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Comparing Dictionary Definitions and Glosses in Hypertext Foreign Language Reading:
Facilitating Foreign Language Reading Comprehension and Vocabulary Acquisition

■ **This study was motivated by current interest in computer-assisted language learning and was undertaken specifically to investigate the question of whether hypertext referencing of computerized texts facilitates both foreign language reading comprehension and vocabulary acquisition. Advanced university-level EFL students in Israel participated in the study. Results of the repeated measures research design showed that neither of two on-line reading conditions with hypertext links (with access to hypertext glosses or with access to a hypertext dictionary) had a statistically significant advantage over the third on-line reading condition (with access to a paper dictionary) in terms of students' overall reading comprehension or their short-term or delayed vocabulary retention. However, in both the on-line gloss and the on-line dictionary conditions, students looked up significantly greater numbers of words than in the paper dictionary condition. The results are discussed along with interview data showing students' preferences for the on-line dictionary.**

Introduction

Since the introduction of computers into the field of second or foreign language education, a number of practitioners have concluded that this technology has great potential for language learning. Language educa-

tors are endorsing the use of computers as essential components in language teaching, emphasizing the fact that computers are capable of performing multiple tasks and are more than just text processors.

Among the concerns often raised in the domain of computer-assisted language learning (CALL) is how to use the potential of a computer to enhance the language-learning process. The present study was undertaken to investigate the question of whether hypertext referencing of computerized texts facilitates both foreign language *reading comprehension* and *vocabulary acquisition*.

Literature Review

With the development of electronic dictionaries, a number of researchers have investigated their usefulness as on-line tools, contributing both to enhancing reading comprehension as well as vocabulary learning. Leffa (1992) compared the use of an electronic dictionary and a conventional dictionary in a translation task and found that the students who used an electronic dictionary demonstrated better comprehension and also completed the task in less time. Aust, Kelley, and Roby (1993) compared the use of an on-line dictionary and a conventional paper dictionary in the process of reading comprehension. They introduced the term "consultation trigger point," referring to the finding that the participants looked up significantly more words when using an electronic dictionary. Knight (1994), who compared the effect of CALL dictionary lookup with guessing words from context, reported that those participants who used a dictionary learned more words and comprehended the text better. To explore the relationship between lookup behavior and vocabulary learning, Chun and Plass (1997) ran three studies with their second-year students of German using a multimedia program called CyberBuch. The program provided annotations through pictures, printed text, and video. Their results demonstrated that students who worked in a multimedia environment showed a better ability to retain vocabulary. Laufer and Hill (2000) used a CALL program comprising a text, highlighted low-frequency words, and access to different lexical information about the words. They found that multiple dictionary information reinforces vocabulary retention.

With respect to electronic glossing, Davis and Lyman-Hager (1997) examined the performance of intermediate-level students of French when reading a glossed excerpt from a computer screen. They found that the participants showed positive attitudes toward the computerized glosses. Lomicka (1998) investigated the way multimedia annotations influence the level of comprehension. The participants in her study, second-semester students of French, were asked to read a text under three conditions: full glossing, limited glossing, or no glossing. The data suggested that computerized reading with glosses "may promote a deeper level of text comprehension" (p. 41).

Among the few studies that have compared the use of dictionaries with the use of glosses is the study conducted by Roby (1999). Participants in this study were asked to read a biographical sketch taken from a Spanish-language feature magazine. The four treatment groups were (a) paper dictionary, (b)

paper dictionary plus glosses, (c) computer dictionary, and (d) computer dictionary plus glosses. The computer dictionary contained entries taken from the paper dictionary; the glosses were written by the researcher for the purpose of the study. Roby found that participants in the computer conditions looked up significantly more words than participants in the paper dictionary conditions.

Thus, previous studies have shown that both dictionaries and glosses can advance reading comprehension and vocabulary learning when compared to reading without such supports. The question, then, becomes not whether but how and when to use glosses during second/foreign language reading, and which type of support (dictionaries or glosses) provide the better scaffolding for the second/foreign language reader.

A critical study of this question was conducted in 1996 by Hulstijn, Hollander, and Greidanus. They investigated the influence of marginal glosses, dictionary use, and reoccurrence of unknown words on incidental vocabulary learning in noncomputerized second/foreign language reading. In their study, Dutch advanced students of French read a French story in one of three different conditions: the use of marginal glosses (providing L1 translations of unknown words), the use of dictionaries (providing a bilingual dictionary), and a control condition with neither glosses nor dictionaries provided. The study was focused on "incidental" vocabulary acquisition because the L2 readers were reading for the purpose of text comprehension and did not know in advance that they would be tested on vocabulary. In that study, among other things, Hulstijn et al. found that both the marginal gloss and the dictionary groups acquired vocabulary more effectively than the group that read only the text. They also found that the marginal gloss group had the best retention of the target words overall, primarily, they speculated, because the L2 readers in the dictionary condition seldom used their dictionaries, looking up only 12-15% of the target words. However, when the L2 readers in the dictionary condition did look up a word, their chance of remembering its meaning was greater than the average retention for the marginal gloss group. Thus, the study showed that a hard-copy dictionary is less efficient for L2 (incidental) reading vocabulary acquisition than a marginal paper gloss primarily because of the L2 readers' reluctance to use the dictionary during reading. The dictionary was, however, more effective as an aid in acquiring vocabulary when it was actually used.

Another study, by Luppescu and Day (1993), showed that although the use of a dictionary improves vocabulary acquisition and reading comprehension over reading without dictionaries, the efficiency of the dictionary becomes questionable when time and effort are considered. Consulting a conventional paper dictionary essentially distracts from and interrupts the reading process.

Given the findings presented above, especially those of Hulstijn et al., we were prompted to ask: If we can make dictionary access as convenient during reading as accessing a gloss, what are the effects on L2 reading comprehension and L2 vocabulary acquisition? We hypothesized that when the additional time/nuisance factor of dictionary use is significantly

reduced, via hyperlinked dictionaries, dictionaries become a more efficient and more effective means for enhancing reading comprehension as well as vocabulary acquisition.

Research Hypotheses

The following hypotheses were formulated at the outset of the study.

When dictionaries are as readily accessible as marginal glosses, namely through hypertext referencing, and when the lexical items are important for comprehension and are not already known to the learners:

1. On-line dictionary access will be at least as facilitative of foreign language reading comprehension as on-line glosses, which, in turn, will be more facilitative than a paper dictionary.
2. On-line dictionary access will be at least as facilitative of foreign language vocabulary acquisition as on-line glosses, which, in turn, will be more facilitative than a paper dictionary.
3. On-line dictionaries will be accessed by learners as frequently as on-line glosses and more frequently than a paper dictionary.

Participants

Participants were 75 advanced university learners of English as a foreign language at Bar-Ilan University in Israel. They were all placed in the advanced level classes via the Psychometric Exam administered by NITE (The National Institute for Testing and Evaluation).

Materials

The three reading texts chosen for the study were all authentic texts selected from the texts of the Advanced Level Course books at a different Israeli university, the Open University in Israel. For the purpose of the study, only self-contained sections of about 500 words were selected. All texts were comparable, not only in number of words, but also in sentence length and number of idea units. For each text, five reading comprehension questions were constructed; all were variations of multiple choice questions (some had multiple distractors as well as the correct response, some were true/false, some were fill-in-the-blank from a range of choices). All questions tested comprehension of either main ideas or important details, and all questions required an understanding of the target words.

Thirty target words per text were selected for hyperlinking to glosses or dictionary entries. Targeted words were important to the understanding of the text and were not guessable from context. All words were pilot-tested with 50 students not involved in the study but registered in EFL courses at the same advanced level. The students were presented lists of the words and were asked to indicate all the words unknown to them. The most frequently indicated words were selected as the original 30 target words. After running a pilot of the study at the Open University, with 10 advanced students in each

of three groups taking the test under one of the three conditions, changes in the choice of the target words were introduced.

Vocabulary tests that asked students to match the target English words with their Hebrew translations were developed to accompany each text.

In addition, 15 participants were randomly selected, 5 from each group after the last session, to participate in a structured interview. These students were asked 10 questions about their reading and vocabulary learning strategies, preferences as to the reading environment (conventional classroom or computer lab), type of dictionary, and type of gloss. These results are briefly discussed below.

We are aware that the literature is rife with controversy over exactly what constitutes a "gloss," and exactly what constitutes a "dictionary definition." For our purposes, we operationalized each of these constructs as follows:

1. An on-line gloss was an English word highlighted in the text and hyperlinked to the Hebrew translation of its meaning in that text.
2. An on-line dictionary definition was an English word highlighted in the text and hyperlinked to an on-line bilingual English-Hebrew dictionary (*Babylon* or *Michal*).
3. A paper dictionary definition was an English word in a text, not highlighted in any way, found in a paper bilingual English-Hebrew dictionary *(The Oxford Student's Dictionary for Hebrew Speakers).*

Research Design

A within-subjects, repeated measures research design was employed, allowing all participants to be exposed to all three of the treatment conditions. Each participant read a total of three computerized texts, one under each of three conditions:

1. The text hyperlinked to a computerized gloss;
2. The text hyperlinked to an on-line dictionary;
3. The text with no hyperlinks, but a paper dictionary provided.

Each of the three texts occurred in each of the three conditions. Immediately after reading text Number 1 and answering reading comprehension questions, students took a vocabulary test on target words in that text. The test measured students' immediate short-term retention of the words. To test for delayed retention of vocabulary, the same test was administered before the reading of the next text, exactly 1 week later. The fourth and final session consisted solely of the last delayed vocabulary retention test.

Microsoft Toolbook

To create the computerized texts and link them to hypertext references and then create log files of the students' activity, we needed a viable authoring system that would be relatively easy to use. For those purposes, we chose to

use Toolbook, a Windows-compatible Microsoft product. It is a user-friendly and reliable authoring environment suitable for our purposes. Toolbook had the further advantages that:

1. Texts can be transported to a page in Toolbook or typed directly on a page.
2. Words can easily be made into "hotwords."
3. Those hotwords can be hyperlinked to glosses or dictionary definitions.
4. Glosses or definitions pop up as small windows and disappear when the user clicks anything on the page, therefore making it easy to use.
5. A log file can be created that tracks the number of times the user clicks on each link and the duration of its display.
6. Reading comprehension questions and the vocabulary tests can be included in the lesson, as can any student attitudinal questionnaires.
7. Toolbook automatically saves students' work on a floppy disc, reducing the possibility of lost data.

Analyses

An analysis of variance procedure with repeated measures was performed on each one of the dependent variables: reading comprehension, short-term and delayed vocabulary acquisition, and number of word "lookups." The independent, repeated measure was the condition: on-line gloss, on-line dictionary, or paper dictionary.

Results

The descriptive results are shown in Table 1.

Table 1
Means and Standard Deviations

Condition	*Reading comprehension Max = 100%*			*Short-term vocabulary test Max = 30*			*Delayed vocabulary test Max = 30*			*Number of word "lookups" Max = 30*		
	N	Mean	SD	N	Mean	SD	N	Mean	SD	N	Mean	SD
On-line gloss	55	83.0	12.6	55	7.4	2.7	55	6.7	2.5	50	16.4	9.7
On-line dictionary	55	80.5	15.4	55	7.0	3.0	55	6.3	2.7	39	14.4	7.9
Paper dictionary	55	79.5	15.2	55	8.0	2.4	55	6.3	2.8	41	6.3	5.5

Simple inspection of Table 1 shows that students scored pretty much the same across all three conditions on the reading comprehension tests and on the short-term and delayed vocabulary tests. Although we did run the inferential statistical ANOVA tests for these variables, we need not have bothered. Contrary to hypothesis Number 1, none of the conditions had a statistically significant impact on the students' overall reading comprehension. Similarly, there were no statistically significant differences among the conditions for students' short-term or delayed vocabulary retention, although, of course, short-term vocabulary retention was better than long-term vocabulary retention. (There was also a slight trend in the short-term vocabulary test data for the paper dictionary condition to be slightly more facilitative of short-term vocabulary retention, but that wasn't significant at the p = .05 level.) Thus, we found no support for either research hypothesis 1 or research hypothesis 2.

Only our third research hypothesis was supported by our data. In the on-line gloss and on-line dictionary conditions, approximately one half of the 30 target words were looked up by the students; while in the paper dictionary condition, only about one fifth of the words were looked up. An analysis of variance procedure showed that both the on-line gloss and the on-line dictionary conditions produced statistically significantly greater numbers of word "lookups" than the paper dictionary condition (F = 14.31, p = .001). As we expected, the more cumbersome and more time-consuming nature of looking up words in a paper dictionary—which interferes with and slows down the reading process—led to fewer lookups in the paper dictionary compared to the number of lookups in the more readily accessible hypertext glosses and on-line dictionary.

Discussion

We still believe in our first two research hypotheses, even though we did not find support for them in these data. When we asked ourselves why we did not find support for our first two research hypotheses, we noted the following about the data. Although students scored relatively high (80%) on the reading comprehension questions, they didn't score very high on the vocabulary tests, either immediate or delayed (only about 20-25%). How can this be, if the reading comprehension questions depended upon understanding the target vocabulary items? It could be that the reading comprehension questions were too easy, or that they didn't really require knowledge of the target vocabulary. But we don't believe that either of these two possibilities is the case. Although the reading comprehension questions required knowledge of the vocabulary to correctly respond, there were just too few of them to adequately test all of the vocabulary items. A future replication of this research should have a better balance between the number of critical vocabulary items and the number of reading comprehension questions.

Second, even in the two on-line conditions, students looked up only about half of the target words. This could mean that many of the target words were already known to the students, but if that were so, why didn't they do

better on the vocabulary tests? Rather, we think this means that although they didn't know the words (further supported by the fact that these words were identified on word lists as unknown by a similar group of advanced students not in the study), the students didn't feel the need to look them up and were content to guess their meaning from context.

Third, we noted that there was not a lot of difference between the information contained in the glosses and in the bilingual on-line dictionary. The entries in the on-line bilingual dictionary were often similar to the gloss. In both conditions, the student finds a direct translation of the English word into Hebrew. In some cases, the dictionary offers multiple translated meanings of the word. This might explain the lack of any differences between the hypertext gloss and hypertext dictionary conditions. It doesn't explain the lack of differences between the two hypertext conditions and the paper dictionary condition.

Fourth, we noted that our students were fairly advanced learners of EFL, and we speculate that our results would be different with students at the intermediate or beginner levels, where the need for dictionaries is greater. Again, future replication of this research should be conducted with learners at lower levels of EFL proficiency.

Finally, it should be pointed out that we did test for possible differences due to the order in which the three treatments were administered to students, and we found no significant order effects.

One analysis that still remains to be done is to examine the relationships between the words that were looked up by the students and their scores on these words in the vocabulary tests to determine whether the words they looked up were the words they got correct on the vocabulary tests.

Random interviews conducted with 15 students after the four sessions revealed that some students found the highlighted hyperlinks to be helpful, and others found them disruptive. When asked whether they thought they remembered new words better when the words were glossed or when they looked them up in a dictionary, 9 out of the 15 responded that they found the dictionary more helpful. As to their preference between an on-line dictionary and a paper dictionary, 12 out of the 15 students said they preferred the on-line dictionary "because it does not interfere with the reading process and is quick." Last, several students indicated that while they appreciated the fact that unknown words could be found more quickly when they were reading in a computerized lab, they also noted that they could not get immediate feedback on their answers to the reading comprehension questions and that they preferred to do their EFL reading in a conventional classroom where there is more personal contact with the teacher and more immediate feedback on their performance.

Authors

Adina Levine is assistant coordinator of advanced EFL courses at Bar–Ilan University in Israel. She holds a Ph.D. in linguistics from the Hebrew University, Jerusalem. She has published papers on reading comprehension and different aspects of foreign language acquisition. She is a frequent presenter at TESOL, AAAL, and AILA conferences.

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Patricia L. Carrell, Professor Emerita, Southern Illinois University, retired from full-time university teaching at Georgia State University in June 2002. She continues to be professionally active, conducting research, publishing, guest lecturing, presenting at conferences, and reviewing for numerous journals and publishers. In her career, she has published extensively on L2 reading.

Lily Vered has taught EFL in Israel on all levels—school to university. She was a teacher educator at Levinsky College of Education and for many years head of its English Department; she has worked for the Open University of Israel since 1983 as a teacher educator, materials developer, and project coordinator. In the last decade she has specialized in exploiting technology for EFL and on-line education.

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