Research on the Influence of Computer Hypermedia Annotations on Incidental Vocabulary Acquisition in English Reading

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Abstract—This paper aims at disclosing the influence of computer hypermedia annotations on the incidental vocabulary acquisition of Chinese students in English reading. Firstly, the author defines and explains the basic concepts, and summarizes the development trend of English reading vocabulary teaching. Through several experimental cases, the author discusses the effect of different annotation modes, ranging from English mode, Chinese mode, image mode, no-image mode, to the combination of texts and images, on the students' incidental acquisition of English vocabularies, and analyzes the test results of the experimental cases in light of the characteristics of long-term memory. According to the empirical results, the combination of Chinese annotations and images has better effect than other modes, and plays a positive role in promoting students' incidental vocabulary acquisition.

Keywords—computer hypermedia, English annotations, English vocabulary, incidental vocabulary acquisition, empirical study

1 Introduction

The proliferation of computer and development of network technology have given birth to a series powerful technology tools that display hypermedia annotations in different forms (e.g. text, audio, image, and video) and different places in the text. With the aid of the new tools, it is possible to find the meaning of new words with just a few clicks instead of resorting to the monotonous and time-consuming dictionary-consulting strategy [1]. The annotations of second language learning have been extensively studied in foreign countries. In contrast, domestic scholars have just begun to study computer-aided hypermedia annotations. Although it is widely believed that computer-assisted learning has a positive effect, almost no one has studied the specific effects of incidental vocabulary acquisition in reading [2]. With the popularity of computer hypermedia equipment in the classroom in China, hypermedia technology in the teaching practice has drawn more and more attention. In view of the situation and the importance of vocabulary in English learning, it is of great necessity to make

better use of computer hypermedia technology to improve students' word-base and vocabulary acquisition.

In light of the above, this paper focuses on the effect of hypermedia annotations on the Chinese English learner' vocabulary acquisition in English reading, aiming to reveal the impact of different modes of hypermedia annotations on incidental vocabulary acquisition. Firstly, the author interprets and analyzes the definitions of the concepts, laying a solid theoretical foundation for the experimental research. Then, the author sets the objectives of the experimental research, and conducts an experiment among college students to verify the attainability of the objectives. The conclusions are drawn through the combination of theory and practice. Finally, the author gives instructions on computer hypermedia annotations in light of the formation characteristics of long-term memory.

2   Theoretical basis

2.1   Incidental vocabulary acquisition

The term "incidental acquisition" first appeared in the papers on experimental psychology in the early 20th century [3].Some scholars hold that incidental vocabulary acquisition is different from purposeful learning (e.g. the purposeful memorization of words by reciting word lists, doing vocabulary exercises, and so on.); it refers to the incidental learning of words in the course of doing other learning tasks. The modifier "incidental" means the new words are learned through the comprehension and coherent grasp of the full text because vocabulary learning is not the primary focus of the learner or the main content of the learning material [4]. Despite the lack of a unified definition of incidental vocabulary acquisition in the research field of second language learning, most of second language researchers recognize the important role of incidental vocabulary acquisition in second language learning.

2.2   Annotation

Some scholars believe that this term can be traced back to the Middle Ages, when students turned to annotations for better understanding of articles in foreign languages, usually in Latin. For the coherence of the reading process, annotations are traditionally placed at the margin or bottom of the page so that the students can apprehend the meaning of the article without looking up the dictionary. Some other scholars suggest that annotation also refers to the hint that pops up after the learner clicks on an unfamiliar word. Text explanations (the combination of the target language and English) and illustrations of words or phrases are two common modes of annotations.

2.3 Hypermedia

Hypermedia presents relevant file information in multiple forms of media. It combines the multimedia and multimedia hypertext in the information browsing environment [5]. In addition to text, hypermedia also expresses information through graphics, images, sounds, animations, or video clips, and establishes links between different media. The dual-coding theory holds that our memory system contains two independent but interrelated systems of information processing codes: the verbal system and the nonverbal system. The former processes language codes and stores language information, while the latter handles nonverbal factors, mainly images, emotional responses, and visual imagery [6]. It is proved that the learner has better understanding and memory of the words processed simultaneously by the two systems than those processed by the verbal system alone.

3 Application of computer hypermedia technology in English reading

3.1 English reading case – text annotations

The hypermedia and other computer aided technologies are increasingly applied in English reading in China. This paper takes an excerpt (Figurer 1) from an article for extensive reading in *Experiencing English: Integrated Book* (Edition 2) and carries out a case study of the application of computer hypermedia technology in the vocabulary annotations of English reading (Heidari & Mohammad, 2003).

My Advice to Students: Education Counts

My basic advice is simple and _heartfelt_: Get the best education you can. Take advantage of high school and college. Learn how to learn.

It's true that I dropped out of college to start _Microsoft_, but I was at Harvard for three years before dropping out——and I'd love to have the time to go back. As I've said before, nobody should drop out of college unless they believe they face the _opportunity_ of a lifetime. And even then they should reconsider.

Fig. 1. The case of the application of computer hypermedia technology in the vocabulary annotations of English reading

As shown in Figure 1, the learner can view the corresponding notes by clicking on the underlined keywords [7,8]. The hypermedia annotations make it more convenient and less time-consuming for students to complete the reading of the whole article, and improve the efficiency and conciseness of the English reading process. It also enables the learner to acquire key new words incidentally in the course of reading [9].

3.2 English reading case – image annotations

In addition to text annotations, hypermedia technology gives birth to image annotations, and even voice annotations. The key word "skating" is taken from a piece of reading material and assumed to be new to the learner. Besides, it is assumed that the text annotations are insufficient for the learner to understand the key word. In this case, we can use images to help the learner get the meaning of the word through the application of hypermedia technology [10].
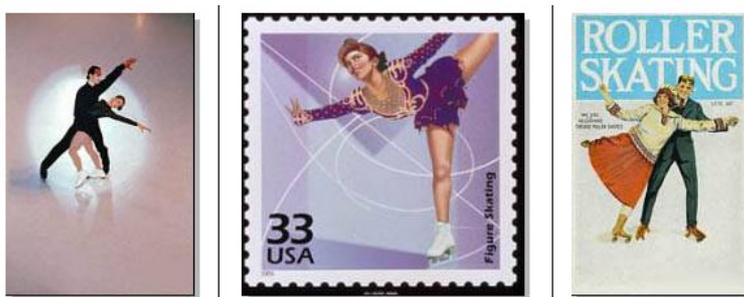
Fig. 2. Image annotations for "skating"

Thanks to the latest development in computer hypermedia technology, the text annotations and image annotations can either be used alone or in combined forms [11]. Next, we will demonstrate the impact of different annotation modes on incidental vocabulary acquisition through concrete examples.

4 Empirical study of the effect of computer hypermedia annotations on incidental vocabulary acquisition in English reading

4.1 Empirical research method

In view of the current research in China and the purpose of this paper, we must probe into the followinge issues in the empirical experiment.

(a): The effectiveness of image annotation mode and no-image annotation mode on incidental vocabulary acquisition;

(b): Comparison between the effects of Chinese annotations and English annotations on incidental vocabulary acquisition;

(c): The influence of the combination of Chinese and English annotations and interactive image annotations on incidental vocabulary acquisition.

117 second grade non-English majors are selected from four different classes. The four groups share the same male/female ratio. The students usually score 70-80 points in English exams [12]. The analysis of variance (F=1.45, p=0.36>0.05) demonstrates that the four groups of students stay on the same level of English performance.

Reading materials. In order to ensure that the reading material is neither too difficult nor too easy for the subjects, we use an article in *New College English (Second Edition) Fast Reading* (Book 2) published by Shanghai Foreign Language Education Press [13]. Featuring fluent narration and good storytelling, the 728-word article contains no professional knowledge that may hinder the subjects' understanding of the article.

The following steps are taken to guarantee that the target vocabulary is new to the subjects. First, ask ten students, who will not participate in the experiment, to read the selected passage and mark the new words [14]; Second, let 3 experienced English teachers read the article, and highlight the words they believe that are unknown to the students; Third, choose low frequency words. The words marked by the teachers and students constitute the target vocabulary [15]. The word length is controlled between 5 and 9 letters. Under the guidance of computer teachers, we prepare 4 different hypermedia modes using relevant software: 1. Chinese annotations; 2. Chinese + image annotations; 3. English annotations; 4. English + image annotations [16].

Test the contents of the test paper. The reading test verifies the students' comprehension of the article and mastery of the vocabulary with five multiple choice questions. The points scored by a student in each question are added up to get his/her total score. The student is awarded 1 point for each correction option and 0 point for each wrong option. The full mark is 12 points.

4.2 Experimental steps

1. Experimental arrangement: After the learning task is introduced, the 4 groups of students are arranged to read the article. The article is annotated differently for each group. Then, the students are asked to take a 35-min long reading comprehension test.
2. Instant vocabulary test: Right after the 35-min test, the four groups of students are arranged to take another 15-minute vocabulary test. The second test aims at checking the incidental vocabulary acquisition of 12 target words.
3. Delayed vocabulary test: Two weeks after the instant test, the students sit the vocabulary test again to verify their mastery of the vocabulary. In the new test, the order of words is rearranged.
4. Data collection by SPSS11.0: This step collects the scores of the instant and delayed vocabulary tests under the 4 modes [17].

4.3 Analysis and discussion of research results

Table 1 displays the average scores of the instant and delayed tests under the modes of Chinese annotations, English annotations, Chinese + image annotations, and English + image annoteations.

According to the table above, the average scores of the instant and delayed tests under the mode of Chinese annotations are 5.35 and 3.35, respectively; the average scores of the two tests under the mode of Chinese + image annotations are 6.37 and 4.3, respectively; the average scores of the two tests under the mode of English anno-

tations are 3.94 and 2.83, respectively; the average scores of the two tests under the mode of English + image annotations are 4.17 and 2.9, respectively. It is clearly revealed by the statistics that the annotations have improved the students' mastery of the vocabulary to different degrees, and the effect lasts 2 weeks at the least. Hence, computer hypermedia annotations do have a positive effect on incidental acquisition of English vocabulary.

Table 2 shows the t-test results of the samples in the cases of pure text annotations. The average score of the group under the mode of Chinese annotations is 5.97, while that of the group under the mode of English annotations stands at 3.89. Through the analysis of the t-test results (t=8.54, p<0.05), we can tell the significant difference between the two groups. It is easy to draw the conclusion that the Chinese annotations mode is more conducive to the learning and memorization of new words than the English annotations mode.

Similarly, Table 3 illustrates the differences between image annotations mode and non-image annotations mode. It can be inferred that the two modes have no significant difference in the learning and understanding of new words when image is taken as the only influencing factor.

Table 1. The average score of the target groups

Language	Chinese				English			
Image	**No**		**Yes**		**No**		**Yes**	
	M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
Instant test	5.35	1.31	6.37	0.97	3.94	1.35	4.17	0.69
Delayed test	3.35	0.98	4.33	1.00	2.83	0.75	2.90	0.59

Table 2. T Test results of separate samples in the cases of pure text annotations

Language	**Chinese**		**English**		**T**	**Sig**
Test	*M*	*SD*	*M*	*SD*		
Instant test	5.97	1.21	3.89	0.77	8.54	0
Delayed test	3.75	1.08	2.5	0.59	5.68	0

Table 3. t test results of separate samples by image annotations

Language	**With Image**		**Without image**		**T**	**Sig**
Test	*M*	*SD*	*M*	*SD*		
Instant test	5.18	1.40	4.61	1.37	2.66	0.59
Delay test	3.20	1.13	3.13	0.86	2.30	0.23

The influence of Chinese, English, and interactive image annotations on incidental acquisition of English vocabulary is discussed below. In Table 4, 1 stands for Chinese annotations, 2 stands for Chinese + image annotations, 3 stands for English annotations, and 4 stands for English + image annotations.

Table 4. The test results of the four different annotation modes

	Annotation mode	Annotation mode	Variance	standard deviation	Significance
Instant test	1	2	-0.96	0.31	0.002
		3	1.46	0.29	0.000
		4	1.19	0.30	0.000
	2	3	2.43	0.29	0.000
		4	2.16	0.30	0.000
	3	4	-0.27	-0.29	-0.034
	Annotation mode	Annotation mode	Variance	standard deviation	Significance
Delayed test	1	2	-1.22	0.22	0.000
		3	0.28	0.21	0.183
		4	0.39	0.22	0.073
	2	3	1.50	0.21	0.000
		4	1.90	0.22	0.000
	3	4	0.040	0.21	0.058

The experiment proves that the four annotation modes, namely Chinese annotations, English annotations, Chinese + image annotations, and English + image annotations, have promoted the incidental vocabulary acquisition of second language learners to different extents. The finding is echoed by many research results in foreign countries. The experiment also reflects the obvious effect of the interaction between text factors and image factors on the incidental vocabulary acquisition by the subjects in the reading process. With the extensive use of electronic text in second language teaching, it is an effective way to improve the students' incidental acquisition of second language vocabulary through the addition of hypermedia vocabulary annotations in reading materials. The provision of hypermedia annotations not only enhances the students' understanding of the text, but also improves their understanding, impression and memory of new words.

In the instant and delayed tests, the Chinese annotations mode exhibits superior performance to the English annotations mode. This is because the subjects tend to think in their native language. In terms of the mastery of new words, the image mode is expected to be more effective than the non-image mode. However, there is no significant difference in the actual test results, indicating that the students are not fully ready to embrace the application of computer hypermedia in English teaching. In light of this, we must pay attention to two questions in English teaching in China: One the one hand, we should attach more importance to the learning process, and should not judge the English proficiency of a student purely based on exam scores; on the other hand, we ought to promote the application of computer hypermedia annotation technology in English reading.

From the delayed test results, it is also learned that vocabulary acquisition rate stands at only 36% and 23.6%, indicating that a single short-term learning is far from enough for the learner to fully master the vocabulary. As a results, further consolida-

tion is needed after incidental vocabulary acquisition to deepen and extend the memory of new words.

4.4 Relationship between long-term memory and vocabulary acquisition

Figure 3 describes the structure and formation of long-term memory. It offers a proper explanation of the significant impact on vocabulary acquisition from the interaction between image annotations and text annotations.
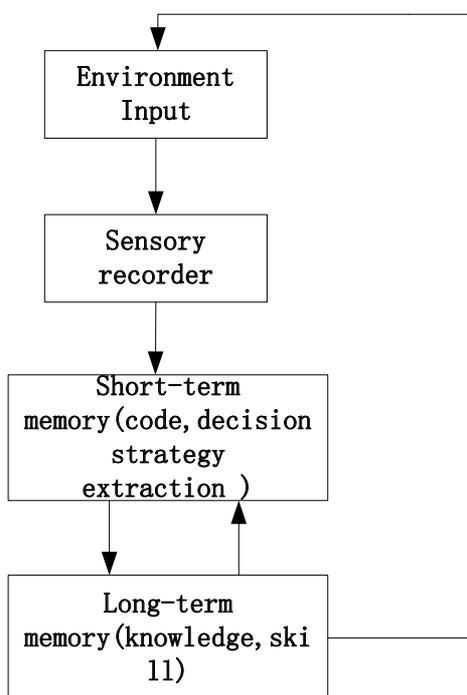

Fig. 3. Memory structure diagram

The formation of long-term memory is heavily influenced by environmental factors. The body records the signals in the surrounding environment, forms short-term memory based on the recorded signals, and develops long-term memory through memory coding, extraction, etc. Unless the input information is noticed by the learner, it will not be processed by the memory system in the body. Thus, we must find the proper ways to attract the students' attention so as to achieve effective learning and memory.

In the application of computer hypermedia in vocabulary annotations of English reading, the interaction between image annotations and text annotations triggers the generation of multiple sensing signals of the body. That is why the score of incidental vocabulary acquisition under this mode is higher than that of any other mode.

5 Conclusion

Vocabulary has always been a bottleneck in the English learning among Chinese students. This paper studies and analyzes the application of computer hypermedia technology in English reading annotations. It elaborates on the concepts of incidental acquisition, annotations and hypermedia, and carries out an experiment to test the levels of students' incidental vocabulary acquisition in different modes. The following conclusions and prospects are drawn through the analysis of the test results and in light of the formation characteristics of memory:

1. The application of computer hypermedia promotes the students' vocabulary learning for all annotation modes have a positive effect on incidental vocabulary acquisition.
2. The combination of computer hypermedia texts and images is more likely to stimulate the formation of long-term memory than pure text or image annotations.
3. The computer hypermedia technology should be promoted to the teaching of English reading so that the students are more willing to accept the teaching mode and realize incidental learning and mastery of vocabulary in the reading process.

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