.80%</td>
<td>73.71%</td>
</tr>
<tr>
<td>monolingual print dictionary (L2 definitions) (n = 15)</td>
<td>27.70 s</td>
<td>70.96%</td>
<td>66.47%</td>
</tr>
<tr>
<td>Total</td>
<td>19.92 s</td>
<td>78.24%</td>
<td>70.36%</td>
</tr>
</tbody>
</table>

The figures in Table 1 show that the students using bilingual EDs (L1 definitions) had the fastest access time, followed closely by those using fully bilingualized EDs (both L1 and L2...
definitions) and bilingual print dictionaries (L1 definitions), and that those using monolingual print dictionaries (L2 definitions) had the slowest access time by far. The figures in Table 1 also show that the vocabulary scores in the receptive skills test were similar for the first three groups but those for the last group were substantially lower. The high score of the fully bilingualized ED group on the productive test is not surprising because the students in this group had the double benefit of having both L1 translations, L2 definitions, and sentence examples at their disposal.

**Survey Results**

Three kinds of surveys were used in this study. First, all students completed an “informal computerized bilingual dictionary usage survey” (see Loucky, 2003). Second, the students who used print dictionaries completed an “approach to vocabulary learning questionnaire,” a questionnaire modified for EFL students from Lessard-Clouston’s (2000) research. Third, the students who used EDs completed a “survey of computerized bilingual dictionaries” that included questions on the eight major phases of lexical processing (see Loucky, 2002a, 2006) and how these students used various functions of their EDs to help expedite these phases. These phases are

1. Assessing degree of word knowledge,
2. Accessing new word meanings,
3. Archiving new information for study,
4. Analyzing word parts and origins,
5. Anchoring new words in short-term memory,
6. Associating words in related groups for long-term retention,
7. Activating words through productive written or oral use, and
8. Reviewing, recycling, and retesting vocabulary items.

**Assessing degree of word knowledge**

When the students assessed their degree of word knowledge, they initially checked the manuals of their EDs to see how many words their EDs contained. The EDs had an average of 150,000 English words, ranging from 2,000 for bilingual EDs to 460,000 for fully bilingualized EDs. This large number of words would give students a great study advantage if they would actually use all of the L1 and L2 data and functions available to them in the EDs. When asked how many words the students thought they knew, their replies ranged from lows of 300-500 words to highs of 4,000-6,000 words. It was enlightening to note that when tested online using V-Check’s online test (see http://lexxica.com), the higher proficiency level students knew an average of 2,508 words, 300 words more than they thought they knew.

**Accessing new word meanings**

The survey asked the students how often they used their ED and in what situations. The students replied that, for English to Japanese translations, they used their ED 30%-70% of the time; for Japanese to English translations, 20%-30% of the time, and for checking unknown Kanji, 0%-5% of the time. Some students commented that they used the dual lexicon functions of their bilingualized EDs to better expand their word knowledge by adding meanings and synonyms by checking target words in both languages.
Archiving new information for study

The survey asked students how they recorded the new words they found in their ED. Seventy percent of the students mentioned writing new words in textbook margins or in notebooks. Thirty percent said that they did not record new words. Since many ED models now record learners’ word searches for 10-100 words, this feature may make learners more passive about writing notes for themselves. They may feel such a practice is not a good use of their study time because they can now easily review “history search” files (which are automatically archived). Nevertheless, students should be taught that not making use of these files for review is a waste of a precious resource. They should also be shown how to manually enter other word data and sentence examples into “word memo” functions because such a practice would be helpful for future review of vocabulary. This approach would be particularly useful if students are shown the benefits of activating new words in their own written examples via “pushed output production” (see Loucky, 2004). As one student declared, “If you don’t record [and presumably review] once a week, you don’t remember.”

Analyzing word parts and origins

The survey asked students if their EDs had any special functions which helped them break up new words into parts or illustrate the use of new words in sentences. No students mentioned having or knowing about functions that break words up into parts, although various EDs have much useful grammatical and etymological information available in them in the form of links and search functions. Over half of the students said their ED provides both common phrases and sentence examples. Less expensive ED models lack sentence examples, and some students who own them tend to also use print dictionaries when they need more information. One student said that using an ED “can help me to memorize new words by giving not only meaning but sentence examples also”—a point lexicographers and ED technicians should both keep in mind.

Anchoring new words in short-term memory

The survey asked the students whether their EDs had images, sounds, or other special functions to help illustrate new word meanings, forms, or use. If so, the students were then asked to describe these special functions and explain how they worked to help them fix new words in memory. Only two students said their EDs had any special means of helping them to remember new words, but one mentioned using letters, pictures, or sounds. Another noted that pronunciation capacity of his ED helped him to remember new words. Students often mentioned the need to have access to both pronunciation and illustrations of word meanings (see Loucky, 2003a, 2003b).

Few EDs yet have special audiovisual functions, except for software or online programs. Although some students tested previously (Loucky, 2002a, 2002b) had access to online dictionaries via handy phones, few knew how to use them, and connection speed was slow and costly. Only more expensive ED models provide pronunciation, but these are not so commonly bought by students on limited budgets. Some sites are beginning to make available reading and listening texts with vocabulary glosses, accessible via mobile phone or online programs (e.g., http://WordChamp.com).

Some more expensive hand-held EDs and special desktop computers (e.g., certain Fujitsu and SONY models) can recognize a user’s handwriting or voice. (One student had such a device.)
If these devices could also be developed to remember a user’s simple hand-drawn pictures, this function could be used to enhance students storing audiovisual clues to help reinforce and retain forms and meanings of new words. Fully bilingualized portable software and online dictionaries should have pronunciation functions in both languages to be completely bidirectional. Some can now pronounce entire sentences (e.g., Osama Tsuyaku and King Translator). Oxford’s Wordpower Genie program, while only monolingual, has excellent linking capabilities and pronunciation available in either American or British English. (One student used both of these programs.) The Oxford program also comes with a print dictionary and has a collocation program available as an extra option.

**Associating words in related groups for long-term retention**

The survey asked the students if their EDs helped them organize their vocabulary learning. The survey also asked the students whether and how they organized their vocabulary learning and whether their EDs had special functions to help them do so. One student remarked that such ED functions would enable him to remember new words more systematically. Another said that he grouped some words with the same or similar meanings or with opposites. Another student made and put vocabulary cards in groups in order to study them together. Nevertheless, only 20% of the students said they organized or grouped new words in any way. Most Japanese students do not seem to organize their vocabulary learning in any particular way and often employ the same old method used for learning new Kanji characters—repeated writing on cards and rote memorization, usually out of context.

Organizing vocabulary is an area where their learning could be greatly improved if EDs (and language teachers) would help learners to organize new words into related groups by common themes, domains, or keywords (see Coll, 2002). This author’s web site does this with about 2,000 advanced vocabulary words by using the semantic field keyword approach (see [http://www.call4all.us/SFKAINDEX.html](http://www.call4all.us/SFKAINDEX.html)).

**Activating words through productive writing and oral use**

The survey asked the students whether their EDs gave them opportunities to use new words right away and, if so, how. None of their EDs seemed to give them specific ways to use new lexis. This could be easily improved by including more practice exercise functions. For example, the Oxford learner’s dictionary has such practice exercise software available with some versions of their learner’s dictionary. These seemed to be quite useful and well designed when tested by participants at a CALL conference (JALT CALL, 2000). One student stated that he should “write many sentences which are composed of new words I have looked up to do so.” Another said activating would “help me learn by remembering how to use words when going beyond word meanings alone.” A third wanted to have correct pronunciation functions to help him improve his active production. In general, the higher proficiency students seemed to understand the benefit of having access to these functions.

**Reviewing, recycling, and retesting vocabulary items**

The survey asked the students whether they reviewed new words and whether their EDs helped them in this task. Sixty-five percent of the students said that they reviewed words some of the time; several admitted to doing no review at all.
History searches. Most EDs now have auto-archiving capacity to support history searches for words. Auto-archiving gives students an automatic review by showing the last word they looked up the next time they turn the machine on. Students often remarked very favorably on this special function: “I check the words that I want to learn, my device memorizes those words, and then I can easily find it next time [when it’s needed].” “My CBD can remember words I look up, so I can find and use these new words faster.” “It allows me to peruse new words I want to learn.” “History search helps me to confirm meaning and spellings, as well as pronunciation if it’s available.” This automatic archiving and review provided by history searches is recognized by virtually all users as being one of the major strengths and advantages of EDs over print dictionaries.

Special functions for vocabulary practice. No students mentioned having special functions on their EDs to practice vocabulary, though many of the more expensive models do. Students have often not read manuals to figure out all of the diverse functions of EDs. Training is needed in this area to help them to better maximize the use of all the best language learning functions present in EDs. A crucial and common pedagogical finding in this study and other studies of Japanese students using EDs (Bower & McMillan, 2007; Kobayashi, 2007) is that despite an increasing number of students buying electronic dictionaries, many have been given virtually no instruction about how to maximize their use for effective vocabulary and language learning. This situation could change if language teachers became better informed and more skillful in training their students how to use EDs and by following a systematic plan to incorporate each technical feature to help build up all of the eight essential vocabulary learning phases.

In summary, the students using EDs had better vocabulary accessing speeds, as one would expect from high speed rapid search functions. The students using the L2 monolingual dictionaries had the slowest average accessing speed, most likely because of the added cognitive burden placed on the learners of having to work only in the L2 without access to L1 translation support. Comparison of the scores on the receptive vocabulary test shows that the L2 monolingual users had the lowest mean, once again presumably due to lack of L1 support. The other three groups who had L1 support had similar scores. Comparison of the productive vocabulary test scores shows that the students using the fully bilingualized EDs had the highest scores, followed by those using the bilingual EDs and the L2 monolingual dictionaries. The students using the bilingual EDs had the lowest scores, but, because this group contained only three students, their scores cannot be considered at all reliable. Finally students’ responses to survey questions show highly variable vocabulary learning practices and minimal use of ED features in support of those practices.

DISCUSSION

Based on the findings above, we can now address the need to train learners to make better use of ED functions. The students’ responses to questions about the functions in their EDs support previous findings by Bower and McMillan (2007). They too found that most Japanese college students have not received adequate training on the use of ED functions to maximize their vocabulary and language development. The results presented here show that teachers need to give students explicit strategy training to

1. maximize the advantages of using monolingual learner dictionaries first, to build a habit of trying to think first in the L2, learning to note and assess word ratings, and focus first on memorizing high-frequency vocabulary items;
2. access as much information as quickly as possible about target terms by using the jump function to go quickly to various lexicons within the ED;
3. archive this new data either automatically in the history search function or in optional memo functions, where notes and example sentences may be added;
4. associate or organize words into related word groups by learning to use collocation dictionaries and thesauri or online concordancers (e.g., www.lextutor.ca/concordancers); and
5. actively review vocabulary by using the history search or memory functions as often as possible (e.g., see http://www.WordChamp.com) and using these new words in personal writing and speaking.

Language teachers and learners both need to make much better use of the above enumerated features to enable better vocabulary and language development. Consistent use of history search, memory, jump, collocation, and thesauri functions could serve to provide far more chances for useful elaboration and activation of new terms in language learners’ own speaking and writing tasks. Systematic training in the effective use of portable and online dictionaries is clearly needed. Since portable and online dictionaries are most commonly used by English learners for reading and writing, Bower and McMillan (2007, p. 7) are on target in their recommendation that “these may be areas where research is most urgently needed. It would be fruitful to explore how learners utilize and navigate between the different dictionaries and functions of their EDs while engaged in reading and writing tasks.”

The most useful functions for language teachers to consider before guiding students on investing in EDs, either portable or software, include

- number and type of dictionaries included (e.g., Japanese-English, English-Japanese, Oxford English dictionary, Japanese-Japanese),
- number of entries,
- type and number of kanji available in a separate kanji dictionary,
- illustration features,
- katakana dictionary,
- thesaurus,
- word challenge,
- English language usage handbook,
- availability of English language manual,
- possible search functions (e.g., quick search, combination search, component search, phrase search, and idiom search),
- English-Japanese menus,
- jump functions between dictionaries,
- manual word memo,
- back function,
- search history and automatic archiving for quick review,
- spell check,
- wild card,
- kanji test,
- pronunciation/voice function,
- optical character recognition canning or computer uploading capabilities,
- online help, and
- travel help features (e.g., travel dictionary, travel phrase dictionary, travel guide, tax calculator, currency conversion, world times, etc.).
PEDAGOGICAL IMPLICATIONS

Again, a crucial finding of this study is that despite an increasing number of Japanese students buying EDs, many have been given virtually no instruction on how to maximize their use for effective vocabulary and language learning. Following a clear learning system such as the simple taxonomy of major vocabulary learning stages listed above can greatly assist both teachers and students by giving them a specific plan of action when encountering new words. Further, improvements in the linking functions in EDs make them increasingly easier for learners to use in order to find almost any aspect of vocabulary that they may need, including a much wider variety of sentence examples, collocations, and idioms for productive use.

To help learners in rapid access to L2 vocabulary meaning, dictionary makers should aim to continue to improve the ways in which they clarify meanings and illustrate appropriate contextualized word usage. The findings in this study suggest that this can be done by using the insights of semantic field keyword networks in conjunction with better linking strategies for finding basic synonyms organized by major topic words. As McAlpine and Myles (2003, pp. 81-82) have said, such an ED would be able to embed basic synonym and topic hyperlinks systematically into the fabric of dictionary definitions in order to help ESL writers zero in on the phraseology appropriate to particular contexts .... Linking all the expressions covered in the dictionary to basic vocabulary items and commonly associated words would give the ESL dictionary user two new ways to access the English lexicon .... It would combine the insight of the human lexicographer, whose job it would be to recognize and describe extended lexical entries, with the brute searching power of the computer. Such an ESL dictionary would be experimental in design, for its aim would not be to analyse the lexicon of English, but to present it synthetically, to illustrate it in action.

When one considers both receptive and productive aspects of vocabulary knowledge which language learners need to be able to access rapidly, it becomes clear that EDs with advanced search systems and the capability of linking both within and between programs make them a logical choice for making words and phrases easier to find. Many students now prefer to use free online dictionaries via desktop computers or mobile devices. Since most Japanese students carry both EDs and cell phones with internet connectivity, they need to be trained on how to effectively use the online dictionaries. Regardless of whether using a print dictionary or an ED, language learners should be trained to try to guess meanings of new words from context first and then to check an L2 monolingual learner’s dictionary. After these two steps, they can check a bilingual ED to confirm or correct their guess and use other functions to help them learn and remember the new words. There is a danger that without adequate training low-proficiency learners may consult a bilingual ED immediately, without much effort to recall or guess the meanings of unknown words. These learners should be encouraged and shown how to interact more with the context to try to learn new word meanings, forms, and relationships in actual use, a task that learning to use a concordancer may help them to accomplish.

CONCLUDING RECOMMENDATIONS

As we seek to build a more comprehensive theory of second language vocabulary acquisition (SLVA), carefully monitored studies of CALL-enhanced vocabulary learning strategies and online reading need to be done. Systematic principles and proposals that test learners’ patterns of SLVA are needed to develop a more complete picture or model of lexical development in
second language learners. As Grabe and Stoller (1997, p. 100) have recommended, “Additional studies that explore different types of dictionary use over time for L2 learning might help to clarify the effectiveness of dictionaries as L2 language learning resources.”

Based on the findings of this survey presented here, repeated observations, and a review of many electronic and online dictionaries, the following recommendations can now be given. First, this study supports Bower and McMillan’s (2007) recommendations and ranking of ED resources for Japanese learners of English. For learners lacking money to buy any portable ED, using free online dictionaries is the best option. Many college-level learners in Japan and other countries now have cell phones fully equipped with internet connections that enable them to use online dictionaries, and others have built-in dictionary functions.

Bower and McMillan’s (2007) rankings are useful to consider when advising students about buying a portable ED or a cell phone. The researchers have stated that jump and memory functions are now standard on most EDs, but the following seven major functions should also be considered in the order listed below:

1. Bilingual English-Japanese and Japanese-English dictionaries,
2. English-English learner dictionaries,
3. English-English standard dictionaries,
4. Japanese-Japanese dictionaries (L1 Kanji Dictionaries),
5. thesaurus,
6. collocation dictionaries, and
7. voice functions (using text-to-speech for pronunciation).

Guidance in which functions can best meet students’ language learning needs and how to use those functions with other online tools to maximize their second language vocabulary acquisition is crucial. Based on reviewing many types of reading programs and over 30 different types of EDs available in Japan, the relative advantages of using EDs, reading programs, and versatile online dictionaries become quite clear (see http://www.call4all.us///home/_all.php?fi=d).

EDs and translation devices can clearly help language learners to gain immediate access to a much broader variety of lexical and grammatical information than can normally be expected from the use of print dictionaries alone. The meanings of words are often fully illustrated with various sentence examples and collocations, usually enhanced with explanations of grammatical points, and have pronunciation and automatic storage and review functions as well. Improvements in design now enable students to learn new strategies for extracting new information, as well as archiving and arranging it for subsequent review and use in communication.

Using insights from electronic corpus research (e.g., see Hirata & Hirata, 2007) can help us to continue to improve print dictionaries, and especially EDs by providing learners with definitions that are clear, accessible, and lexically and syntactically contextualized. EDs that reflect the principles discussed above will be very useful to language learners by providing them with tools that are precise and thorough, quick and accurate, yet portable and convenient. These are the most basic standards for making dictionaries more user friendly to today’s students as they look for computerized devices to help make second language acquisition more rapid and interesting, enjoyable, and efficient.

Based on this and previous studies of ED use at three Japanese colleges (Loucky, 2006) several conclusions may be drawn concerning the use of EDs and reading software versus the use of textbooks alone. First, EDs, and by extension CALL reading software, appear to be both
more technologically expedient (providing more rapid access to unknown word meanings) and more cognitively efficient in terms of helping to speed up lexical processing and recording of the L2 mental lexicon. Second, computer and engineering majors seem to be able to learn more quickly how to make efficient use of EDs and reading software than English majors, but this ability also seems to depend on the individual student’s level of English proficiency and prior experience using computers. Third, foreign language learners with higher levels of L1 and L2 vocabulary knowledge and L2 proficiency can be expected to not only use computerized tools more effectively, but also to learn new target language vocabulary more rapidly than students with lower levels of vocabulary knowledge or language proficiency. Fourth, students who systematically use structured vocabulary learning strategies to integrate a combined emphasis on form, meaning, and use seem to learn and retain new language more rapidly and completely (Loucky, 2004, 2005). Future studies should explore the effectiveness of multifunctional EDs, those with functions such as word search histories and word review games, compared to less expensive models that do not these functions.

While EDs are extremely helpful for Japanese language learners, students clearly need substantial guidance to maximize their usefulness. Teachers and students alike need to become more familiar with the various features and functions available on each type of ED for enhancing the acquisition of all four communication skills. Teachers should also help raise learners’ awareness of various functions in their EDs in order to make better use of them. However, more important than the number of multimedia or technological functions students use is the type, order, and consistency of vocabulary learning tasks they complete to learn new words.

In light of the findings presented here and other studies on EDs, reading programs, and online dictionaries, a specific plan can now be proposed to advance foreign language vocabulary development.

First, EDs, software, and websites that provide fully bilingualized support seem to be most effective and helpful, especially to learners with limited English proficiency. Electronic devices that are fully bilingualized, offering students immediate access to both L1 and L2 information and explanations along with both audio and visual helps, seem to best promote vocabulary acquisition and retention.

Second, website designers, teachers, and publishers should seek to provide language learners with more low-intermediate-level reading and listening materials. While higher level learners can of course benefit from the use of authentic text and gain new vocabulary from monolingual glosses alone, a simplified text option offering bilingual glosses is more often preferred and required by language learners at lower levels of proficiency. The use of text-to-speech and other multimedia annotations should be further investigated to help enhance reading comprehension and speed, as well as learners’ enjoyment of language learning programs.

Third, teachers should encourage both deeper and more active lexical processing and use.

Fourth, teachers should also encourage multiple lookups and systematic lexical processing via use of a simple memorable framework such as the one discussed above and repeated here:

1. Assessing known versus unknown words,
2. Accessing new words as rapidly as possible,
3. Archiving newly learned vocabulary items,
4. Analyzing new words by word parts and origins,
5. Anchoring new words in short-term memory,
6. Associating words in related groups for long-term retention,
7. Activating words in writing and speaking, and
8. Reviewing, recycling, and retesting vocabulary items.
These practical principles for more systematic vocabulary teaching and learning also suggest many potentially fruitful areas for further research. While useful to consider learners’ preferred learning styles and strategies when buying an ED, studies have repeatedly shown that many Japanese learners lack adequate awareness and training in their effective use. Most do not use enough effective vocabulary learning strategies or are unaware of how to use them together in an integrated system (Loucky, 2006). In future studies of EDs or automatic glossing programs, it would be most useful to have some type of timed testing of vocabulary learning that also captures learner usage data (preferably including unobtrusive video screen capture) to identify the learning strategies that students actually use and their relative effectiveness for learning new words. Finally, more surveys of individual students’ use of dictionaries and vocabulary learning strategies are needed with students at different levels of proficiency majoring in a variety of academic fields.

REFERENCES


APPENDIX A
Common Electronic Dictionary Functions (summarized from Fauss, 2001)

A. Common main features
   (Most computerized bilingual dictionaries in Japan have various combinations of some of these features.)
   1. Japanese language dictionary
   2. Kanji dictionary
   3. English-Japanese dictionary
   4. Japanese-English dictionary
   5. Japanese common expression dictionary
   6. Katakana words (original foreign word dictionary)
   7. Kana or Romaji typewriter keyboard entry choice
   8. English synonym dictionary

B. Newer features of more expensive models
   (These models may include some or all of the features below.)
   1. English-English learners dictionary
   2. English thesaurus

C. Innovative and helpful functions
   1. Spell check
   2. Word search history
   3. Archiving memory (automatic, manual, or save and print)
   4. Jump (moving from one dictionary to another)
   5. English word search assists (similar to spell check, but users can focus their search more)
   6. Idiom and phrasal verb look-ups
   7. Compound word look-up
   8. English conversation phrasebook (usually used for travel)
   9. Voice function for pronunciation

APPENDIX B
Vocabulary test (with 15 low-frequency words)

Part I: Receptive vocabulary
Choose the answer, A-C, which you think is closest to the meaning of the target word.

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
<th>C</th>
<th>Target word</th>
<th>Answer</th>
</tr>
</thead>
<tbody>
<tr>
<td>joke</td>
<td>praise</td>
<td>mock</td>
<td>deride</td>
<td></td>
</tr>
<tr>
<td>insult</td>
<td>charity bazaar</td>
<td>dance</td>
<td>fete</td>
<td></td>
</tr>
<tr>
<td>pass through</td>
<td>stop</td>
<td>stay</td>
<td>permeate</td>
<td></td>
</tr>
<tr>
<td>flexible</td>
<td>lovely</td>
<td>firm</td>
<td>resilient</td>
<td></td>
</tr>
<tr>
<td>raised platform</td>
<td>door</td>
<td>floor</td>
<td>dais</td>
<td></td>
</tr>
<tr>
<td>double</td>
<td>cheat</td>
<td>swim</td>
<td>swindle</td>
<td></td>
</tr>
<tr>
<td>production</td>
<td>river</td>
<td>increase</td>
<td>influx</td>
<td></td>
</tr>
</tbody>
</table>
Part II: Productive vocabulary
Write an original sentence using each of the words below correctly. (Do not copy dictionary examples.)
deride, fete, permeate, resilient, dais, swindle, influx, occult, insipid, variegated, bequeath, hoard, stub, terse, venerable

AUTHOR’S BIODATA
For over 20 years John Paul Loucky has taught all areas of EFL in Japan. His dissertation compared the use of an extensive text-based sustained silent reading approach to both intensive audiolingual and CALL-based methods of vocabulary development. His research interests include L2 reading and vocabulary acquisition, use of various glossing and translation programs, and electronic and web dictionaries. His webpage (http://www.CALL4All.us) provides a clearinghouse of CALL organizations and a virtual encyclopedia of language education sites worldwide.

AUTHOR’S ADDRESS
John Paul Loucky
Seinan JoGakuin University
1-3-5 Ibori, Kokura-kitaku
Kitakyushushi, Fukuokaken
Japan 803-0835
Phone/fax: +093 583 5748
Email: jploucky@mx22.tiki.ne.jp