A Project entitled

The effects of physical body movement on preschoolers'English vocabulary memory in mainland China

Submitted by

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Declaration

I, , declare that this research report represents my own work under the supervision of , and that it has not been submitted previously for examination to any tertiary institution.

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Abstract:

This study aims to investigate whether incorporating physical body movement into vocabulary teaching can improve the English vocabulary memory of kindergarten children in mainland China. The ideas of this study are derived from the Dual coding theory (DCT) and Total Physical Response (TPR). Built on these two theories, this study comes up with two teaching strategies, which are "triad code strategy" and "dual code strategy". The triad code strategy integrates three elements- physical, visual, and verbal into teaching (i.e., using physical body movement, pictures, and verbal explanations). In contrast, dual code strategy only includes visual and verbal stimuli. This study adopted a quasi-experimental design. Participants were 32 children aged 4 to 5 years old (K2) whose mother tongue was Mandarin from a local kindergarten in Shanxi province, China. The data were analyzed by the *t*-test, and the main findings were summarized as below: (1). The triad code strategy was more effective in improving children's English vocabulary memory than the dual code strategy; (2). The average improvement of animal and action vocabularies was significantly different for children in the triad code strategy condition; (3). Gender did not have any significant effects on children's vocabulary memory. The results of this study serve as empirical evidence to fulfill the research gap and as insights for kindergarten teachers in improving their teaching practice.

Keywords: Dual coding theory, Total physical response, Physical body movement, Foreign language teaching, English vocabulary memory, Early childhood education

1. Introduction

The importance of vocabulary in foreign language learning motivates EFL instructors across the world to experiment with different teaching strategies and language stimuli to find ones that are effective. In line with the integration and collision of eastern and western cultures, many western teaching approaches (i.e., TPR approach, immersion method, etc.) are accepted and widely used in early childhood settings in China to support young children's English learning (Yu & Ruan, 2012). In contrast to the traditional English teaching method that advocates rote learning, the contemporary pedagogical method in China incorporates new ways of teaching (i.e., child-centered, learning by doing) for students, especially for young kids (Fees, Hoover, & Zheng, 2014). Therefore, this study is to continue exploring effective English teaching approaches based on the previous vocabulary teaching theories of DCT and TPR. These two theories have been investigated by many researchers in the area of foreign language learning in different countries. Virtually all findings indicated these two methods positively affected the improvement of vocabulary in foreign language learning. However, previous research studied these two theories independently. Therefore, this study tries to combine them and examine the effects of this combined method on young children's vocabulary memory.

The official language in mainland China is Mandarin, and most children learn English as a foreign language (EFL). An EFL environment refers to the fact that English is not the native language of the majority people in mainland China and English is not used as the main medium of interaction in people's daily life (Ng, 2013). Since it is not easy for local Chinese children to naturally master English, improving children's learning environment (i.e., teaching approaches, tools, etc) is of paramount importance to

supplement the shortage of authentic English learning environment in children's daily lives.

In terms of the study's significance, the results of this study will provide valuable suggestions for kindergarten teachers to improve their teaching practice. Besides, there is a paucity of research investigating the effects of integrating physical body movement in teaching. Therefore, this study can bridge the research gap and contribute to the research area of early language teaching. Moreover, researchers in the relevant fields can utilize the research results to conduct further studies.

2. Literature review

2.1.Theoretical framework

This study is grounded on two theories — Dual coding theory (DCT) and Total physical response (TPR). These two theories are deemed to be effective and useful in assisting children' vocabulary learning and memory. The following paragraph will explain these two theories in detail and exhibit some relevant articles about the relationship between these two theories and vocabulary learning.

2.1.1. Dual coding theory

(1). Definition

Dual coding theory, an evidence-based teaching strategy from cognitive psychology developed by Paivio, proposed that the information represented both visually and verbally was recalled better than information held in only one format (Paivio, 1991). For example, showing a picture and verbally telling children what it is at the same time can help children understand and remember the word better. The DCT includes two coding

systems, which are visual and verbal systems. These two coding systems interact, and this interaction results in better recall (Paivio, 1991). The DCT emphasizes the importance of images (or pictures) in assisting children to comprehend and memorize information (Paivio & Clark, 2006).

(2). DCT and vocabulary learning

Most existing studies on DCT and vocabulary learning relies on the use of multimedia technology (i.e., animated videos, softwares) to facilitate children's vocabulary learning and memory. The results generally reveal that DCT has a positive influence on children's vocabulary learning and memory. A recent study by Wong and Samudra (2021) reported that dual-language learners benefited from media content delivered both orally and visually and they were able to identify more words when the words were dual coded.

With dual code information found to be more effective than single code information, the research further found that different types of verbal and visual stimuli have different influences. Kassim (2018) investigated the effects of animated images and translations on ESL learners' English vocabulary learning by employing multimedia software in Malaysia. The researcher compared the effects of different formats of visual information (static visuals and moving visuals) paired with translations on ESL learners' vocabulary memory. Kassim (2018) found that undergraduates with access to translations and animated images could retain more target words than those who viewed translations and static images. Captioned videos is another application of DCT. The captioned videos include verbal (i.e., audios) and non-verbal information (i.e., images, texts). A study by Hariffin and Said (2019) examined the effects of captioned videos on primary ESL

learners' vocabulary acquisition in a Malaysian rural setting. The results revealed that captioned videos could help children identify the meaning of newly learned words and improve vocabulary recognition.

Overall, these research points out the effectiveness of DCT in vocabulary learning and memory with assistance of technology. However, less research is conducted on Chinese young children in kindergarten settings, so the application of DCT in Chinese context for young children's vocabulary learning and memory remains unclear. Regarding previous research findings, the result is likely to be positive— the DCT is effective as well in helping young Chinese children retain vocabularies.

2.1.2. Total Physical Response

(1). Definition

Total physical response (TPR) is a famous language teaching method created by Prof. James Asher. TPR attempts to teach language through speech and physical activity simultaneously. It mimics the way children learn their first language (Asher, 1977). When children learn their mother tongue, their parents will be physically involved in conveying language. For example, parents will use some gestures to tell children the meaning of their speech. In the TPR method, the text is not required. Teachers can only use their voice and physical body movement to perform class activities. Er (2013) proposed that among various foreign language teaching methods, TPR was the most appropriate and effective one for young learners when it was followed by games, songs, stories, or demonstrations. This kind of teaching strategy could create an interesting, enjoyable learning environment to engage young children in the language learning process (Er, 2013). There are two main characteristics of TPR. Firstly, language processing is

dominated by the left brain, and physical body movement is mainly controlled by the right brain. Utilizing TPR in language teaching helps children work on both parts of the brain (Asher, 1977). In addition, children focus on movement while learning a language, so they acquire the language unconsciously which reduces the stress of learning a language.

(2). TPR and vocabulary learning

Current studies on TPR and vocabulary learning consistently substantiate the effectiveness of TPR in facilitating children's vocabulary learning. The results obtained from Hounhanou 's study (2020) discovered that teaching English vocabulary through TPR allowed students to learn faster and easier. Besides, Hounhanou (2020) suggested the use of TPR in teaching English vocabulary to EFL beginners. Sariyati (2013) also found that TPR effectively enhanced vocabulary mastery of elementary school children and the TPR method was suitable for teaching young learners as children loved moving around. Similarly, Nuraeni (2019) pointed out that TPR was beneficial for children to memorize and understand vocabularies, and agreed that TPR was a suitable method to teach vocabularies, especially young learners.

2.1.3. Summary

Among previous literature, although these two theories are studied independently, it is also possible to integrate them in terms of their similarities. Specifically, both theories can be used for improving vocabulary learning and memory. Besides, the two theories embrace some types of language stimuli which help children learn and memorize foreign languages. For example, DCT involves both visual and verbal stimuli to facilitate language learning, while TPR incorporates physical elements. Hence, this study tries to

integrate DCT and TPR to create a new teaching method and investigate its effects on children's vocabulary memory.

Based on these two theories, in this study, the name of dual coding theory is borrowed to describe the teaching strategy that uses pictures and verbal explanations as dual code strategy. Accordingly, the teaching strategy that integrates pictures, verbal explanations, and physical body movement is named as triad code strategy.

2.2. Vocabulary learning

(1). Terms

For vocabulary learning, there are many related terms described in previous literature, such as vocabulary learning, vocabulary acquisition, and vocabulary memory. As stated by the American Psychological Association, vocabulary learning means securing skills or knowledge, while vocabulary memory relates to how the mind stores and recalls information (VandenBos, 2007). The difference between vocabulary learning and vocabulary acquisition is that vocabulary learning is conscious and deliberate, but vocabulary acquisition is usually subconscious and natural. It is impossible to learn or acquire vocabulary without memory, so memory can be seen as the outcome of vocabulary learning and acquisition. This study mainly focused on vocabulary memory, exploring the invisible process (i.e., how children encode and retrieve vocabularies) from observable behaviors (i.e., the number of recalled vocabularies).

(2). Vocabulary learning

Vocabulary is fundamental for children's speaking and reading ability. Mediha and Enisa (2014) claimed that sufficient vocabulary storage was a prerequisite for effective

communication. Also, the breadth (the number of words known) and depth (semantic association of words) of vocabulary knowledge were related to children's reading pace and comprehension (Tannenbaum, Torgesen, & Wagner, 2006). Therefore, increasing children's vocabulary storage is significant for their language development and should be valued by teachers.

(3). Vocabulary memory

A new word, perceived through the sensory system, passes permanently to the brain's long-term memory after being properly processed in the working memory (Slavin, 2018). The function of working memory is to deal with the information stored in short-term memory. When teachers teach children vocabulary through pictures, speech, and physical body movement, all these information is temporarily stored in children's short-term memory. Then the working memory will process and encode these information. Information that is successfully encoded will be stored in long-term memory. Because there are three types of stimuli (i.e., visual, verbal, and physical), so each vocabulary will be encoded by at least three channels in the brain, which increases the opportunity to successfully encode vocabularies. In other words, the more language stimuli teachers use, the more likely children to remember more vocabularies. This study was to measure children's long-term memory of newly-learned vocabulary after teaching. To test whether the vocabulary is successfully stored in long-term memory, a recall test will be used to measure the retrieval process.

2.3 Gender difference in vocabulary learning

Numerous articles on gender differences in vocabulary memory proposed that girls outperformed boys. For instance, a study by Kaushanskaya, Gross, and Buac (2013),

which investigated the gender difference in children's (5 to 7 years old) word learning, found superior performance in girls for learning novel English words and girls outperformed boys on word learning tasks. Moreover, studies that documented gender differences in language measures in childhood generally found that girls outpaced boys in language learning (Eriksson et al., 2012). However, a study examined the impacts of different teaching methods on EFL vocabulary learning of elementary school boys and girls (Naeini & Shahrokhi, 2016). The results revealed that there were not any statistically significant differences between the male learners' and female learners' vocabulary performance for both the TPR method and the direct teaching method.

2.4 Teachers' preference for teaching strategies

Reported by a study, kindergarten teachers lack the awareness of employing physical body movement in their daily teaching practice. Lao and Rao (2013) conducted a study about teachers' preferences on pedagogical strategies. The study showed that kindergarten teachers' most frequently used instructional strategy to teach preschool children vocabulary is "the use of visuals" (i.e., pictures, videos). Besides, among nine types of vocabulary teaching strategies summarized by Lao and Rao (2013), none of the six kindergarten teachers reported that they had applied body movement into their daily teaching. As a result, investigating the effects of body movement on teaching practice will provide a new sight for current teaching practice in kindergartens.

2.5. Body movement and vocabulary memory

Much evidence showed the positive influence of physical activity on children's memory. For example, Hostetter and Alibali (2008) pointed out that body movements can facilitate the retrieval of mental lexical items. In addition, brain research showed that physical

activity could increase the volume of the hippocampus which controlled the transfer of information from working memory to long-term memory and improved memory accordingly (Erickson etal., 2011). Among the massive literature, there are scarce articles talking about integrating physical body movement into teaching. The following paragraph presents three relevant studies about the relationship between physical body movement and vocabulary memory, which suggest some research gaps for future research.

Toumpaniari, Loyens, Mavilidi, and Paas (2015) conducted a study showing that representing words through physical activities and gestures could improve preschool children's foreign language (i.e., English) vocabulary retention with a sample of 67 preschool children aged four years old in Athens. The research focused on combining classroom-based embodiment of physical activities and gestures to facilitate vocabulary learning. All children were divided into three groups (i.e., embodying words through physical activities and gestures; embodyingwords through gestures only; traditional teaching without physical activities and gestures). Participants were taught 20 new English words, all falling in the category of animal names. A cued recall test was used to test participants' vocabulary memory performance. The author clarified that in embodying words through physical activities and gestures condition, children acted out movements from various animals. In contrast, in embodying words through gestures only condition, children acted out movements of the same animal words with gestures while remaining seated. The results revealed that embodying words through physical activities and gestures would be more efficient for learning foreign language words than embodying the same words through gestures only. Also, learning a foreign language by embodying words through physical activities and gestures or through gestures only is

more effective than learning in a traditional way.

Another study by Mavilidi, Okely, Chandler, Cliff, and Paas (2015) in Australia maintained that children who learned a foreign language (Italian) in a way that integrated physical exercises recalled more Italian words than children who learned by repeating words. The researchers compared four conditions (i.e., learning through task-relevant physical exercises;learning through task-irrelevant physical exercises; learning through task-relevant gestures; learning by repetition of words). The physical exercise meant moving around, and gesture referred to acting while being seated. The selected words ranged from action words (i.e., fly,jump, throw) to adjectives (i.e., fast, slow) to nouns (i.e., dance) which were familiar to children. A free recall test and cued recall test were used in this study. The results of the cued recall test showed that all conditions outperformed the repetition condition and the task-relevant physical exercises condition outperformed the task-relevant gestures condition.

These two studies focused on the effects of different types of physical body movement (i.e., physical activity/exercise and gestures) on children's vocabulary retention performance. They all agreed that embodying words through physical activity/exercise and gestures led to a higher cued recall test performance than embodying the same words through gestures only. Hence, this study will not differentiate different types of physical body movement. The term "physical body movement" used in this study involved both physical activity/exercise and gestures. Vocabularies used in these two studies were different, either falling into one category (i.e., animals) or different categories (i.e., jump, low, dance). It was reported that by embodying words through physical body movement, these types of vocabularies were recalled better. However, the difference between the

improvement between different categories of vocabularies remained unclear. Moreover, these two studies were conducted in Athens or Australia, so whether the same results were applicable to Chinese children was not clear as well. Furthermore, these two studies did not compare the gender difference in children's vocabulary memory. Therefore, whether girls perform better than boys or reverse in memorizing vocabulary remains unknown.

In addition, a new study recently has investigated how gestures and pictures enhanced foreign language vocabulary memory of eight-year-old children through a long-term experiment in Germany (Andrä, Mathias, Schwager, Macedonia, & von Kriegstein, 2020). The results revealed that gestures and pictures could enhance children's vocabulary memory compared with non-enriched learning. Based on children's performance in cued vocabulary recall and translation tests, this study observed similar effects between gestures and pictures on children's vocabulary memory. This result was contradictory to previous findings in adults, suggesting gestures were more effective in improving children's vocabulary memory than pictures. According to this study, gestures and pictures had positive impacts on children's vocabulary retention respectively. However, it did not examine the combined effects of gestures and pictures on children's vocabulary retention. Also, this study targeted primary school children, which suggested a future research direction for younger children.

2.6 Research Gap

Based on the results of previous research, it was expected that integrating physical body movement into teaching would increase children's vocabulary memory of a foreign language. In other words, children who are taught by triad code strategy would recall

more vocabulary than children who are taught by dual code strategy in the cued recall test. Therefore, this study will examine this relationship again to find whether this relationship also applies to Chinese children. Secondly, previous research did not compare the impacts of a teaching strategy on the improvement of different types of vocabularies. Thus, this study tries to find in the triad code strategy condition, whether the improvement between animal vocabularies and action vocabularies is different. Furthermore, the gender difference in recalling vocabulary varies among different literature and previous studies did not show significant results. As a result, this paper would like to explore whether gender has any significant effects on children's vocabulary memory.

3. The present study

The study tried to answer the following research questions:

1. Do children in the triad code strategy condition recall more vocabularies than children in the dual code strategy condition in the cued recall test?
2. Is there a difference between the number of recalled action vocabularies and the number of recalled animal vocabularies by children in the triad code strategy condition?
3. Does gender have any significant effects on children's vocabulary memory?

Null Hypotheses:

1. The number of recalled vocabularies by children in the triad code strategy condition is less or the same as that of children in the dual code strategy condition in cued recall test.

2. There is no significant difference between the number of recalled action vocabulariesand the number of recalled animal vocabularies by children in the triad code strategy condition.
3. There is no significant difference between the number of recalled vocabularies bygirls and boys.

Alternative hypotheses:

1. The number of recalled vocabularies by children in the triad code strategy condition is significantly greater than that by children in the dual code strategy condition in cued recall test.

2. There is a significant difference between the number of recalled action vocabularies and the number of recalled animal vocabularies by children in the triad code strategy condition.
3. There is a significant difference between the number of recalled vocabularies by girlsand boys.

4. Methodology

4.1.Research design

The study adopted a quasi-experimental design which was similar to a true experiment, but without random assignment. Due to kindergarten-related concerns (i.e., time, management issues), it was not convenient to randomly assign all participants to different conditions. As a result, children were just randomly assigned as two classes to different conditions in the study. The independent variable (IV) was different teaching strategies (i.e., dual code strategyand triad code strategy). The dependent variable (DV) was the

number of vocabularies that children correctly recall after teaching. All children in two conditions were taught by the same person (experimenter) to reduce the teaching influence from different teachers (i.e., teaching style). In this study, two conditions were compared:

Experimental group: children were taught with triad code strategy

Control group: children were taught with dual code strategy

4.2.Participants

Participants include 32 children (12 boys and 20 girls) aged 4 to 5 years old (K2) whose mother tongue is Mandarin. They are typical-developing children without any special needs.K2 children are more capable of following the instructions of teachers and acting out some actions (The Curriculum Development Council, 2017). All participants come from a local kindergarten called Yuci District Qingji Kindergarten (榆次區輕機幼兒園), located in Shanxi province, mainland China. This school is a local private Mandarin kindergarten where the teaching and communication language is Mandarin only, and no English class is included.As reported by the kindergarten principal and class teachers, none of these participants had prior English experience at both home and school. Also, none of the participants' parents is anEnglish speaker. Therefore, we can roughly assume that all children know little English vocabulary and their English abilities are similar at the beginning of the experiment.

32 participants belong to two classes— the bubble class (泡泡班) and the bean class (豆豆班). Each class has 16 participants, but the gender ratio is a little different between the two classes. The bubble class has 4 boys and 12 girls, so the boy to girl ratio is 1 to

3. For the bean class, there are 8 boys and 8 girls, so the boy to girl ratio is 1 to 1. By random assignment, the bubble class was allocated to the experimental group and the bean class was the control group. As I mentioned, all children do not have prior English experience, so individual differences of prior vocabulary and English ability between two classes can be negligible.

4.3.Materials

The teaching materials used in this study included a storybook (《Brown bear, Brown bear, What do you see?》), six vocabulary cards, a sheet of lyrics, and other things (i.e., secret box,stickers, etc.) (refer to the appendix). The chosen storybook is a well-known picture book which is suitable for beginners to learn English vocabulary and sentence patterns. Six target vocabularies were derived from this storybook. The 6 words were "jump","walk", "run", "cat", "bird", "duck", categorized as action vocabularies and animal vocabularies. These vocabularies were single-syllable words which were relatively easier for novice English learners. Animal vocabularies were directly shown in the storybook, while action vocabularies were extended from the storybook. For example, when children saw the "frog" from the storybook, the experimenter asked children how the frog moved— the answer was "jump". Then the experimenter would teach the word "jump". On each vocabulary card, the upper part is a picture that is a visual representation of words and the lower part is the spelling of words. The sheet of lyrics was used to teach children a song in which three action vocabularies were repeated. The melody of the song ("Two Tigers") is very popular for young children in mainland China, so that children are easy to follow the song. This song was a supplement material to teach children action vocabularies in a fun way.

4.4.Procedures

Before the experiment, the experimenter invited parents and the kindergarten principal to signthe consent forms and informed them about the experiment procedures. Because it was not feasible to randomize the participants, the two classes were randomly assigned to one of the two conditions by drawing lots. After completing the preparation procedure, the experimenter started teaching.

The total teaching duration was one week. The first four days were to teach children six target vocabularies and the last day was for assessment. For detailed teaching plans, please refer to the appendix. For both the experimental group and the control group, there was one session each day, and each session lasted for 20 minutes. In Total, there were four teaching sessions and one assessment session for each group. The two groups were taught by the same person (the experimenter) with the same learning content. Firstly, the experimenter read the storybook with children together. When it comes to the target vocabularies while reading the storybook, the experimenter paused and showed correspondent vocabulary cards to teach children target vocabularies. The experimenter said the vocabulary first in Mandarin and then in English. The experimenter followed the same teaching procedure when taught in the experimental group and the control group. The difference is that in the experimental group, the experimenter showed the vocabulary cards, pronounced the vocabulary in Mandarin and in English, and at the same time did body movement. Accordingly, children in the experimental group were asked to show physical body movement while saying out the vocabulary in English. However, in the control group, the experimenter only showed the vocabulary cards and pronounced the vocabulary in Mandarin and in English. Also, children were asked to say out the

vocabulary in English only.

At the end of the teaching week, all participants in two conditions attended an individual recall test to record how many words they could remember. Also, they need to indicate their satisfaction with this English learning experience.

4.5.Measurement of memory performance: cued recall test

The final memory test will be implemented in a cued recall format. For example, when the experimenter said the word in Mandarin, then the child said the same word in English. A checklist containing all words was used for the experimenter to tick the correctly recalled vocabularies by children. The cued recall test is derived from the concept of paired-associatelearning which is a typical strategy to help children build association between the response and stimuli (Ashcraft & Radvansky, 2010). During the teaching week, children learned boththe Mandarin and English sounds of each word which built an association between two sounds. Later, when the experimenter said a word (i.e., “cat” 猫) in Mandarin, children responded “cat” in English.

For measuring children’s satisfaction with the English class, a five-point Likert smiley rating scale was used. The smiley scale was reliable and was not influenced by age, gender, or education (Jäger & Bortz, 2001). Children were asked to answer one question (“do you like the English course?”). The labels under five faces are “very unsatisfied, unsatisfied, ordinary,satisfied, and very satisfied”. The question and the labels were read out by the experimenter and children had to indicate their answers on a smiley scale by coloring one face.

5. Data Analysis & Results

5.1. Method for data analysis

The method used for data analysis in this study is the *t*-test, including the independent samples *t*-test and the paired sample *t*-test. The *t*-test is often used to test whether the difference between the means of two sets of numbers is significant or not (Xu et al., 2017). Specifically, independent samples *t*-test is to compare the difference between the means of two sets of numbers from two sample groups. In contrast, the paired sample *t*-test is to compare the difference between the means of two sets of numbers from one sample group. Besides, *t*-test can be categorized as the one-tailed and the two-tailed *t*-test. One-tailed *t*-test is to test whether the mean of sample A is significantly greater than or significantly less than the mean of sample B. One-tailed *t*-test has directions. However, for two-tailed *t*-test, it is to examine whether the mean of sample A and the mean of sample B are significantly different.The direction remains unclear. The mean of sample A may be greater than sample B, or vice versa. One-tailed *t*-test is used when there is sufficient evidence from previous research suggesting the direction, while two-tailed *t*-test is used when the evidence is not sufficient. For example, the research question 1 was analyzed by a one-tailed t-test because previous studies showed a consistent conclusion that embodying words through physical body movement could improve children's vocabulary memory. Therefore, with the strong evidence, this study would like to ascertain this relationship. Since the evidence about the impacts of triad code strategy on different categories of vocabulary memory and gender difference was insufficient, research questions 2 and 3 were tested by two-tailed *t*-test to identify whether there was significant difference between variables. However, the direction of difference (i.e., greater or lower) can not be concluded through this study.

Usually, the significance level α=0.05. The significance level indicates if the result of *t*-test—*p* value is lower than 0.05, we can reject the null hypothesis and accept the alternative hypothesis.

5.2 Results

Table 1. Compare the means of the number of recalled vocabularies in two groups

	Mean	One-tailed independent samples *t*-test *p* value
Experimental group (n=16)	3.938	0.001
Control group (n=16)	2.125	

*significance level α=0.05

Table 1. showed the means of the number of recalled vocabularies in experimental group and control group, which were 3.938 and 2.215 respectively. By using the one-tailed independent samples *t*-test, *p* value equalled 0.001 which was lower than the significance level α=0.05. According to the result, the null hypothesis was rejected and the alternative hypothesis wastrue. Hence, it is concluded that at the significance level α=0.05, the number of recalled vocabularies by children in triad code strategy condition was significantly greater than that bychildren in dual code strategy condition.

Besides, the means in table 1. indicated that children's average improvement of vocabulary was around four vocabularies for the experimental group and was around two vocabulariesfor the control group after one-week teaching.

Table 2. Compare the means of the number of recalled animal and action vocabularies in experimental group

		Mean	Two-tailed paired sample *t*-test *p* value
Experimental group (n=16)	Animal vocabularies (Bird, duck, cat)	2.313	0.005
	Action vocabularies (Jump, walk, run)	1.625	

*significance level α=0.05

Table 2. presented the means of the number of recalled animal and action vocabularies in the experimental group. By using the two-tailed paired sample *t*-test, *p* value equalled 0.005 which was lower than the significance level α=0.05. Based on the data, null hypothesis was rejected. Thus, there was a significant difference between the number of recalled action vocabularies and the number of recalled animal vocabularies by children in triad code strategy condition. The average improvement of animal vocabularies was slightly greater than that of action vocabularies.

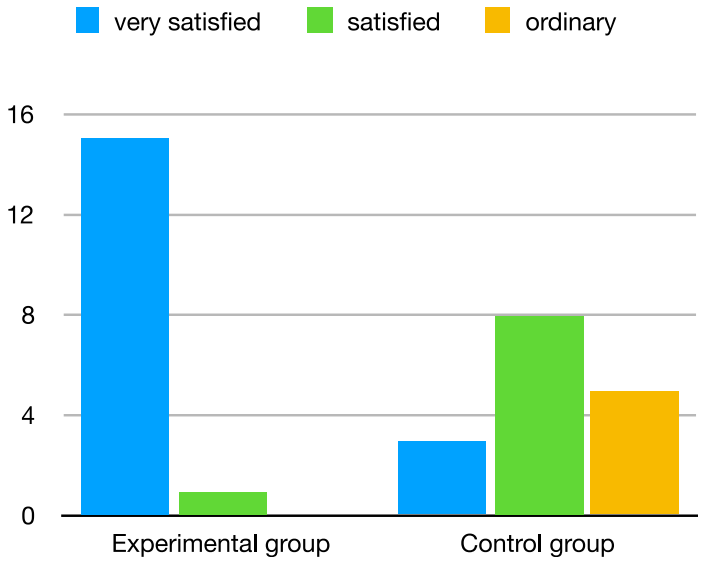
Table 3. Compare the means of the number of recalled vocabularies by girls and boys

	Mean	Two-tailed independent sample *t*-test *p* value
Girls (n=20)	3.35	0.188
Boys (n=12)	2.5	

*significance level α=0.05

Table 3. Compared the gender difference in the number of recalled vocabularies. Because the *p* value (0.188) was larger than the significance level 0.05, the null hypothesis could not be rejected. In other words, at the significance level α=0.05, there was not a significant difference between the number of recalled vocabularies by girls and boys. Although the meanscores of girls and boys showed in Table 3. were different, the two means did not have statistically significant differences.

Table 4. Children's satisfaction with the one-week English course



In table 4, the graph depicted Children's satisfaction with the one-week English course. In the experimental group, all participants were satisfied with the English course and the majority of them (15 out of 16 participants) indicated "very satisfied" with the English course. However, in the control group, children's attitudes varied. Although most children were satisfied with the English course, some children (5 out of 16 participants) thought the course was ordinary. Also, the number of children who got satisfied with the English course in the experimental group (16 participants) was greater than that in the control group (11 participants). Therefore, the triad code teaching strategy was more welcomed by children.

6. Discussion

By comparing *p* value and significance level, the study results rejected null hypotheses of research question 1 and 2, but failed to reject that of question 3. Firstly, it was concluded from table 1 that triad code strategy was more effective in improving children's vocabulary memory than dual code strategy. The result was in line with previous research, indicating integrating physical body movement into teaching was conducive to children's vocabulary memory. Also, the results supported that three code processing could increase the chance of successfully encoding vocabulary and storing vocabulary in long-term memory. Besides, the test score for the control group was low (i.e., the average improvement of vocabulary was 2 words), which indicated that learning English was not an easy task for four to five years old children, especially for those who lived without an authentic English learning environment. However, the scores of the experimental group was significantly higher than the control group, suggesting triad code strategy was an effective foreign language teaching method to improve children's vocabularies. Moreover, the result showed that the experimental group outperformed the control group. On the one hand, it might be due to the difference of teaching strategy in two groups. Because the triad code strategy was thought to be more effective than the dual code strategy, the group that used the triad code strategy would yield higher scores than another group. On the other hand, another plausible explanation is the gender difference. Some previous literature pointed out female learners usually outperformedmale learners in language learning, so the group with more girls was likely to achieve higher scores. Although the experimental group and the control group have the same number of participants (16), the gender ratio is not

the same— the experimental group (12 girls) has more girls than the control group (8 girls). Therefore, the experimental group is likely to show a better performance than the control group.

Secondly, table 2. exhibited that the effectiveness of triad code strategy was significantly different for teaching different types of vocabulary. This is a new finding based on previous research which did not compare the difference between different categories of vocabulary for a teaching approach. Although which type of vocabulary is recalled better in terms of statistical significance remains unknown, the means showed that children's average improvement of animal words (2.313) is greater than that of action words (1.625). Therefore, it can be inferred that the triad code strategy may be more effective in teaching children animal vocabularies than action words. Future studies can explore the significance of this assumption. There are several explanations for the assumption. One possible reason is that children are more familiar with animals in their daily life, so they learn animal words quicker and better than action words. Another explanation may be that animal words are easier to pronounce than action words in this study. For instance, the consonants of walk, jump, run (/w/, /dg/, /r/) is more complicated and difficult to pronounce than that of bird, cat, duck (/b/,
/k/, /d/).

Thirdly, the results from table 3 were congruent with Naeini and Shahrokhi's research(2016), stating gender did not have any significant effects on children's vocabulary retention. However, this result was contradictory to much existing literature that supports girls having advantages in memorizing vocabulary compared with boys. It was difficult to explain this result, but it might be related to sample bias. This study had

a relatively small sample, including only 20 girls and 12 boys. Hence, the inconsistency between previous research andthis study is likely to be an accidental incident. This result may not serve as strong evidence to support or deny previous research.

With reference to table 4., children's attitudes towards the one-week teaching provide some meaningful suggestions. The results revealed that children liked the teaching method which incorporated physical body movement (i.e., physical activity and gestures), possibly because this teaching method is more interesting and interactive. Also, the results suggested that triad code strategy is a preferred way for teaching children in the future.

7. Limitations and future direction

There are several limitations in the present study. Firstly, participants in this study were blinded about which group they were, but the teacher (experimenter) was not blinded, which might give rise to the result bias. Hence, future studies can try to conduct double blind research to prevent biases. Secondly, this study did not randomly assign all participants to two groups. Therefore, in the future, researchers can use random assignment to repeat this study. In addition, the sample size (32 participants) of this study was small. Thus, other researchers can recruit more participants to improve the research design. Moreover, This study conducted a one-week teaching program. Accordingly, future research can carry out long-term follow-ups, such as longitudinal research studies to investigate the long-term effects of triad code strategy. Furthermore, this study was conducted in the context of mainland China. Thus, future research can expand the results to other contexts (i.e., Japan,America, European countries, etc.)

8. Implications:

The results from the study exhibit some theoretical implications for research in relevant fields. For example, triad code strategy is significantly effective for Chinese children to remember English vocabularies, but the significance may vary in other contexts (e.g., Japan, U.S.). Besides, integrating both body movement and pictures in language teaching is more effective for early English teaching than using pictures only. Practically, The results suggest kindergarten teachers integrate both body movement and pictures in their teaching to help children remember English vocabulary better. However, the triad code strategy is not suitable for teaching color or some abstract vocabularies because these vocabularies cannot be represented through physical body movement (Paivio, as cited in Selim, 2010)

Word count: 6305

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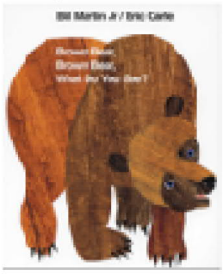
Appendices:

Teaching materials:

1. Storybook《Brown bear, Brown bear, what do you see?》



2. Vocabulary cards

3. Lyrics of a song

4. Others (secret bag, stickers,..)