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Research Article

Computer Multimedia Aided Word Annotation for Incidental Vocabulary Acquisition in English Reading

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Abstract

As computer technology advances at a full speed and the national education has been highly internationalized, there is uproar of English education in China. From primary preschool education to advanced education in universities, the computer multimedia English teaching model has been generally recognized. Some staggering problems such as low English vocabulary and poor memory in the learning process are highlighted. For this purpose, the paper, on the grounds of inputs and attention hypotheses, investigates how the incidental vocabulary acquisition of English reading is subject to English and Chinese annotation languages, the individual, multiple annotations and unannotated format. Test objects are established in the permutation and combination modes. Vocabulary, profound knowledge scale and SPSS software are adopted to analyze the test results. After the test, it turns out that multiple Chinese annotation mode have the best effect of incidental vocabulary acquisition in English reading process. It is hoped that the study can effectively inspire the English learners, teachers and the dissertation and journal editors.

Keywords

Annotation • English • Incidental Vocabulary Acquisition • SPSS

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As the national education institutions are highly internationalized, the English teaching occupies a more important position at all ages. A surge of computer multimedia technologies makes the diversified English learning modes emerge. Among them, the learning mode in the word annotation forms plays an important role in improving students' reading comprehension vocabulary in English learning process. Why many English vocabulary learning modes appear is attributed to the fact that English vocabulary lays a foundation for listening, speaking, reading and writing skills, and also serves as an important part irreplaceable in foreign language education. By far, the English vocabulary annotation generated by computer multimedia aided technologies has exerted a great effect on the incidental vocabulary acquisition in reading comprehension at home and abroad (Paek, Hoffman & Saravanos, 2016).

The study of the incidental vocabulary acquisition in reading comprehension at home and abroad mainly include the following three arguments: First, the memory effect of re-learning new words that appear in the material after reading comprehension is far better than that of single task of completing reading comprehension. For the former, the learning mode is good at the incidental vocabulary acquisition; second, the multi-selective annotations have a better learning effect on incidental vocabulary acquisition. An annotated environment in the case of multiple annotations in a specific reading material allows a better reading effect than the unannotated environment; third, Chinese students will get different effects on the vocabulary learning in reading comprehension in the cases of the Chinese and English annotations. In the instant test, it is observed that the former is better than the latter, but just the other way in the time delay test. Most of study objects mentioned above are students in universities, who hold different positioning of vocabulary learning effect on the reading comprehension with Chinese and English annotations. The mode only involves the presence or absence of annotation.

Subsequently, this paper builds a rich test combination available from different arrangements of single, multiple annotated and unannotated formats for Chinese and English languages. Here take middle school students as test objects, who are tested for the vocabularies and depth knowledge scales. The test results are analyzed by SPSS software. It turns out that the memory effect of multiple Chinese annotations in reading comprehension are at best, basically adapting to the laws and methods of vocabulary learning of middle school students. It is hoped that this study will provide some help and technical support for all English learners (Esmond, 2017).

Incidental vocabulary acquisition and theoretical study

Incidental vocabulary acquisition and influence factors

The concept of incidental vocabulary acquisition was proposed by Nagy, Herman and Anderson in the study of children's native language learning modes. Studies have shown that children's language is unintentionally acquired from various meaningful activities, as a by-product of children's cognitive activities. Incidental vocabulary acquisition corresponds to intentional learning characterized by the learner's focus on vocabulary learning, as an inevitable result produced by conscious behavior (Tang & Treffersdaller., 2016).

Incidental vocabulary acquisition in the specific reading comprehension is to translate the content into the semantic information as main focus. In the process of reading comprehension, the vocabulary acquisition is an attached product of semantic learning. It does not regard vocabulary learning as the cognition subject. Therefore, in the study of incidental vocabulary acquisition, there are some influence factors including vocabulary size, ability of guessing words, reading materials and tasks, which interact with each other, as shown in Fig 1.

As shown in Fig 1, the four factors of incidental vocabulary acquisition influence and promote each other. The content style and task of reading materials are important factors for incidental vocabulary acquisition of learners. If learners are familiar with the content of reading materials and interested in the writing style, then it is easy for them to finish the task of reading materials. The vocabulary size and the ability to guess words are the other factors to restrict the incidental vocabulary learning. When the learners with wide vocabulary make the topic of reading comprehension, they have an obvious advantage in the case of whether to complete the task or the incidental vocabulary learning, while the ability to guess words is required for reading comprehension since it plays a good function as a bridge to semantic comprehension and the vocabulary learning (Khezrlou, Ellis & Sadeghi, 2017).

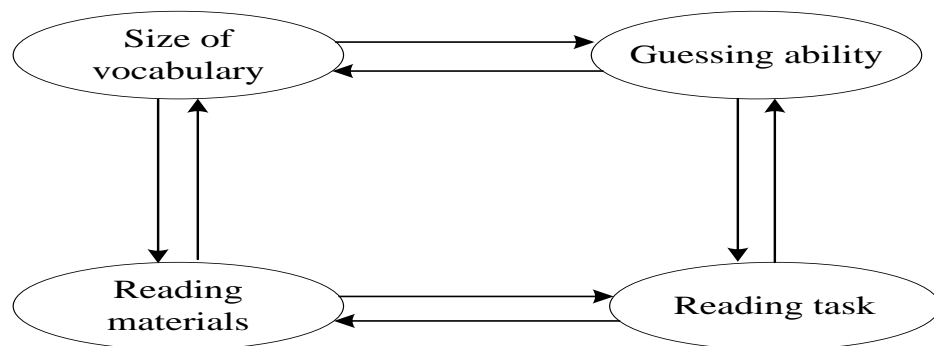


Figure 1. Four factors in incidental vocabulary acquisition.

Annotation

In the teaching process, the annotation has become an indispensable tool, especially for learning new words, required annotations can play a good guiding role for learners. In normal use, the annotations are often added in the vicinity of the relevant texts, often in bold or in colored forms, and play a role of attracting attention. Along with the advancement of computer technology, multimedia technology has also produced a huge effect on annotation teaching, allowing learners to reach the incidental vocabulary acquisition from the different reading modes (Grand *et al.*, 2017).

From the analysis of the technical features of the annotation itself, there are the Chinese and English annotations. According to the form of annotations, there are single, multiple annotations and no annotation. Different formats of annotations in different languages will have a great influence on learners, so that the modes in which the languages and formats are arranged and combined will generate a variety of annotated content forms, also as the core of the study, as shown in Fig 2.

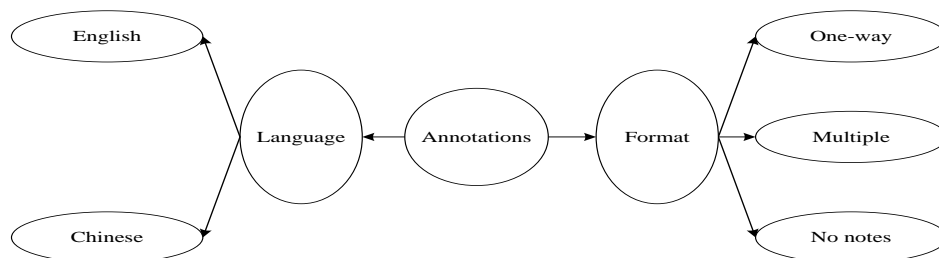


Figure 2. Language and format of annotations.

As shown in Fig. 2.2, there is difference in the classification of annotations from different perspectives. According to the languages and formats, a variety of permutation and combination modes can be available. This paper focuses on multiple Chinese and English annotations, individual, multiple annotations and no annotation. (Lund & Douglas, 2016).

Attention and inputs assumptions

Attention assumption is defined such that learners carry out knowledge recognition and brain registration on knowledge in a short time memory when they absorb and transform the semantics of the reading materials. If attention distracts from it in a short time, effective learning will not be produced, so that the vocabulary will not be memorized effectively. So, attention is a precondition for the occurrence of learning. In the test design and study, this paper assumes that all students can exert the effect of the reading content learning and incidental vocabulary acquisition with specific attention (Albaladejo *et al.*, 2018).

The basic idea of the inputs hypothesis is that the learners do a lot of inputs on the reading materials driven by different tasks, including the search of the target vocabulary, the comparison of new words, the marks of annotations, the subjective initiative and other processing and operations. When completing reading materials and learning the vocabulary, the increase in the task processing inputs has a positive effect on the incidental vocabulary acquisition. Even the vocabulary learning with high inputs has a memory effect better than the vocabulary with low inputs. In the test layout, it is believed that students can proactively look up the target vocabulary, and independently learn the derivatives from the target vocabulary and similar words, that is, the vocabulary inputs for the test are equal (Cohen *et al.*, 2018).

So, the attention and inputs hypotheses in the test are designed as the theoretical foundations. The two theoretical hypotheses play an important guiding role in the tests, and exclude a large number of artificial uncertain factors, reducing the uncertainty of the tests, and enhancing the reliability, objectivity and feasibility of the test. The theoretical foundations of the tests are shown in Fig 3.

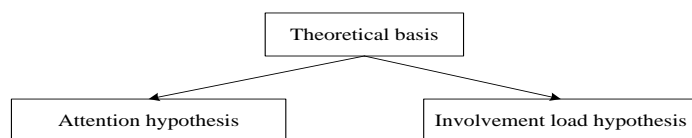


Figure 3. Language and format of annotations.

Empirical Study Process

Test problem and tools

Test problems. The vocabulary annotation in reading comprehension plays an important effect on the incidental vocabulary acquisition of learners. In the test, the students' memories about vocabulary are analyzed by the instant and time delay tests, thereby finding the more reasonable annotation mode to exert a better effect on the incidental vocabulary acquisition. The main questions the study focuses on include:

- (1) Which of the two language annotations in English and Chinese is more conducive to incidental vocabulary acquisition;
- (2) Which of the three formats of annotations, i.e. single, multiple annotations and none, in the instant test can play a more positive effect on the incidental vocabulary acquisition;
- (3) In the time-delay test, which of the annotation modes that languages and formats permutate and combine in different ways can enhance the effect and the extension of the vocabulary memory after-acquisition.

Test tools. The test tools use the vocabulary test and deep knowledge scale, and the test results are calculated and analyzed by SPSS software (Konetes, 2011).

The students' vocabulary is tested by the Vocabulary Size Test (VST). Only those students who have a vocabulary at a VST level of greater than 2000 can participate in this test. The VST upgrades a level every exceeding 1000 words. It is a comprehensive, scientific and reliable vocabulary test method.

The Vocabulary Knowledge Scale (VKS) is used to measure the vocabulary knowledge level, mainly assesses to which degree the target vocabulary is mastered by students. According to the VKS standard, there are five levels. The specific scores are shown in the Table 1.

Table 1
Knowledge Level Assessment Criteria

Category	Score	Meaning
I	1	Not at all familiar with the word
II	2	Familiar with the word, but I don't know what it means.
III	2	Familiar with the word, but I don't know what it means.
	3	Able to write synonyms or translation for this word
IV	2	Familiar with the word, but I don't know what it means.
	3	Able to write synonyms or translation for this word
V	2	Familiar with the word, but I don't know what it means.
	3	Able to write synonyms or translation for this word
	4	Accurate Semantic Use of Target Words in Sentence-making
	5	Accurate semantic and grammatical use of target words in sentence-making

As shown in Table 1, the scores of the five levels set by VKS are definite and have strong operability, so that the objective vocabulary mastery degrees can be classified for the students.

For the test results, the classic SPSS data analysis software is commonly used to analyze data in many large-scale Internet companies and laboratories in domestic and foreign markets. The paper uses the SPSS24 to analyze the effect of incidental vocabulary acquisition based on data from the instant and time-delay tests.

Test object

Before the comparative judgement matrix is built,

The test objects are students from Classes 10 and 11, Senior Grade Three in Beijing. Their English vocabulary levels are all more than 2000 after VST test, and the English scores of the final exam are 94.07 and 97.87, respectively. The specific scores are distributed as shown in Table 2 and 3.

Table 2
Comparison of the Achievements of Class 10 and Class 11

Class	N	Mean value	Standard deviation	Error value of mean
10	47	94.0745	9.41436	1.37323
11	41	97.8659	10.83572	1.69225

Table 3
Analysis of the Differences in the Achievements between Class 10 and Class 11

	T-test of mean equation				
	t	df	Sig.	Mean difference	Standard error value
English Grades	-1.757	86	.083	-3.79139	2.15843

Test procedure

The test lasts for four weeks, the subjects and processes should be strictly arranged and designed in weekly test every time the test is conducted to make the tests objective and reliable (Perez *et al.*, 2014).

Students' vocabulary is tested using the VZT in the first week. The test consists of four sets of multiple-choice questions. Each set of questions is presented in 10 single-choice questions. The correct choice gets 1 point. The student's test score is divided by 40 and then multiplies by 100 to get the student's actual vocabulary. There are 85 students whose vocabulary exceeds 2000. As the test subjects, 85 students are then divided into five groups in accordance with the vocabulary distribution. The students are rationally grouped according to the one-way analysis of variance. The specific classification standards are shown in Table 4.

From the results of the univariate analysis in Tables 4, it is known that the mean value changes from 24.8235 to 26.5882, the significance $p=.161 > 0.05$, which indicates that the vocabulary levels of the students grouped in the test are basically fair.

In the second week, the reading material, the article named with the Reform and Opening-up in the China Daily, is chosen for feasibility test. Here, the English teacher of the class is invited to circle the new words in the material at less than 5%, and the target vocabulary is determined.

Table 4
Average Scores and One-way Variance of Vocabulary Scores in Five Groups

	N	Mean value	Standard deviation	F	Saliency
Group 1	17	26.5882	2.37326	1.686	.161
Group 2	17	24.8235	4.33352		
Group 3	17	26.4706	2.78652		
Group 4	17	24.4118	2.89523		
Group 5	17	25.8824	2.75868		
Total0--0-	85	25.6353	3.15416		

The subjects are tested in the third week. The target vocabulary is marked with none, Chinese annotations, English annotations, multiple English annotations, and individual English annotations, and then distributed to the five groups of students, respectively. The first, second and fifth groups of students complete the questions at the end of material after the reading of 20 min; the third and fourth groups complete the above test in 25 minutes. The completed questions include five single-choice and two translation questions in an attempt to test the subject's mastery of vocabulary acquisition in the test. After that, an instant test is conducted within 10 min, mainly testing the target vocabulary in the reading material.

The time-delay test is completed in the fourth week. Instant test lasts for about ten days, then time-delay test is conducted. The VKS is used to test the knowledge depth. During the test, it is required to disturb the order of the test questions, in order to ensure the authenticity of the test.

Results and Discussion

Influence of annotated language on incidental vocabulary acquisition in an instant test

Statistical analysis is performed on data of the above test procedure by the software SPSS24, and the results are shown in Table 5.

Table 5
Differences in Scores of Five Annotations in Real-time Tests

Grades	Unidirectional English		Unidirectional Chinese		Multiple English		Multiple Chinese		No notes	
	M	SD	M	SD	M	SD	M	SD	M	SD
	26.71	5.14	30.82	10.42	29.88	5.99	35.00	6.78	26.00	4.21

As shown in Table 5, under the guidance of multiple Chinese annotations, the student test score is 35.00, significantly higher than the other four annotation modes. The average score of single Chinese annotation is 30.82, ranking second, nearly one point higher than that of multiple English annotations. The results tested from single English and no annotations are 26.71 and 26.00, respectively. As described above, the influence of annotation languages on incidental vocabulary acquisition in the instant test are as follows: multiple Chinese annotations > single Chinese annotation > multiple English annotations > single English annotation > no annotation (Ghabanchi *et al.*, 2010).

Influence of five annotation modes on incidental vocabulary acquisition in the instant test

In the software SPSS24, statistical analysis is performed on data from instant test, according to the univariate analysis of the five annotation modes. The specific results are shown in Table 6.

Table 6
One-way ANOVA of Five Annotations in Instant Testing

Category	Sum of squares	df	Mean square	F	Saliency
Between groups	880.843	4	220.211		
In groups	3771.111	82	45.989	4.788	.002
Total	4651.954	86			

As shown in Table 4-1, the test scores produced by the five different annotations in the instant test are different, and the difference among them can be calculated by $(F(4,82) = 4.788, p = 0.002 < 0.05)$. It can be seen that the vocabulary score of multiple Chinese annotations is significantly higher than that of other groups, $MD = 8.57143$ and 8.5333 .

In the end, the SPSS software is used for the five different annotation modes to calculate the mean difference, standard deviation, significance and the upper and lower limits of the confidence interval, the specific statistical results are shown in Table 7.

Table 7
Multiple Comparison of Five Annotation Methods

Annotation mode I	Annotation mode J	Average difference value	Standard deviation	Saliency	Confidence interval	
					Lower	Upper
U-English	U-Chinese	-4.39496	2.78707	.747	-13.026	4.3258
	M-English	-3.45378	1.86898	.535	-9.0638	2.1563
	M-Chinese	-8.53333	2.02227	.002	-14.677	-2.4663
	No notes	-.03810	1.43810	1.000	-4.3504	4.2742
U-Chinese	U-English	4.39496	2.78707	.747	-4.2358	13.0257
	M-English	.94118	2.91436	1.000	-7.9844	9.8668
	M-Chinese	-4.17647	3.01496	.858	-13.349	4.9962
	No notes	4.35686	2.65867	.713	-4.0337	12.7474
M-English	U-English	3.45378	1.86898	.535	-2.1563	9.0638
	U-Chinese	-.94118	2.91436	1.000	-9.8668	7.9844
	M-Chinese	-5.11756	2.19438	.234	-11.721	1.4860
	No notes	3.41569	1.67149	.412	-1.7126	8.5440
M-Chinese	U-English	8.53333	2.02227	.002	2.4663	14.6765
	U-Chinese	4.17647	3.01496	.858	-4.9962	13.3491
	M-English	5.11765	2.19438	.234	-1.4860	11.7213
	No notes	8.57143	1.84128	.001	2.8461	14.2205
No notes	U-English	.03810	1.43810	1.000	-4.2742	4.3504
	U-Chinese	-4.35686	2.65867	.713	-12.747	4.0337
	M-English	-3.41569	1.67149	.412	-8.5440	1.7126
	M-Chinese	-8.57143	1.84128	.001	-14.221	-2.8461

Comparison of vocabulary memory retention results against incidental vocabulary acquisition

the time-delay test after a week is compared with the instant test conducted on the day of the test for the vocabulary memories of the subjects on the incidental vocabulary acquisition, and the results are counted up in Table 8.

Table 8
Comparing the Results of Real-time Test and Delayed Test

Mode	N	Instant test		Delay test	
		Mean value	Standard deviation	Mean value	Standard deviation
U-English	17	26.7059	5.14496	25.2941	4.74032
U-Chinese	17	30.8235	10.41775	26.4118	10.01910
M-English	17	29.8824	5.98835	27.0588	4.16039
M-Chinese	17	35.0000	6.78233	26.5294	5.14924
No notes	17	26.0000	4.21307	24.9412	3.28768

As shown in Table 4-4, the results of the instant test under the five annotation modes are better than that of the time delay test. The greatest change occurs in the delay test result under multiple Chinese annotations, which declines from 35.00 in the instant test to 26.5294 in the time-delay test. In order to better display the variation range of the two tests, the scores under two test modes are displayed in the histograms, as shown in Fig. 4.1.

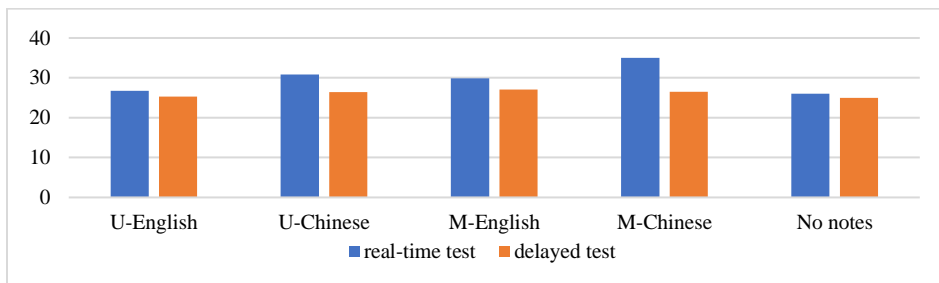


Figure 4. Comparing the results of real-time test and delayed test.

As shown in Fig. 4.1, in the two test sessions, the scores of incidental vocabulary acquisition are significantly different, according to the statistical results, it is known that, in the instant test, the scores of incidental vocabulary acquisition comes with the following results: multiple Chinese annotations > single Chinese annotation > multiple English annotations > single English annotations > no annotation; in the delay test, the scores of incidental vocabulary acquisition are sorted: multiple English annotations > Multiple Chinese annotations > single Chinese annotation > single English annotation > No annotation. Such sorting results can be further analyzed by means of mean value, standard deviation, standard error, upper and lower limits of the confidence interval, and the difference parameters in specific sample scores are shown in Table 9.

Table 9
Differences in Scores between Real-time and Delayed Tests

	Mean value	Standard deviation	Paired sample test		t	df	Sig.
			Lower	Upper			
U-English	-4.35294	9.15793	-9.06151	.35563	-1.960	16	.068
U-Chinese	-6.58824	9.84288	-11.64898	-1.52749	-2.760	16	.014
M-English	-2.00000	6.55744	-5.37152	1.37152	-1.258	16	.227
M-Chinese	-1.23529	10.18289	-6.47085	4.00026	-.500	16	.624
No notes	-4.17647	7.40131	-7.98187	-.37107	-2.327	16	.033

Annotations > single English annotation > no annotation; In the delay test, the scores of incidental vocabulary acquisition are sorted: multiple English annotations > multiple Chinese annotations > single Chinese annotation > single English annotation > no annotation. Such sorting results can be further analyzed by means

of mean, standard deviation, standard error, upper and lower limits of the confidence interval, and difference parameters for the specific sample scores are shown in Table 9.

As shown in Table 4-5, the test scores of the incidental vocabulary acquisitions are more obviously different in the instant and the delay tests, and the deviation in different annotation modes varies. For example, in the single English annotation, there is no significant difference from the difference feature factors $t=-4.35294$, $df=16$, $p=0.033<0.05$. Similarly, there is no significant difference between multiple Chinese and English annotations. However, the feature factors of single Chinese annotation and none, $t=-6.58824$, $df=16$, $p=0.014<0.05$ and $t=-4.17647$, $df=16$, $p=0.033<0.05$ reflects an obvious difference between the instant and delay tests, and the vocabulary memory effect in the instant test is better.

Conclusion

The role of computer multimedia aided word annotation in the incidental vocabulary acquisition of English reading has been increasingly highlighted. Therefore, on the grounds of the attention hypothesis and inputs hypothesis, this paper conducts immediate and delay tests on the test students, use the identical reading materials to annotate five different words, and make a tracking and analysis according to the students' accomplishment of reading comprehension and memory effect of new words. The test results are analyzed using vocabulary, depth knowledge scale and SPSS software. It turns out that many Chinese annotations marked in the reading comprehension materials play the most obvious role, and the memory of new words is more persistent. This conclusion is consistent with most of the practical experience of English vocabulary learning. It is hoped that the results available in the paper can offer aid to all English learners.

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