


The Effect of Pictures on Online Business English Vocabulary Retention of EFL Learners Amid the COVID-19 Pandemic

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ABSTRACT

Students can find numerous online resources and platforms for English vocabulary learning during COVID-19. However, most online vocabulary recollection research was concerned with general vocabulary retention, particularly the impact of pictures on general vocabulary memorization. Little is known about business English vocabulary and the relationship between it and pictorial annotations. Therefore, this study investigated the impact of pictures on student retention of business English vocabulary presented online and employed the two-way mixed design ANOVA to analyze the data. The findings revealed that while images did not improve online recollection of word form, they contributed to meaning retention in both the immediate and delayed post-tests. Furthermore, there was a significant change in recollecting word meaning across different presentation modes over time, although the change was not significant in word form retention. Future studies should investigate multiple parts of speech of business English vocabulary and the effects of individual differences on the results.

KEYWORDS

Business English, COVID-19, EFL, Online English Learning, Pictorial Aids, Pictures, Retention, Vocabulary

INTRODUCTION

COVID-19 accelerated the adoption of modern emerging technologies, altering people's lifestyles, work patterns, and business strategies (Amankwah-Amoah et al., 2021). Even though the epidemic is ongoing, many countries still conduct international trade and transactions to cope with the economic crisis caused by the pandemic. Therefore, it is of significance for business practitioners to communicate effectively in English due to the dominant position of this language in the business world. Business English vocabulary plays a vital role in business English learning.

During this special time, online learning has offered great opportunities for any type of education. Learners can find numerous online resources and platforms. For instance, the use of Twitter exerted a strong and positive impact on general education, as well as academic accomplishment in education (Yu & Yu, 2022). Similarly, learners can also learn business English vocabulary under simultaneous

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professional guidance via such online resources and platforms, e.g., the Tencent Meeting (one of the popular online platforms, a Chinese version of Zoom). However, e-learning was confronted with both benefits and challenges (Yu, 2021). Therefore, it is meaningful to investigate factors that may aid business English vocabulary retention during this particular time.

Plenty of studies have investigated online vocabulary learning and retention. Many factors can exert an influence on vocabulary recall. In the formal instruction context, the teacher's attitude toward the concept of vocabulary and students' willingness to learn vocabulary could influence the final outcome (Shamsan et al., 2021). In addition, other factors that could influence vocabulary learning included: the linguistic features of vocabulary; individual differences; first language and foreign-language interference; the teacher and teaching strategies; the ability of memory to encode, store, and recollect acquired vocabulary; the nature of vocabulary development; and the presentation mode of vocabulary (Takac, 2008). This study will compare the impacts of different presentation modes on new vocabulary recollection.

Previous works have compared several presentation modes where pictures were widely used. Lin & Yu (2017) studied mobile-assisted vocabulary learning using three modes: text mode, text-picture mode, text-sound mode, and text-picture-sound mode. Ren (2018) compared three groups that were shown words with text, pictures, and a combination of the two respectively. Liu (2018) explored the effectiveness of word-picture presentation, word-list presentation, and word-context presentation. However, most studies have only examined presentation modes on general vocabulary learning; little is investigated in business English vocabulary. Since the 1960s, business English differentiated itself from general English with its professional terms (Ellis & Johnson, 1994). In this light, the outcomes of business English vocabulary learning using various presenting approaches may differ from those of general vocabulary.

This research examined the effectiveness of pictorial aids on business lexis recollection through Tencent Meeting. To reduce as many variables as possible, the author presented the learning materials and control the time for retention by using the Tencent Meeting. Since the target of recalling the business English vocabulary in this research was to identify and remember the meaning and form (spelling) of every word, an English-to-Chinese translation (E-C) test and a Chinese-to-English translation (C-E) test were implemented. The main research question in this study is: do pictorial annotations play a vital role in people's business English vocabulary retention? The following specific research questions are proposed:

1. Do pictures affect students' online immediate retention of word form?
2. Do pictures affect students' online delayed retention of word form?
3. Is there a statistically significant change in the online recollection of word form over time?
4. Do pictures affect students' online immediate retention of word translation?
5. Do pictures affect students' online delayed retention of word translation?
6. Is there a statistically significant change in the online recollection of word translation over time?

LITERATURE REVIEW

English Vocabulary and Business English Vocabulary

In some scholars' point of view, "vocabulary" equals "words." For example, Carter (1987) described words or vocabulary in his paper as a minimum meaningful unit of a language. When it comes to the classification of such a large scale of words, there were generally two ways based on previous literature. The first focused on where words were used (Zhang et al., 2014), and the vocabulary could be grouped as oral and written ones (Diller, 2007). The second put words into general and specific use. General vocabulary wordlists could aid in the early learning process by offering common vocabulary items that featured frequently across diverse texts, and they could also serve as a baseline for recognizing

more specialized vocabulary (Brezina & Gablasova, 2015); while formal communication in a specific profession or sector of industry, such as in a commercial setting, always demanded the use of specialized vocabulary (Zhang et al., 2014).

Given the fact that international business activities are indispensable in people's daily life and are in rapid development, learning business English words can be crucial. Therefore, many researchers have put effort into studying their features. According to Zhao (2007), a massive number of business terminologies and jargon were used in formal business writings, which meant nouns may account for a large proportion of business vocabulary. Pickett (1989) classified business English vocabulary into six dimensions, including commonly used vocabulary, vocabulary containing daily words that may be difficult for the general public to understand, vocabulary derived from everyday words but requiring precise business knowledge to fully comprehend, and so on.

Different Vocabulary Presentation Modes

Word-list mode is the most common form of presentation in vocabulary learning and retention (Ren, 2018). This mode contributes to new vocabulary learning (Lewis, 1971), and it is especially efficient in remembering a large amount of vocabulary (Nation, 1982). However, this presentation mode also has limits. For instance, vocabulary learned through the word-list mode can be easily and quickly forgotten for a lack of cognitive processing, and this presentation method is unable to motivate students to learn (Parreren, 1989). Thus, there can be other assistance to vocabulary retention.

The mode with pictures has the possibility of improving the word-list mode. The findings of a study by Emirmustafaoğlu & Gökmen (2015) showed that the advantage of images over L1 translations in children's memory of L2 vocabulary was attributable to their efficiency as signals for recall. Furthermore, Andrä et al. (2020) discovered that both gestures and images improved children's L2 learning, and the effects lasted for a long time. Kaplan-Rakowski et al. (2021) also pointed out that two-dimensional pictures (2D) performed better than immersive stereoscopic three-dimensional pictures (S3D) on vocabulary recollection. However, some studies did not support the usefulness of pictures. Acha (2009) explored that children who only received verbal annotations remembered more word translations than children who received both visual and verbal annotations or only visual annotations. In addition, in a study by Tan et al. (2020), although the use of images improved vocabulary productive results in both the post-test and delayed post-test, it contributed little to vocabulary receptive scores.

Another annotation mode is with English explanation. It is a presentation mode with texts utilizing the same language of the target words to explain word meanings or give descriptions. Some studies introduced this mode. Yoshii & Jeffra (2013) used simple language to explain the target words for adult learners at beginning and intermediate English proficiency levels. Lin & Yu (2017) also adopted this mode in their research in which 32 eighth-graders participated. The effectiveness of the English explanation mode varied. However, few studies adopted the three modes to investigate their impacts on business English vocabulary.

This study will compare the aforementioned three presentation modes. The word-list mode will be a control group. The word-list mode usually presents words with phonetic symbols and corresponding meanings in learners' native language (Ren, 2018). But since the target for learners in this research is to remember the word form and word translation, the word-list mode will only present words with corresponding meanings. In that way, to be fair and scientific, the other two modes will also comprise Chinese translations so that it will be clear to see if different aids can benefit business English lexis form and meaning retention. Therefore, the three presentation modes in this study are words with pictures and Chinese translations, words with Chinese translations only, and words with Chinese translations and English explanations.

THEORETICAL FOUNDATION

This section introduces the Dual Coding Theory (DCT) (Paivio, 1986) and Atkinson and Shiffrin's Modal Model (Atkinson & Shiffrin, 1968). The DCT will lay a foundation for explaining and specifying how pictures facilitate the retention of business nouns, while the Modal Model of Memory can support the whole mechanism of vocabulary memorization in different stages and provide a theoretical basis for the distinction between short-term and long-term memory.

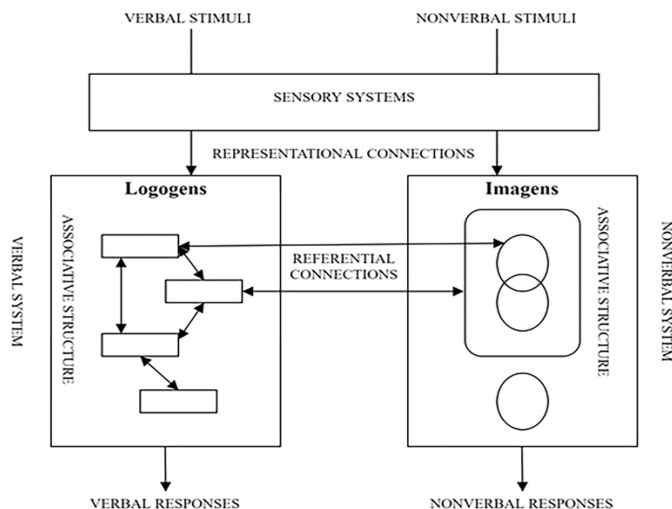
Dual Coding Theory

Paivio (1986) first initiated the Dual Coding Theory in the 1970s. He contended that the historical foundation of the theory is the Loci method in which people use images to strengthen their memories. Another solid basis of it is cognitive psychology. The theory has been applied to many academic fields such as linguistics, education, etc.

Figure 1 presents the operational process of DCT. The core of dual coding theory is that it has two sets of coding systems: the verbal coding system and the non-verbal coding system (Paivio, 1986). The two systems are independent as well as interrelated. Each coding system has its own representative elementary unit which is called logogens and imagens. The representative unit of the verbal system is logogens, containing forms such as words, phrases, sentences, etc. Imagens are representative units of the non-verbal coding system. They refer to events, objects, and situations, such as pictures, sounds, and so on. Later, in 2001, Sadoski and Paivio (2000) put forward the operation model of dual coding theory. The model has three processing periods: representational processing, associative processing, and referential processing.

In the first level of representational processing, the two types of representatives will be activated in their own corresponding systems. Specifically, verbal stimuli activate logogens in the verbal system; non-verbal stimuli activate imagens in the non-verbal system. The second stage is associative processing which proceeds in the separate coding systems. The logogens will activate more logogens in the verbal system, while the imagens will activate more imagens in the non-verbal system. The third is referential processing. In this process, the information activated is bidirectional. For example, verbal stimuli can activate imagens in the verbal system.

Figure 1. General operational process of Dual Coding Approach (Paivio, 1986)

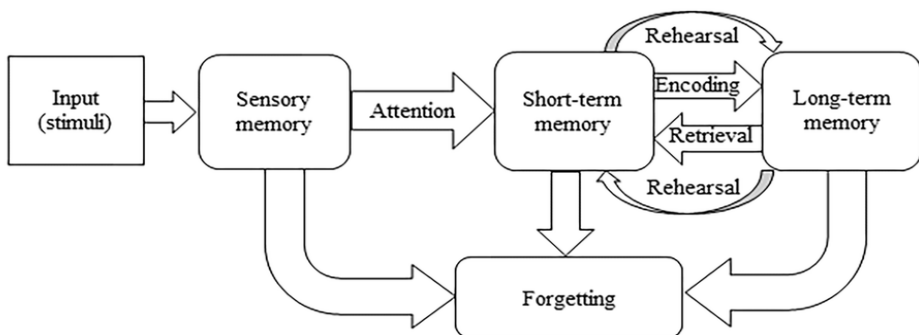


Modal Model of Memory

Many cognitive psychologists attempt to find out the universality of human memory. In 1968, Atkinson and Shiffrin (1968) proposed their finding in *Human Memory: A Proposed System and Its Control Process*. According to their viewpoint, human memory can be categorized into three phases, which are sensory memory, short-term memory (STM), and long-term memory (LTM).

Figure 2 shows the mechanism of the model. Generally when people spot an object or learn a new word, the superficially processed information is kept in sensory memory in the first stage, which can only be stored for around 0.25 seconds. Then, the memory stored in sensory memory can enter the next stage of STM if being properly processed. STM, however, has two divisions. One is called direct memory; the other is working memory. If the information in the second stage is processed further through shallow ways, such as repetition, then it will come into working memory. Whether the information will come into LTM depends on the degree of information processing. If the information is under shallow processes, such as rehearsal and repetition, it will not be stored in LTM and will be forgotten later. However, if being processed deeply, the information will be more likely to enter LTM. The common way of deep learning is to build connections between the information and the existing knowledge or try to understand and memorize the meaning of the information. In addition, it is worth noting that although the information kept in LTM is permanent, it still needs some stimulus to recall.

Figure 2. Modal Model of Memory (The Atkinson-Shiffrin Memory Model) (Atkinson & Shiffrin, 1968)



METHODOLOGY

The methodology in this study was inspired by Yoshii & Jeffra's (2013) research. This section will illustrate how participants, materials, and instruments were selected or initiated in detail. And Figure 3 will represent the whole procedure.

Participants

The process of choosing appropriate participants consisted of two steps. In the beginning, 93 students from a university took the business vocabulary test (not for the experiment) through Tencent Meeting instead of taking it offline due to the ongoing pandemic. The author played a role as a controller by using the screen-sharing function of Tencent Meeting to present the testing vocabulary and relevant items so that students could have the same amount of time to learn and remember the words online. After the recollection process, students were required to finish a word-meaning recognition test (English-Chinese translation) and send their answers to the author via the “private chat” function of Tencent Meeting. Students who knew more than half of the Chinese meanings of the chosen words were excluded for they had a large vocabulary size that may distinguish them from other participants. Then, the remaining 61 participants who had similar sizes of the business English vocabulary came at the experiment stage. The experiment adopted the same testing pattern except that the participants had to complete two post-tests of word-form recognition (Chinese-English translation) and word-meaning recognition (Chinese-English translation). Despite having studied English for at least 13 years, their English proficiency and skills varied.

The selected 61 students were randomly allocated to three groups to guarantee the validity and fairness of the experiment. Groups A and B had 20 students respectively, while Group C had 21 students. Each group used a different vocabulary presentation mode: words with Chinese meanings and pictures for group A, words with Chinese meanings and no other means of assistance for group B (word-list mode, a control group), and words with Chinese translations and English explanations for group C. The participants were not informed concerning the purpose of the test and were not allowed to check the words in the dictionary during or after the pre-test.

Before implementing the experiment, the author asked three non-participants to estimate the time used to learn and remember the target words as well as identify the effectiveness of pictures through Tencent Meeting. The time included looking through one target word, its meaning, or pictures or an English explanation of the word. It turned out the time range for learning fell between 5 and 12 seconds. Shorter items needed a shorter period while longer ones required longer. The total amount of time used in the memorization period for each group was approximately 2 minutes. The way that the author presented the learning materials and controlled the experiment followed that of the pre-test of selecting participants.

Materials

There were two material kinds: target words and corresponding pictures that fit those words. Advanced Business English Vocabulary was used as the source of the word selection. Moreover, two fundamental requirements should be met when choosing target words: (a) the target vocabulary or their meanings in business contexts should be completely unfamiliar with every participant; (b) the words should be nouns that can be easily represented with certain images. Then, four steps were followed in order to select target words:

Step 1: A total of 30 words were randomly chosen from the advanced business English vocabulary list.

Step 2: Ninety-three volunteers of the class of 2021 at a university took the word test. They were asked to write down the Chinese translation of the words.

Step 3: Sixty-one students who recognized less than 50% of the new words were selected.

Step 4: Seven words of which none of the 61 participants knew about meanings were chosen as the final target words.

The pictures that could clearly illustrate what the target words meant should also adhere to certain standards. The pictures were searched out on Google by following two criteria: the information conveyed from the pictures should be direct and the English and Chinese words on the pictures should not contain the target words and their meanings. Furthermore, to make sure that different people could understand the message conveyed by those pictures, three non-participants of the same university were invited to confirm the effectiveness of the pictures via the Desktop-sharing of Tencent Meeting (the effectiveness of pictures was also reflected through three participants' answers to the customized surveys presented in Appendix 1).

Instruments

This research included an immediate post-test and a delayed post-test to identify participants' vocabulary retention (Liu, 2018). The interval time between the two post-tests was 2 weeks. As the three groups were tested by different presentation modes of the chosen vocabulary, the author designed three papers for memorization of word form and Chinese translation for the immediate post-test, and three similar papers for the delayed post-test with orders of the items being rearranged (see Appendix 1). The entire experiment lasted for over a month from the beginning of January 2021 to the end of February 2021, which was conducted online using Tencent Meeting due to the outbreak of the COVID-19. All 61 students participated in the two post-tests.

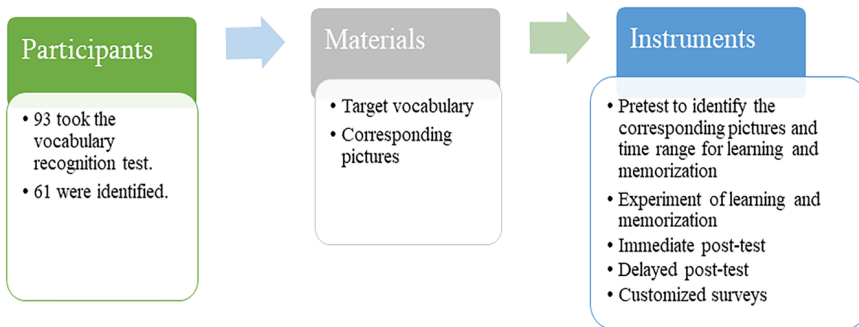
The instant post-test and the delayed post-test followed the same routine after the learning and memorization stage. In the learning process, the participants in each group were asked to read every piece of information on the screen and try to remember the seven words and their Chinese meanings. The author was the timing controller who made sure that one item appeared at a time and participants in the same group had the same amount of time to read each item. Then, they completed the immediate post-test of the Chinese-English translation (C-E translation) and the English-Chinese translation (E-C translation) of the seven words online within 3 minutes. After 2 weeks, the students were invited to complete the delayed post-test.

This study adopted a self-designed rating system and a customized survey. The overall score for either C-E translation or E-C translation was 7 points. One right answer received 1 point. More importantly, the Chinese translations did not need to be identical to the given ones on learning materials. For example, the following translations of "shop-floor" were all acceptable: 车间; 生产车间. Following the two post-tests, three students in each of the three groups were randomly chosen to answer questions in three short customized surveys (See Appendix 1). The surveys were designed to determine how students in three groups remembered the target words, thus aiding the author to do a discussion based on the test analysis results.

Variables

This research contained both independent and dependent variables. The independent variables were three different presentation modes, while the dependent variable was the time. The presentation modes were also between-group variables because there were three groups and each group utilized one mode. The within-group variable was the time since every participant in three groups had to take two post-tests which took place in two different time points.

Figure 3. Process of the experiment



RESULTS

The research questions proposed was be addressed by employing SPSS 23.0 to facilitate data analysis of the scores of each participant in two post-tests. The main statistical method was two-way mixed design ANOVA. The descriptive statistics intended to present which group performed better in both the immediate post-test and the delayed post-test. The ANOVA analysis could reveal whether the three groups differed significantly in three word-memorization strategies.

Questions 1-3: The Retention of Word Form

Table 1 presents descriptive statistics of the immediate and delayed post-tests of the recall of business vocabulary form. In the immediate post-test, the mean value of Group B is 5.65 ($M_B = 5.65$), being the highest. It is followed by Group A, which is 4.15 ($M_A = 4.15$). The lowest score of the mean value is Group C, 3.62 ($M_C = 3.62$). In the delayed post-test, Group B still obtains the highest mean value of 5.15 ($M_B' = 5.15$), followed by Group A ($M_A' = 4.95$). The mean value of Group C is 3.86 ($M_C' = 3.86$). The presentation mode of Group B (words + Chinese translation) seems to be the most effective in recollecting word form in both the post-tests.

Group A: words + Chinese translation + pictures

Group B: words + Chinese translation

Group C: words + Chinese translation + English explanation

Table 2 illustrates within-subjects effects of the retention of word form, i.e., whether there is a significant change over time in recalling word form between the immediate post-test and the delayed post-test. The results show that there was no significant effect of time interval, indicating that the effectiveness of word-form recollection in the immediate post-test was similar to that in the delayed post-test, $F = .702, p = .405 > .05$ (Greenhouse-Geisser corrected). In addition, there was no significant interaction effect between time and vocabulary presentation modes, $F = 3.044, p = .055 > .05$ (Greenhouse-Geisser corrected).

Table 1. Descriptive statistics of the post-tests of word form

	Group	Mean	Std. Deviation	N
Word Form in Immediate Post-Test	A	4.15	2.254	20
	B	5.65	1.531	20
	C	3.62	1.802	21
	Total	4.46	2.046	61
Word Form in Delayed Post-Test	A	4.95	1.538	20
	B	5.15	1.694	20
	C	3.86	2.007	21
	Total	4.64	1.826	61

Note. Full score = 7

Table 2. Tests of within-subjects effects of the retention of word form

Source		df	Mean Square	F	Sig.
Time	Greenhouse-Geisser	1.000	.981	.702	.405
Time*Group	Greenhouse-Geisser	2.000	4.252	3.044	.055
Error (Time)	Greenhouse-Geisser	58.000	1.397		

Table 3 shows a significant main effect of the vocabulary presentation modes, $F = 5.378$, $p = .007 < .05$. Table 4 compares the three presentation modes represented by three groups. The mean difference between A and B is $-.850$, $p = .103 > .05$; The mean difference between A and C is $.812$, $p = .115 > .05$; The mean difference between B and C is 1.662 , $p = .002 < .05$. The figures indicate that the significant difference lies between group B and group C, which means the presentation mode of words and Chinese translations was more effective than words with Chinese translations and English explanations, while the learning mode with pictures did not outperform the other two modes.

Table 3. Tests of between-subjects effects of the retention of the word form

Source	df	Mean Square	F	Sig.
Intercept	1	2538.479	482.539	.000
Group	2	28.293	5.378	.007
Error	58	5.261		

- Group A: words + Chinese translation + pictures
- Group B: words + Chinese translation
- Group C: words + Chinese translation + English explanation

Table 4. Pairwise comparisons of the retention of the word form

(I) Group	(J) Group	Mean Difference (I-J)	Std. Error	Sig. ^b
A	B	-.850	.513	.103
	C	.812	.507	.115
B	A	.850	.513	.103
	C	1.662*	.507	.002
C	A	-.812	.507	.115
	B	-1.662*	.507	.002

* The mean difference is significant at the .05 level.

The above results answered questions 1-3. Pictures did not have an advantage in the online recollection of word form in the immediate and delayed post-tests. Instead, the presentation mode of words and Chinese translations was more effective than words with translations and English explanations. Moreover, there was no statistically significant change over time of the presentation mode in the recollection of word form in this research.

Questions 4-6: The Retention of Word Translation

Table 5 shows descriptive statistics of the post-tests of Chinese translations of the target business vocabulary. In terms of the two post-tests of mean value, group A (words + Chinese translation + pictures) outperformed the other two groups with $M_{A_2} = 4.95$ and $M_{A_2}' = 3.80$. Group B (words + Chinese translation) has higher mean value ($M_{B_2} = 4.60$) than group C (words + Chinese translation + English explanation) ($M_{C_2} = 4.14$) in the immediate post-test. Similarly, group C obtains the lowest mean value in the delayed post-test ($M_{C_2}' = 2.52$; $M_{B_2}' = 2.60$). The presentation mode utilizing pictures seems to be the optimal one out of the three modes in retaining vocabulary meanings.

Table 5. Descriptive statistics of the post-tests of Chinese translation

	Group	Mean	Std. Deviation	N
Chinese Translation in Immediate Post-Test	A	4.95	1.191	20
	B	4.60	1.847	20
	C	4.14	1.740	21
	Total	4.56	1.628	61
Chinese Translation in Delayed Post-Test	A	3.80	1.322	20
	B	2.60	1.667	20
	C	2.52	1.470	21
	Total	2.97	1.581	61

Notes. Full score = 7

Group A: words + Chinese translation + pictures

Group B: words + Chinese translation

Group C: words + Chinese translation + English explanation

Figure 4 reflects the similar findings of that in the descriptive statistics in Table 5. It is clear from the line chart that group A has the highest estimated mean value, followed by group B and group C in that sequence. Although the three groups all drop at different rates over time in terms of the mean value, group A remains the greatest, and it decreases less dramatically than group B (the most dramatic) and group C.

Figure 4. Profile plots of the retention of Chinese translation in two post-tests

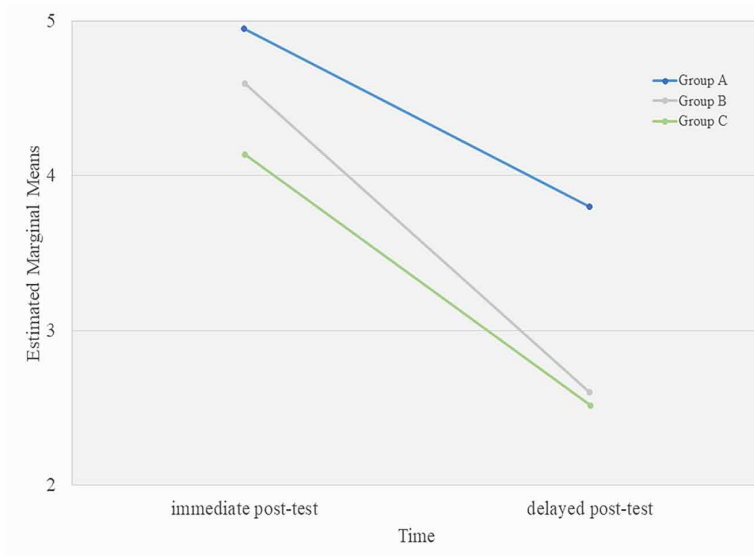


Table 6 shows the within-subject effects of word-translation retention. The results demonstrate that the time interval had a statistically significant effect, implying that the effectiveness of word-translation recollection in the immediate post-test differed from that in the delayed post-test, $F = 56.736, p < .05$ (Greenhouse-Geisser corrected). Furthermore, no significant interaction effect between time and vocabulary presentation strategies was found, $F = 1.335, p = .271 > .05$ (Greenhouse-Geisser corrected).

Table 6. Tests of within-subjects effects of the retention of Chinese translation

Source		df	Mean Square	F	Sig.
Time	Greenhouse-Geisser	1.000	77.036	56.736	.000
Time*Group	Greenhouse-Geisser	2.000	1.813	1.335	.271
Error (Time)	Greenhouse-Geisser	58.000	1.358		

Table 7 shows a significant main effect of the vocabulary presentation modes on vocabulary meaning recollection, $F = 3.403, p = .040 < .05$. Table 8 compares the three presentation modes represented by three groups. The mean difference between A and B is 0.775, $p = .069 > .05$; The

mean difference between A and C is 1.042, $p = .014 < .05$; The mean difference between B and C is 0.267, $p = .521 > .05$. According to the figures, the significant difference is between groups A and C, indicating that the presentation method with pictures was more effective than words with Chinese translations and English explanations.

Table 7. Tests of between-subjects effects of the retention of Chinese translation

Source	df	Mean Square	F	Sig.
Intercept	1	1732.546	495.481	.000
Group	2	11.899	3.403	.040
Error	58	3.497		

Table 8. Pairwise comparisons of the retention of the Chinese translation

(I) Group	(J) Group	Mean Difference (I-J)	Std. Error	Sig. ^b
A	B	.775	.418	.069
	C	1.042*	.413	.014
B	A	-.775	.418	.069
	C	.267	.413	.521
C	A	-1.042*	.413	.014
	B	-.267	.413	.521

* The mean difference is significant at the .05 level.

Group A: words + Chinese translation + pictures

Group B: words + Chinese translation

Group C: words + Chinese translation + English explanation

The answers to questions 4-6 were found in the preceding findings. Pictures had an advantage in the online recollection of word meaning in the immediate and delayed post-tests, the effectiveness of pictures was even more obvious when compared with memorizing vocabulary meanings using English explanations. Moreover, while there was a statistically significant change over time in the recollection of word meaning in this research, pictures still contributed a great deal in recollecting meanings.

DISCUSSION

The main aim of this study was to examine whether pictures contributed to online business English vocabulary retention. Specifically, this research explored the effects of three presentation modes on the online recollection of business English vocabulary (all nouns): adding Chinese meanings to the new words (traditional word-list mode); adding pictures and Chinese meanings to the new words; and adding Chinese meanings and English explanations to the new words. It turned out that the recall rate of word form of participants in the word-list group performed better than the recall rate of students

in the group with English explanations and the group with pictures in both post-tests. Time did not have a significant effect on the results. However, students in the group with pictures outperformed the other two groups of students in the retention of meaning in both post-tests. Moreover, there was a statistically significant change over time in the recollection of word meaning. The findings will be discussed by referring to the Dual Coding Theory and the Modal Model of Memory.

Online Retention of Business English Vocabulary Form

The mode with pictures and the mode with English explanations did not impact the retention of vocabulary form while the word-list mode did. The results were aligned with some previous studies where word-list mode was effective in vocabulary recall (e.g., Acha, 2009). One explanation is that pictures as *imagens* have built connections with corresponding Chinese (*logogens*) in the first place in the students' heads so that students unintentionally neglected the English equivalents, which was confirmed by three students in the short survey. Another explanation can be that both pictures and English explanations have increased students' cognitive load due to overly presented information, and students were unable to remember the form of each word clearly with all the information occupied.

On the contrary, the word-list mode allowed the target words to be directly connected to their corresponding meanings (Acha, 2009). It was also considered an effective approach for language beginners to learn and retain new vocabulary (Nation, 1990). Based on the results of the survey, students in the word-list group had more time and higher efficiency than the other two groups to remember the spelling and form of the target words. Such repetition was likely to make the words enter the short-term memory and even the long-term memory from the sensory memory. Therefore, participants in the word-list group were able to have higher scores in the form-retention than their peers in the other two groups.

The results indicated that there was no statistically significant change in word form remembering over time. The students in the word-list group had long-term memory for those word forms, since they would still recall the majority of them after 2 weeks. Or 2 weeks was insufficient time for them to forget most of the business vocabulary. Nonetheless, students in the picture and English explanation groups were unable to recall the spelling of numerous target words after a 2 week interval because they had less impression on the words than their counterparts in the word-list group.

Online Retention of Business English Vocabulary Meaning

Pictures contributed to the retention of word meanings. This result was consistent with many prior studies where pictures were also used as a presentation mode for online vocabulary learning (e.g., Emirmustafaoğlu & Gökmen, 2015), but it was against the findings in Tan et al. 's (2020) research in which pictures contributed little in vocabulary receptive scores (knowledge of word meanings). However, Liu et al. (2020) discovered that students assisted with pictures were more inclined to focus on the pictures than on the words, which is demonstrated true in this study. Some students associated pictures with relevant Chinese meanings based on the answers collected in the short survey, indicating they progressed to the referential stage where *logogens* were activated by non-verbal stimuli, i.e., the pictures. The students established a link between the pictures and their existing knowledge, which was a successful procedure for deepening their memory and advancing them to the long-term memory stage. As a result, even though they forgot the meanings of some words in the delayed post-test after 14 days, they still surpassed the participants in the other two groups.

The word-list group and the English explanation group achieved less satisfying mean scores of recalling meanings of target vocabulary than the picture group. Although the word-list group was not significantly different from the picture group in the meaning recollection in the immediate post-test, it could not recollect as many word meanings as the picture group did in the delayed post-test. The decrease for the word-list group was extremely dramatic. Learners could not process new vocabulary deeply by word-lists because they did very little cognitive processing (Liu, 2018). Similarly, students in the word-list group in this research were not provided with any media to associate the words with

non-verbal stimuli, such as pictures or situations. They only stayed at the repetition stage. On the contrary, participants in the English explanation group were overwhelmed by too much information presented in English, increasing their burden in comprehending the message conveyed. Consequently, they were not great performers in word meaning retention in both delayed post-tests for being distracted from the learning target.

CONCLUSION

Major Findings

This research analyzed the effect of pictures on online business vocabulary retention. Sixty-one participants in the class of 2021 of a business English major were involved in the experiment. According to the findings, pictures were more effective in remembering business word meanings in both the immediate post-test and delayed post-test than in the recollection of the spellings of the target words. Having interviewed nine participants in three groups (three for each), the author could understand participants' psychological activities during the experiment and further verify the assistance of the presentation modes. According to the answers to the survey and the theoretical support from the two theories of DCT and Modal Model, the possible explanation could be that students provided with pictures could better associate them with existing knowledge of L1 compared to the other two modes, hence strengthening their understanding and retention of target business vocabulary meanings.

Contributions and Limitations

There have been a variety of studies on the influence of images on general English vocabulary recall. Nevertheless, few studies could be found that were scientific and systematic on the influence of visuals on business English vocabulary retention. This study discovered different results when compared to studies on general vocabulary learning, revealing the impact of pictures on business lexis retention. More importantly, since international trade has a significant impact on the world economy during and even after the epidemic, business practitioners are supposed to acquire the necessary business English vocabulary to facilitate successful economic and trade activities between countries, thus maintaining the economic vitality of society. Consequently, there is an urgent need to enhance the quality of business English education, and the findings of this study can have implications for business vocabulary teaching and learning.

However, the study also has limitations. The sample size and the cultural diversity of the participants cannot be considered perfectly representative. Future studies should expand the sample size and examine whether pictures still work to facilitate people from various racial backgrounds to memorize online business vocabulary form and meaning. Moreover, this study only included business English nouns while there are many business words (e.g., verbs) that are difficult to be expressed by suitable pictures. Additionally, because the assessments were conducted online and unsupervised, some students may have been distracted from the study, reducing its precision and validity. Lastly, this study did not examine certain participants' features, such as gender differences, which might have influenced the outcomes. Yu (2019) pointed out in his article that there were considerable gender differences in cognitive loads, attitudes, and academic achievements in English language learning supported by a mobile learning platform. Hopefully, these issues will be addressed in future research.

CONFLICT OF INTEREST

The authors of this publication declare there is no conflict of interest.

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