The Effects of Electronic Dictionary Use on Reading Comprehension and Vocabulary Retention of EFL Students

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Abstract

The dictionary is an essential learning tool for second and foreign language (L2) learners. Yet, the effects of dictionaries, either in printed or electronic form, have never been systematically investigated in the Algerian context. Consequently, this paper compared readers' L2 text comprehension and vocabulary retention across two dictionary conditions. Reading time, dictionary usage, degree of comprehension, and recall of words were the dependent measures employed. Forty-four EFL sophomores were assigned two reading tasks under two conditions: using a printed dictionary (PD) at one time and an electronic dictionary (ED) at another. The presentation mode of the reading tests was on computer screen alone. We used a piece of monitoring software (MS) to record the subjects' lookups in the ED condition and to take notes of the time each subject needed to finish the reading task in both conditions. A paired-samples t-test was then conducted to test the research hypotheses. As for the vocabulary retention tests, we administered a pretest and posttest to the subjects in both lookup conditions (PD and ED), and an independent-samples t-test was conducted to compare memory for words. The analysis of information revealed that the ED enabled the subjects to read the text in significantly less time than the PD did. It was also found that the subjects looked up significantly more words in the ED than in the PD. However, the results indicate that the type of dictionary accessed does not significantly influence comprehension. With regard to vocabulary retention, the findings revealed that PD lookup fosters better recall of vocabulary. It was concluded that EDs would be effective and motivating aids to reading comprehension but could be detrimental to vocabulary retention.

Keywords: Electronic dictionary, printed dictionary, Log files, reading comprehension, Vocabulary retention

1. Introduction

Recently, and as technology develops, the prevalence of conventional PDs has slowly declined due to the remarkable advancements in computer-mediated aids. So in addition to PDs, various types of electronic reference materials have become increasingly available to L2 learners, creating more options for coping with unknown or partially known words. These materials, including pocket electronic dictionaries, CD-ROM dictionaries (CDs), and online dictionaries, have the potential to enhance L2 learning significantly with their features such as the ease and speed of look-ups, the quantity of information, the variety of search roots, and multimedia capacity (Nesi, 1999). Although the term "electronic dictionary" encompasses a variety of devices and technology, the present study focuses only on the dictionary stored in CD-ROM and installed on a computer.

Along with many countries in the Arab world, Algeria is one of the counties where CDs are becoming particularly popular. One major reason for their popularity is due to their extremely cheap price in comparison to PDs. In addition, most CDs are shared and downloadable from the Internet, so it just takes a few tricks and clicks on the Web to have the most popular and up-to-date English dictionaries installed on one's computer. With this variety of dictionaries in print and CD-ROM formats on the market, Algerian learners of English now have as wide a range of choices as ever.

To the best of my knowledge, although more Algerian EFL learners appear to take advantage of CDs nowadays, no research has been carried out on how EFL learners use them and how they might affect L2 learning.

In an attempt to fill in the aforementioned research gap, the present study looked into the use of CDs compared with PDs in relation to L2 learning. In particular, the researcher tried to examine the potential effects of students' use of CDs and PDs on their reading comprehension and vocabulary retention. For that matter, the study addressed the following research questions:

1. Will there be any significant difference in the reading time between the two dictionary conditions (CD and PD)?
2. Will the two dictionary conditions allow any substantial difference in the reading scores?
3. Will there be any noteworthy difference in the number of look-ups between the two dictionary conditions?
4. Is there any correlation between the type of the dictionary used and the degree of vocabulary retention?

In the light of the above questions, the following hypotheses have been put forward:

1. Students will spend less time reading the text in the CD condition than in the PD condition.
2. Comprehension performance will be higher in the CD condition than in the PD condition since CDs are expected to promote better reading comprehension.
3. Students in the CD condition will look up more words to comprehend the text than in the PD condition.
4. Students will remember words better after using PDs than using CDs as the words looked up in the PD will be better retained than those looked up in the CD.

2. Literature Review

2.1. Dictionary Use and Reading Comprehension

Although they use dictionaries in the four language skills, L2 learners use them predominantly while reading (Béjoint, 1981; Chon, 2008). Several studies examined learners' use of dictionaries in reading comprehension as it is "a very private matter, occurring as the need arises, and often behind closed doors" (Nesi, 2002, p. 1).

Language teachers repeatedly get perplexed about the role of dictionaries in reading. Many of them often discourage the use of dictionaries believing that dictionaries do not help students to understand vocabulary in context and because students overuse them at the expense of developing their self-confidence and the ability to guess from context (Bensoussan, Sim & Weiss, 1984). Similarly, teachers' worries over vocabulary learning may result from students' using bilingual dictionaries too blindly, or from students expecting a one-to-one correlation between their own language and English (Stein, 1990).

As far as reading fluency is concerned, researchers and educators are concerned that students' excessive checking of dictionaries interferes with short-term memory and hinders the comprehension processes (Knight, 1994), and, in this way, dictionaries can be cognitively disruptive. A student must know how to spell the word, stop reading, search for the word in an alphabetical order in the dictionary, and then select the appropriate connotation or sense. This is believed to suspend the process of forming a cohesive connection on both sentence and text level. As a result, the frequent lookup may interrupt the flow of concentration and make reading a process of word-by-word decoding, in which the whole meaning is often missed (Summers, 1988; Scholfield, 1982). Moreover, Rhoder and Huerster (2002) claimed that students might not be motivated to stop reading each now and then to look up a word which is represented in a short abstract text, so students may skip those words hoping that the context will explain them.

Despite researchers' and educators' concerns, recent research has shown that dictionary use can benefit language learners. Those who are in favor of using the dictionary in L2 learning suggest that dictionaries can be helpful to learners because, after all, their main use is for lexical information, which is of the utmost importance in L2 learning (Anderson & Freebody, 1981). Consulting a dictionary during reading is "an integral part of the reading process" (Bensoussan, 1983, p. 341), as it helps the reader to find the meaning of the difficult vocabulary, ascertain its meaning based on contextual information, and learn more meanings of the word in other contexts, with different collocates and constructions. This view is also reflected in dictionaries being commonly considered among the language learning aids much favored and mostly used by language learners (Laufer, 2011). In addition, there is evidence that dictionaries facilitate not only vocabulary acquisition (Hulstijn, Hollander, & Greidanus, 1996; Knight, 1994; Luppescu & Day, 1993) but also comprehension of texts (Knight, 1994).

2.2. Moderate Dictionary Use

A review of the relevant literature concerning L2 dictionary use while reading suggests that selective dictionary use may lead to improved comprehension and efficient vocabulary development (Prichard, 2008). In the reading process, dictionary use usually competes with guessing, or just ignoring unknown words. Good readers make good choices about when to use each of these; they do not use the dictionary exclusively, and often do so after making attempts at guessing. Hosenfeld mentioned (as cited in Wang, 2007, p. 6): "It is not that successful readers never look up words . . . but only after efficient strategies have failed".

Nation and Coady (1988) also considered looking up words in a dictionary as the last means of checking a guess, and the guess was only made if the use of the wider context did not provide the meaning. Jones (1995) contended that dictionary use is an effective strategy for learners of English. Such a claim, however, does not necessarily mean that dictionaries are the

sole or the best source of linguistic knowledge, but that dictionaries are one of the tools that learners make use of to figure out the meaning of words (e.g., deducing the meanings of the unknown words from the clues in a text).

2.3. Computerized Dictionary Use

Recent developments in computers have triggered a whole line of interest in computerized dictionaries, online dictionaries, or vocabulary glosses integrated into language learning software or web pages. The latest development of glossing can be seen as computerized dictionaries distributed either in CD-ROMs or through the Internet.

Computerized dictionaries have appeared and offered a wide range of possibilities for the EFL classrooms. Torres and Ramos (2003) highlighted some of the features of computerized dictionaries such as interactivity, quick access, multimedia effects, and extra features. Computerized dictionaries solve the slowness of the process of PDs; some believe that the ease and speed of computerized dictionary lookup might encourage more dictionary use and reading (Weschler & Pitts, 2000). Similarly, Hulstijn et al. (1996) suggested that, because computerized entries are easier to use than the traditional ones (PDs), students will be more likely to use them, unlike the time consuming process of finding information by leafing through PDs.

Moreover, Leffa (1992) compared the efficacy of electronic dictionary glossaries with the traditional PD on text comprehension in a translation task among 20 university students enrolled in a beginner EAP course. Leffa found that the electronic dictionary users understood more of the passage than those who used PDs, 86% and 62% respectively, and the former needed 50% less time to translate the passage. Leffa asserted that in traditional dictionary usage, the learner loses the context of the passage during the time it takes to locate the dictionary entry. He proposed that with a computer dictionary, the speed of access allows the context to remain in the short term memory and, thus, accelerates the comprehension process.

However, in spite of the fact that CDs solve the slowness of process of PDs, some believe that the ease of use may result in shallow processing of the looked up words and will therefore be detrimental to retention. While the ease and speed might encourage more dictionary use and reading (Weschler & Pitts, 2000), the convenience might not be a good thing for vocabulary learning ((Stirling, 2003), as the increased speed of CD lookup may be at the expense of engagement and deeper processing of the words resulting in less vocabulary learning (Peters, 2007).

Overall, more research has to be done to explore the effects of CD use on L2 learning, and how such dictionaries are used, or how they might be used (Nesi, 1999). In the following section, the CD use patterns of some Algerian EFL students will be explored.

3. Instruments and Data Collection Methods

3.1. Participants

Forty-four EFL students (females: 30, males: 14, *M* age = 20.25, age range: 18-30 years) took part in this study. The students were in their second year of study in the Department of English at Constantine University 1 in Algeria. The main reason for our choice of the sample is that students, at this level, with more English learning experience than freshmen, are expected, and at times required, to try some outside readings by themselves. To fill this need, students very often find themselves under situations where they have to cope with longer texts and entirely new vocabulary items during reading. So, to ease this burden, they would feel it necessary to use dictionaries to facilitate their understanding. The subjects consisted of homogenous male and

female students, all sharing similar educational and linguistic backgrounds, and were regularly taking classes in 'Oral Expression' with the researcher.

3.2. Data Collection Tools
3.2.1.   Reading tests from the TOEFL PBT
This study employed two authentic reading tests adapted from the TOEFL Paper-based test, and each test included ten multiple-choice questions aimed at assessing the students' overall understanding of the text and some words and structures. The texts were identical in length and difficulty (word count: 370, 368).

3.2.2.   Dictionaries
Two types of dictionaries were used by the students in this study: a paper dictionary of the students' own choice, and the Cambridge Advanced Learner's Dictionary on CD-ROM. The reason for allowing the students to use their own PDs was to make them feel at ease using the dictionary that they were more familiar with, thereby eliminating any unwanted variables related to the unfamiliarity with the dictionary layout and organization of information, which might invalidate the results of the experiments. Since the PDs used in the study were brought by the students themselves, it was assumed that the students were familiar with them.

3.2.3.   Monitoring Software
A piece of MS installed in the students' computers was set to record the students' lookups in the CD condition, and to take notes of the exact time each student needed to finish the reading tasks in both conditions. The information recorded by the MS was electronically saved in log files concealed in the students' computers for later retrieval by the researcher (See Figure 1 for MS features used in the study).

Figure 1. Time and lookups' recording features in the monitoring software

Enabling the **Window Title Monitoring** feature will start monitoring and recording all applications windows titles on the computer to see what files have been opened and closed, all marked with a timestamp. Similarly, enabling the **Keyboard Monitoring** feature will start the keystroke spy to monitor and log all keystrokes and everything typed during monitoring sessions.

3.2.4.   *Vocabulary Tests*

The vocabulary tests were adapted from the "501 Vocabulary Questions" book published by LearningExpress (2003). The aim of the book is to measure students' knowledge of words generally encountered in textbooks, newspapers and magazines, and especially in standardized tests like the SAT (Scholastic Aptitude Test) or the GRE (Graduate Records Examination). This book was chosen by the researcher for its high practicality in assessing L2 learners' vocabulary.

The vocabulary pretest required supplying definitions for ten supposedly unknown words in ten sentences. The words were printed in **bold** face and were considered to unlikely be known to a fair proportion of students, in view of their proficiency level.

The vocabulary posttest was divided into two parts (5 target words each): The first part was a "multiple-choice" test in which the words were given with a very little contextual support. There were four choices per item: one key (correct answer) and three distractors (options other than the correct answer). Each item of the test required picking the appropriate word. The second part was a "fill in the blank" test in which the words were given alone. The test required filling the blanks with the right word.

3.3. Procedure

3.3.1.   *CD Use Training*

The study took place in a computer lab during the researcher's regular class and under his supervision. Prior to the experiments, the students received 15 minutes of training and watched a short video tutorial about the features and main search functions in the CD. The subjects were briefly introduced on how to use the mouse to move the cursor and then left-click inside the search box of the CD, which was all they had to do in the computer if they wanted to find out the meaning for a given word in the text. The students were then allowed to freely practice on their own so that they interact with the computers and become familiar with the search process and interface design of the dictionary. Since most of the subjects were familiar with computers, this seemed to offer no difficulty for them.

3.3.2.   *Procedure in Reading Comprehension*

The presentation mode of the reading tests was on computer screen alone. The reason for this was to allow the MS to capture the time each student spent on reading. The tests were administered in two separate sessions. In the first session, the students read a text and answered comprehension questions with access to a CD. The MS recorded the students' look-ups without them being aware that they were being monitored for their lookup behaviour. In the second session, the students read another text with access to a PD. However this time, they were instructed to report on the words they had looked up in the dictionary by themselves. It is noteworthy that there was no time limit set on the reading tasks, and that the students were allowed to use the dictionaries whenever they found it necessary. They were instructed to open the reading files by themselves and then save the changes and close the files as soon as they have finished doing the tasks, so that the MS could make notes of the exact time each student started and finished the reading tasks. Reading time was calculated through subtracting the file-opening time (Starting Time) from the file-closing time (End Time).

3.3.3.   Procedure to Test Vocabulary Retention

In order to test students' vocabulary retention, the researcher administered a pretest and posttest to the subjects in both PD and CD lookup conditions. The tests were administered only on paper since the only tested variable was word recall. The time taken to find the target words in the dictionaries was not considered for it is not a variable of interest.

To account for the problem of test wiseness, the researcher assigned 22 students -half of the sample- to the PD lookup condition and the other half -22 students- to the CD lookup condition. It would have been impractical if the same students did the pretest and posttest in one condition, and then did a similar pretest and posttest in the other.

In the pretest, each group of the students were instructed to supply the definitions for the words in **bold** in the sentences using either a PD or a CD. However, they were not informed that a vocabulary retention test would be given regarding the words looked up in the pretest. The researcher also made sure the students did not take any notes regarding vocabulary outside the test room in that they were neither allowed to use mobile phones nor rough papers.

After a week lapse, the students were given the posttest to measure their retention of the words they looked up a week earlier. Yet, this time, students were not allowed to use any dictionary type, but were encouraged to rely only on their memory.

3.4. Data Analysis

IBM SPSS Statistics version 21 was used to analyse the data retrieved from the log files. Descriptive statistics including the calculations of the means and standard deviations were produced for every variable in the study. Inferential statistics including Independent and Paired-samples t-tests were conducted to examine if there were any significant differences between the two conditions regarding the reading time, reading scores, lookup frequency, and vocabulary retention. Such calculations allowed the researcher to check the hypotheses. The significance level in this study was set at $p = 0.05$.

4.   Results and Discussion

4.1. Reading Time

Table 1 indicates the means and standard deviations for reading time in PD and CD conditions.

Table 1. *Means and standard deviations for reading time*

Descriptive Statistics					
Conditions	N	Minimum	Maximum	Mean	Std. Deviation
Printed CD-ROM	44 44	00:40:08 00:24:23	01:14:48 01:04:30	00:54:16 00:43:29	00:06:55.42 00:10:12.79

As shown in Table 1, the students spent 54.16 minutes on average reading the text in the PD condition. In the CD condition, reading time was reduced to 43.29 minutes. A paired-samples t-test was conducted to find out whether the mean difference between the two conditions is statistically significant (See Table 2).

Table 2. *T-test results for reading time*

Paired Samples Test				
Conditions	Paired Differences	t	df	Sig.

	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				(2-tailed)
				Lower	Upper			
Printed – CD-ROM	00:10:46.14	00:09:26.97	00:01:25.47	00:07:53.76	00:13:38.51	7.559	43	.000

The results indicate that there was a highly significant difference in the reading time for PD (M = 00:54:16, SD = 00:06:55) and CD (M = 00:43:29, SD = 00:10:13) conditions; t (43) = 7.559, p = .000. These results suggest that using the CD does have an effect on reducing the time spent while reading. Specifically, our results suggest that when the students used the CD, they managed to read the text in significantly less time than when they used the PD. Therefore, our hypothesis which stated that students would spend less time reading with access to a CD is safely validated.

4.2. Reading Scores
Table 3 indicates the means and standard deviations for reading scores in PD and CD conditions.
Table 3. *Means and standard deviations for reading scores*

Descriptive Statistics					
Conditions	N	Minimum	Maximum	Mean	Std. Deviation
Printed	44	2	9	5.84	1.751
CD-ROM	44	2	9	6.14	2.075

As shown in Table 3, the students scored 5.84 points on average in the PD condition, and 6.14 points in the CD condition. A paired-samples t-test was conducted to find out whether the mean difference between the two conditions is statistically significant (Table 4).
Table 4. *T-test results for reading scores*

Paired Samples Test								
	Paired Differences							
Conditions	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference		t	df	Sig. (2-tailed)
				Lower	Upper			
Printed – CD-ROM	-.295	2.258	.340	-.982	.391	-.868	43	**.390**

The results indicate that there was not a significant difference in the scores for PD (M = 5.84, SD = 1.751) and CD (M = 6.14, SD = 2.075) conditions; t (43) = -.868, p = .390. These results suggest that there were no significant differences in the two conditions on the comprehension measure, and that the students' performance was fairly the same regardless of the type of dictionary used. Therefore, our hypothesis which stated that CD use would promote better comprehension scores is refuted.

4.3. Number of Lookups

Table 5 indicates the means and standard deviations for the number of lookups in PD and CD conditions.

Table 5. *Means and standard deviations for number of lookups*

Descriptive Statistics					
Conditions	N	Minimum	Maximum	Mean	Std. Deviation
Printed	44	3	11	5.82	1.782
CD-ROM	44	0	21	7.05	3.785

As shown in Table 5, the students looked up 5.82 words on average in the PD condition and 7.05 words in the CD condition. A paired-samples t-test was conducted to find out whether there is a significant difference in the number of look-ups in both reading conditions (See Table 6).

Table 6. *T-test results for number of lookups*

Paired Samples Test								
	Paired Differences							
Conditions	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference		t	df	Sig. (2-tailed)
				Lower	Upper			
Paper – CD-ROM	-1.227	3.911	.590	-2.416	-.038	-2.082	43	**.043**

The results indicate that there was a significant difference in the number of lookups for PD (M = 5.82, SD = 1.782) and CD (M = 7.5, SD = 3.785) conditions; t (43) = -2.082, p = .043. These results suggest that the students looked up significantly more words in the CD than in the PD. Therefore, our hypothesis which was that students would look up more words in the CD than in the PD is validated. Due to the differences in the search effort associated with each type of dictionary, searching through PD pages to find a word would naturally require more effort than simply typing in the unknown word into the CD definition window. So the students were probably reluctant and unwilling to use their PDs so often while reading.

4.4. Vocabulary Retention

Table 7 indicates the means and standard deviations for the number of words recalled in PD and CD conditions.

Table 7. *Means and standard deviations for recalled vocabulary*

Descriptive Statistics				
Conditions	N	Mean	Std. Deviation	Std. Error Mean
Printed	22	4.91	1.109	.236
CD-ROM	22	3.82	1.763	.376

As shown in Table 7, the students remembered 4.91 words on average in the PD condition and 3.82 words in the CD condition. Since each half of the subjects did only one test

type, an independent-samples t-test was conducted to find out whether the difference in recall of words between the two test groups (CD and PD) is significant (See Table 8).

Table 8. *T-test results for recalled vocabulary*

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Scores	Equal variances assumed	2.829	.100	2.457	42	**.018**	1.091	.444	.195	1.987
	Equal variances not assumed			2.457	35.365	.019	1.091	.444	.190	1.992

The results indicate that there was a significant difference in the vocabulary recall scores for PD (M=4.91, SD=1.109) and CD (M=3.82, SD=1.763) conditions; t (42) = 2.457, p = 0.018. These results suggest that PD use really does have an effect on memory for words. Specifically, our results suggest that when students look up words in a PD, their memory for words increases. The difference in word retention might be attributed to the effort and relatively longer search process involved in using the PD, unlike in the CD where the look up process is quick and effortless. Our hypothesis which argued that the words looked up in the PD would be better retained than those looked up in the CD is validated.

5. Conclusion

In the study, we attempted to examine the effects of CD use on reading comprehension and vocabulary retention of some Algerian EFL second-years. The findings are in line with previous studies which investigated the effects of CD use on L2 learning. They indicate that the CD was much more motivating and exciting to learners and thus encouraged them to look up more words. The results also suggested that CD use reduces reading time significantly, thereby alleviating the effort needed to read long texts. However, the results do not provide evidence that dictionary type affects text comprehension.

On the other hand, significantly lower recalls were found on lookups performed with access to CD. This indicates that processing lexical information more elaborately through scanning a PD leads to better retention. This deep semantic processing enhances memory by creating memory traces that are stronger than the ones created when the items are superficially processed in CD lookup.

Since dictionary use research is relatively new in the Algerian context, similar studies are needed to generate more understanding in this interesting area of research. Such studies may consider changing the setting, population, or data collection methods probably through choosing a bigger sample and video-taping students' CD lookup behavior by using specific screen-recording software widely available on the Internet.

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