Investigating the Effectiveness of the Uses of Electronic and Paper-Based Dictionaries in Promoting Incidental Word Learning

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Abstract. Although there are a numerous of studies in the facilitative effects of dictionary consultation in promoting word learning, no research has ever been conducted to investigate the effectiveness of a hybrid use of paper-based and electronic dictionaries. The present research, therefore, responds to this call and compares the effectiveness of the pure use of either paper-based or electronic dictionary and the hybrid use of both. The empirical results demonstrate the superiority of the paper-based dictionary over the electronic dictionary, the usefulness of repetition and the greater effectiveness of the hybrid use of both paper-based and electronic dictionary than the pure use of either. We further conclude that the significance of processing for constructing memory, repetition for consolidating memory and diversity for reinforcing memory should be emphasized.

Keywords: Incidental word learning · Repetition · Hybrid usage · Paper-based and electronic dictionaries

1 Introduction

The importance of word knowledge in learning a second language is widely acknowledged in the second language research literature. Word knowledge plays a significant role in communication. It is regarded as an essential item by language learners, and it has close connections with grammatical knowledge [2]. Even though there are times when communication breaks down if learners fail to place words in the proper order, pronounce them accurately, or mark them with proper grammatical morphemes [19], transmission of meaning can generally be achieved. However, the absence of the correct word often impedes the conveyance of a message completely

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[35]. Circumlocution and gestures can compensate to some extent, but they demand too much effort [19]. Knowing the right word is a vital requisite for language communication. As word knowledge is of significance for language learning, research on word learning has been one of the most active areas in SLA research in the past two decades.

2 Related Works

2.1 Incidental and Explicit Word Learning

One theoretical distinction in the literature on word learning studies is that between incidental and intentional learning. Incidental word learning refers to learners acquiring new words from contexts without intending to do so, such as picking up new words during free reading. Intentional word learning, on the other hand, refers to learners acquiring words while intending to do so, such as studying a list of new words or completing activities in a workbook for a set of target words [2]. The main purpose of intentional word learning is to deliberately commit lexical information to memory, whereas the focal attention in incidental word leaning is on something other than learning the language itself. Incidental learning is, to a certain degree, meaning-focused, while intentional learning is language-focused.

In order to distinguish intentional learning from incidental learning, Eysenck [9] proposed that it is necessary to know whether subjects were forewarned about the existence of a subsequent lexical retention test. According to Eysenck, when subjects are aware of the upcoming retention test, they pay more attention to the word meanings and forms so as to memorize them. In this case, knowing the word is an explicit aim rather than a by-product of an activity, hence this kind of learning is intentional. Yet when the subjects are not forewarned about the test, they are unlikely to be motivated to focus on word learning, hence such learning is incidental. However, contradicting this, Keating [13] observed that even though his subjects were informed of upcoming vocabulary posttests, they did not make a conscious effort to commit lexical information to memory. Thus awareness of a subsequent test did not necessarily result in intentional word learning.

In the case of incidental learning, explicit attention on a particular word and its meaning may indeed be induced, but incidental learning does not ensure learners' recognition of the precise meanings of individual words as they may sometimes consider it sufficient to grasp the overall meaning of the message. Thus, while incidental and intentional learning may be a useful theoretical distinction, it does not adequately account for word learning. Hulstijn [11, 12], for instance, has argued that it is the quality and frequency of the information processing activities that determine the retention of new information far more than the question of whether learners are forewarned of upcoming retention tests or whether they process lexical information with or without deliberate intention to commit it to memory.

Schmitt [30] held that two main processes of word learning are incidental learning, which occurs with frequent exposures when attention is focused on the use of language, and explicit learning, which occurs with focused exercises. Explicit learning is facilitative for it promises the greatest chance of information memorization by virtue of

direct attention, but it is laborious and has a high demand of focused concentration. Thus explicit learning activities should be complemented by incidental learning activities, with the major emphasis on language use rather than language learning [30].

2.2 Paper-Based Dictionary Consultation

A great deal of controversy exists among the previous studies on the facilitative effects of dictionary consultation on word learning. On the one hand, some researchers believed that using a dictionary while reading led to inefficient learning. They argued that learners using dictionaries spent more time on reading than learners who read without dictionaries. Luppescu and Day [21] found that learners using dictionaries took twice as long to complete reading tasks than learners who were not allowed to use dictionaries. Studies by Bensoussan et al. [3] and Knight [15] determined that extra time spent on looking up words was unlikely to be used efficiently, as more proficient learners showed little or no gain when using dictionaries. Koyama and Takeuchi [17] even argued that using a dictionary did not always improve comprehension, because dictionary consultation interfered with readers' short-term memory and prevented them from focusing on the text as a whole. In addition, it was found that learners with access to dictionaries sometimes located the wrong dictionary entry resulting in miscomprehension [4, 21, 33].

On the other hand, some researchers argued that dictionary consultation assists reading comprehension and promotes word knowledge development. A series of three studies by Summers [32] showed that learners who used a dictionary scored significantly higher in both reading comprehension and vocabulary learning. Luppescu and Day [21], in a study of nearly 300 Japanese learners of English, also observed that learners who used bilingual dictionaries while reading performed better on vocabulary posttests than learners who read without dictionaries. Similarly, Knight's [15] research on less proficient learners of Spanish revealed that dictionary consultation facilitated reading comprehension and led to word learning even if more proficient learners showed little or no gain. Bogaards [4], who noted that learners may sometimes locate the wrong dictionary entry, also acknowledged that learners were significantly more likely to identify the correct definition in the dictionary than they were to accurately guess the meaning of unknown words from context.

2.3 Electronic Dictionary Consultation

The use of electronic dictionaries has flourished since the 1990s. On the one hand, researchers, teachers and learners are all interested as they are less time-consuming and have more updated information [7, 18, 34]. Another obvious advantage of the electronic dictionary is that it encourages exploratory browsing, and the great number of look-ups is likely to be conducive to incidental word learning [16, 23]. However, many learners may not have comprehensive knowledge of the functions and advantages of electronic dictionaries, and hence failed to make good use of them. It is therefore

important for teachers to provide learners with explicit instruction in using electronic dictionaries so as to better facilitate word learning [16].

On the other hand, many scholars doubt the effectiveness of electronic dictionaries in promoting word learning. Chen [5] believed that electronic dictionaries is inferior to paper-based dictionaries as students, while using paper-based dictionaries, focused more on various aspects of word knowledge (such as part of speech, sample phrases and sentences), thus obtaining better learning results. Sharpe [31] also noted that the ease of electronic dictionary consultation resulted in the short time needed for information retrieval, which further led to shallow processing of the words being consulted, and consequently hindered the word learning.

Although there are many studies on the consultation of either paper-based or electronic dictionary, none of them has ever investigated the hybrid use of both paper-based and electronic dictionaries. The present research, therefore, investigated and compared the effectiveness of the pure use of either paper-based or electronic dictionary and the hybrid use of both, attempting to bring new insights into the field of dictionary consultation for incidental word learning.

3 Method

The present research involved two experiments, comparing the facilitative effects of a paper-based dictionary, an electronic dictionary and the hybrid use of both in promoting word learning. The first experiment compared the Collins COBUILD Advanced Learner's Dictionary (CCALD) and an electronic version of it. Yet the second one, as shown in Table 1, involves comparisons of four conditions of the use of paper-based and electronic dictionaries. Before participating in any of these two experiments, all the subjects were tested by using Paribakht and Wesche's [24] Vocabulary Knowledge Scale (VKS) to investigate their pre-knowledge of the target words.

Table 1. The six conditions in two experiments

Experiments	Conditions	Stage 1	Stage 2
Experiment 1	Condition 1	Paper-based	NA
	Condition 2	Electronic	NA
Experiment 2	Condition 3	Paper-based	Paper-based
	Condition 4	Electronic	Electronic
	Condition 5	Electronic	Paper-based
	Condition 6	Paper-based	Electronic

3.1 Experiments

Experiment 1. 62 subjects participated in the first experiment, 31 of whom completed a reading comprehension task under Condition 1, and the other 31 under Condition 2. In condition 1, the subjects were asked to read a text of 506 words and look up ten underlined target words in the CCALD for better comprehension. The same reading

text with the same ten target words was applied to Condition 2. However, these two conditions were different in that an electronic version of the CCALD was provided to subjects in Condition 2. Being undergraduates from universities at Hong Kong and obtaining IELTS scores ranging from 5.5 to 6.5, all subjects shared similar levels of English proficiency. They were required to follow the instructions for different conditions strictly. 10 subjects participating in this experiment were interviewed after their completion of the task.

Experiment 2. The second experiment was similar to the first one in that the same reading text, the same ten target words, the same paper-based and electronic dictionaries were applied. Yet it was different as a second reading text of 505 words with the same ten target words being underlined was added. In other words, the subjects who participated in Experiment 2 needed to read two texts that imposed dictionary consultation of target words. All four conditions in this experiment included two parts then, between which a break of 30 min was given to the subjects. In Condition 3, the subjects were asked to firstly read the first text and look up the ten target words in the paper-based CCALD, and then read the second text and look up the same target words in the same dictionary. In Condition 4, the electronic version of the CCALD was used. Yet in Condition 5, the subjects were asked to use the electronic version of the CCALD while reading the first text and the paper-based one for the second text, and the other way round in Condition 6. The subjects of this experiment shared similar backgrounds and language proficiency levels with those of Experiment 1. 32 subjects participated in Condition 3, 30 in Condition 4, 31 in Condition 5 and 30 in Condition 6. Additionally, 20 subjects participating in this experiment were interviewed after their completion of the task.

3.2 Reading Texts and Target Words

As both experiments of this research were reading-based, it was essential that the reading texts be suitable for the research objectives and be appropriate for the English proficiency levels and common knowledge of the participants. The two texts were developed through two stages: firstly, selection of texts whose topics were likely to be similarly familiar to all subjects; secondly, modifications of these texts so as to ensure that their levels of difficulty were suitable, neither too difficult nor too easy, for the subjects. Topic familiarity has been noted to have great influence on leaners' reading comprehension and word acquisition by many scholars. Ellis [8], Nassaji [22] and Pulido [26] all found that topic familiarity and expertise in a certain subject facilitated reading comprehension and word retention. Pulido [27, 28] also noted that topic familiarity was consistent with a greater rate of successful inferencing. It was thus crucial to find a topic that was similarly familiar to all the subjects. Therefore, two topics of healthy eating and small class education had been selected. Furthermore, the texts were shortened to 506 and 505 words respectively, and also modified to ensure that the density of words unfamiliar to the subjects were approximately 2 % of the texts. To achieve this, all words used in these two texts, except the ten target words, were from the most frequently used 4000 words in terms of the word frequency list of American English [6].

3.3 Assessment

All the subjects who were not interviewed were immediately tested on their initial learning of the target words by using the Vocabulary Knowledge Scale (VKS). This VKS consists of a self-report format and an interview. It uses a five-point scale to evaluate subjects' self-perceived and demonstrated knowledge of specific words [14]. Its five scales indicate the following five incremental levels of word knowledge: (1) the word was not familiar to the subject; (2) the word was familiar but its meaning was not known; (3) a correct synonym or translation for the word could be given; (4) the word could be used with semantic appropriateness in a sentence; and (5) the word could be used with grammatical and semantic appropriateness in a sentence [24]. The VKS was not designed to estimate general vocabulary knowledge but rather to track the early development of specific word knowledge [24, 29]. It elicited the subjects' perceived knowledge of vocabulary items backed up by verification of demonstrated knowledge [14].

One week after the experiments, all the subjects were unexpectedly assessed on their retention of the target words. The delayed posttests were carried out one week after the immediate posttests following Anderson and Jordan [1], who found that one week after the end of a study period was a critical point of time for the memorization of target information. Further study conducted by Pimsleur [25] also concluded that a word which can be recalled in a delayed posttest taken one week after the initial input was very likely to have been stored in the long-term memory of the subjects.

4 Results

From the descriptive statistics of the pre-knowledge, initial learning and retention of the target words obtained by the subjects participating in the six conditions of dictionary consultation (shown in Table 2 and Fig. 2), it can be seen that: (1) the facilitative effectiveness of paper-based dictionary was greater than that of electronic dictionary in promoting word learning; (2) the hybrid uses of paper-based and electronic dictionaries were similarly effective regardless of the sequence of the use of different dictionaries; (3) the hybrid uses of paper-based and electronic dictionaries were more effective than the pure use of the paper-based or electronic dictionary.

Table 2. Descriptive statistics of the subjects' scores

	N	Pre-knowledge of the target words	Initial learning of the target words	Retention of the target words
Condition 1	31	0.07	12.09	9.08
Condition 2	31	0.08	10.94	8.56
Condition 3	32	0.06	18.06	14.93
Condition 4	30	0.07	16.83	13.87
Condition 5	31	0.07	18.97	15.88
Condition 6	30	0.06	19.01	15.90

4.1 Effectiveness in Promoting Word Learning

The effectiveness of the six conditions of dictionary consultation in promoting the learning of the target words was examined by running paired samples t-tests. The results assessing the difference between the pre-knowledge of the subjects participating in different dictionary consultation conditions and their performances in the two posttests demonstrated significant gains of knowledge about the target words. It is therefore indicated that the subjects had obtained significant development of knowledge about the target words through completing the different tasks, and these tasks had significant facilitative effects in promoting word learning (Fig. 1).

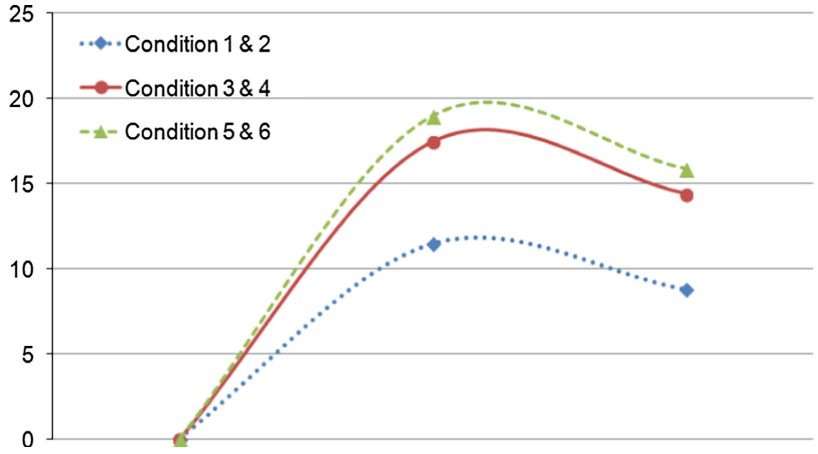

Fig. 1. Average pre-knowledge, initial learning and retention of Condition 1&2, 3&4, and 5&6

4.2 Comparing the Six Condition

To examine whether significant differences existed among the effectiveness of the paper-based dictionary, the electronic dictionary, the pure and hybrid uses of them, the scores of subjects participating in the six different conditions were compared. The results indicated that (1) the paper-based dictionary (condition 1) promoted significantly more effective word learning than the electronic dictionary (condition 2); (2) the repetitive use of dictionaries (condition 3, 4, 5 and 6) significantly increased the effectiveness of dictionaries in promoting word learning (condition 1 and 2); (3) the hybrid uses of paper-based and electronic dictionaries (condition 5 and 6) were significantly more effective than the pure use of either of them (condition 3 and 4); and (4) the hybrid uses of paper-based and electronic dictionaries in different orders were similarly effective (condition 5 and 6).

5 Discussion

In this section, we explain the results of the two experiments from the perspectives of the significance of processing for constructing memory, the significance of repetition for consolidating memory and the significance of diversity for reinforcing memory.

5.1 The Significance of Processing for Constructing Memory

The results of the first experiment of this study, which show that the paper-based dictionary is more effective than the electronic dictionary, provide further support to the arguments of Lockhart and Craik [20], Sharpe [31] and Laufer and Hulstijn [19]. Lockhart and Craik [20] postulated that the opportunity of remembering a piece of information is conditional upon the levels of processing rather than the length of time that it is stored in short-term memory. The subjects being interviewed after their task completion also revealed that the consultation of paper-based dictionary required more time and hence involved greater attention in the processing of information relevant to the target words, thus contributing to word learning. In line with Sharpe's [31] observation, our interviewees revealed that the subjects who consulted the electronic dictionary did not process the information of the target words as comprehensive and deep as those who consulted the paper-based dictionary. Additionally, our results add credit to Laufer and Hulstijn's [18] Involvement Load Hypothesis in that our interviewees acknowledged that the consultation of paper-based dictionary induced deeper and more elaborate processing of the target words than the consultation of electronic dictionary.

5.2 The Significance of Repetition for Consolidating Memory

The significantly better facilitative effects of the conditions in the second experiment (the conditions which asked the subjects to consult the target words twice) than those in the first experiment (the conditions which only imposed the consultation of the target words one time) indicate that repetitions play a crucial role in consolidating memory. Timely repetitions are facilitative for word learning [10, 36]. In accordance with this argument, our interviewees noted that it was the second time of the consultation helped them better comprehend various knowledge aspects of the target words and store such information in their memory. Some of them even admitted that they had difficulty in understanding every piece of information of the target words during their first time of consultation, yet the second chance of reading such information contributed greatly to their thorough mastery of the target words. Therefore, the subjects firmly believed that repetitions were conducive to word retention.

5.3 The Significance of Diversity for Reinforcing Memory

To reinforce the learning of the target words, it is critical to diversify the information provided to learners as the hybrid uses of paper-based and electronic dictionaries were

significantly more effective than the pure use of either of them. Our interviewees pointed out that the repetition of exactly the same thing made them bored, yet the repetition of something slightly different but mainly the same facilitated their digest of the information they had processed before and prompted their further exploratory of the new information. The hybrid use of both paper-based and electronic dictionaries also enables learners to profit from the advantages of both types of dictionaries and explore the best out of them. A hybrid use of paper-based and electronic dictionaries, therefore, should be advocated as both types have certain merits and the complimentary use of them works best.

6 Conclusion

The present research firstly reviews studies in incidental word learning and the facilitative effects of paper-based and electronic dictionaries. In a response to the call for research on the hybrid use of both paper-based and electronic dictionaries, we conducted two experiments to compare the effectiveness of these two types of dictionaries, the pure use of either of them, and the hybrid use of both. The experimental results demonstrate the superiority of the paper-based dictionary over electronic dictionary, the significance of repetition for memory consolidation, and the great effectiveness of the hybrid use of both paper-based and electronic dictionaries. However, this research is limited in terms of its scope of study and the possible influence of experimental conditions, and it is hoped that future studies will offer more insights into this field.

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