

# Skillful Analysis of English Language Lexical Processing and Language Cognitive Learning Assisted by Artificial Intelligence

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## ABSTRACT

With the development of artificial intelligence technology, the learning mode of "artificial intelligence + education" has become the direction of the times. Through a questionnaire survey on students' vocabulary learning strategies and taking students of a middle school as the research object, the study explores the level of strategy use in English vocabulary learning in terms of the frequency of strategy use and the differences in strategy use among students of different levels. On this basis, the way of English word sense processing with the assistance of artificial intelligence is summarized and the word association memory model is proposed. And two classes in a middle school are selected for teaching experiments to apply the word association memory model to English vocabulary learning and explore the effect of the model on students' word memory. Overall the cognitive strategy (3.489) and resource strategy (3.477) of English vocabulary learning are used more frequently. The English vocabulary level model of the students in the experimental class increased after the teaching experiment, which was 8.05 points higher than that of the control class and still 5.118 points higher than that of the control class in the delayed test, reflecting the vocabulary learning effect and durability of the word association memory model. Students can improve their language cognitive learning skills in three aspects: metacognitive strategies, cognitive strategies, and communicative/influential strategies, which further promote the development of English proficiency.

**Keywords:** vocabulary learning strategies, questionnaire survey, linguistic word sense processing, word association memory model, teaching experiment

## 1. Introduction

Cognitive linguistics inherits and develops some ideas from empirical associationism and cognitive psychology [1]. It advocates Piaget's interactionism, which starts from the human psyche that the

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brain's cognition is based on itself to expand outward [2-3]. The brain's thinking begins in the brain exists in the person who interacts with the outside world, and the self-cognition is the result of the person's perception and experience of the objective world, and is the product of the interaction between the person and the external world [4-5]. As far as language itself is concerned language is one of the intelligent activities of human beings, is a component of human cognition the two are closely linked [6]. Cognitive development precedes language and determines language development [7]. The lexical and grammatical structures of language are at different levels [8]. Linguistic units are composed of a combination of form and meaning, have an inner structure of symbols and have a real cognitive status [9]. The meaning of language is not limited to the interior of the language, but is rooted in the cognition of human interaction with the objective world and in the understanding and beliefs of the user about the world [10]. This theory suggests that cognition plays an important role in understanding the deep structure of language and in using it [11].

Like any language, English vocabulary is in a constant state of flux, and the meanings of English words have gone through various changes during their long development [12]. New constructions are constantly being made in the creation of new words, the disappearance of old words and changes in the range of lexical meanings [13]. Understanding these changes, on the one hand, English readers can be a little easier to read in English, no longer knowing but not reaching, and can improve the effectiveness of memorizing words in vocabulary learning [14]. On the other hand, when English teachers know these changes well, they can "teach according to words" and integrate English cultural background into boring vocabulary teaching, which will lead to better learning effects [15].

With the development of cognitive science and the continuous deepening of language research, foreign language teaching is gradually built on a more scientific basis [16]. Cognitive learning is a basic cognitive activity of human beings, which involves not only the acquisition, retention and utilization of knowledge but also motivation, interest, attitude and emotion [17]. Cognitive learning theory regards students' learning as meaning learning that grasps the meaning of things and the internal connection of things [18-19].

Starting from five aspects, namely, resource strategy, cognitive strategy, memory strategy, live strategy, and regulation strategy, this paper investigates the current situation of strategy use in English vocabulary learning through questionnaires and diaries with the students of a middle school, and analyzes the frequency of vocabulary strategy use and the differences between students of different English levels. Subsequently, it summarizes and analyzes the way of English word sense processing assisted by artificial intelligence technology, and proposes a word association memory model on this basis. Then the students of class 203 and class 205 of a middle school were selected as the experimental subjects, in which class 203 as the experimental class applied the word association memory model to learn, and class 205 as the control class did not use intelligent assistive technology. The influence of word association memory model on students' vocabulary learning effect and the accuracy of the effect were explored through data statistics and independent samples t-test before, after and one month after the teaching experiment, respectively. Further, English cognitive learning skillfulness was analyzed in terms of three dimensions: metacognitive strategies, cognitive strategies, and social (affective) strategies.

## **2. Survey on the use of English vocabulary learning strategies**

Vocabulary is an important criterion for evaluating learners' English proficiency, and this chapter of the study aims to understand the current status of the use of vocabulary learning strategies among middle school students.

### *2.1. Subjects of study*

In this research study, 274 students in the first year of high school in a middle school were selected as

the research subjects for the questionnaire survey section, and three students who were good at English and three students who were bad at English in a class of the ninth grade in the school were used as the research subjects for the diary section, and the six students were selected based on the English scores in the final exam. The diary section was chosen to cover three stages: the beginning of the semester, the middle of the semester, and the end of the semester, and each stage of the record lasted for one week, and the students' diaries were required to contain the following three aspects: the date, the source of vocabulary the specific process of learning vocabulary.

## *2.2. Questionnaire*

The questionnaire was designed in an anonymous way and included two parts: basic information and vocabulary learning strategies. The basic information includes gender and last final exam score. The vocabulary learning strategy questionnaire includes five strategies: resource strategy, cognitive strategy, memorization strategy, utilization strategy and regulation strategy. A total of 274 questionnaires were distributed and 270 questionnaires were recovered, of which the questionnaires with missing basic information or omitted vocabulary strategy questions were regarded as invalid questionnaires, and after 35 invalid questionnaires were sifted out, the remaining valid questionnaires were 235 questionnaires. The overall reliability and validity of each strategy of the obtained new variables were found, and the reliability coefficient was 0.894 and the validity coefficient was 0.827, which was greater than 0.7, with good reliability and validity.

## *2.3. Frequency profile of vocabulary strategy use*

2.3.1. Overall situation. This part will analyze the frequency of students' use of various types of vocabulary learning strategies from five aspects: resource strategies, cognitive strategies, memorization strategies, activation strategies, and regulation strategies. From the questionnaire data, the use of vocabulary learning strategies in each category is shown in Table 1. The mean values of the five types of strategies are in the range of 2 to 4, and in descending order they are: cognitive strategy, resource strategy, memory strategy, regulation strategy, and active strategy, among which the mean value of active strategy is less than 3, which is more different from the other four types of strategies.

Overall, students used cognitive strategies, resource strategies, memorization strategies, and modulation strategies more frequently, and activation strategies less frequently. Students' main source of vocabulary is still the exercises, the use of different senses in the memorization strategy still needs to be strengthened, and students perform poorly in reflection and planning in the regulation strategy, and they cannot actively use vocabulary in an active way, which is mainly due to the lack of real-life contexts, and the difficulty of the activation strategy for the students themselves, and the lack of the students' own English language proficiency is also an important reason.

**Table 1.** Use of various kinds of lexical strategies

|             | Resource strategy | Cognitive strategy | Memory strategy | Active strategy | Regulatory strategy |
|-------------|-------------------|--------------------|-----------------|-----------------|---------------------|
| Average     | 3.477             | 3.489              | 3.383           | 2.318           | 3.094               |
| Case number | 235               | 235                | 235             | 235             | 235                 |
| Total       | 900.171           | 903.589            | 901.142         | 810.221         | 893.187             |

2.3.2. Differences between students with different levels of English proficiency. In studies related to the differences in the use of vocabulary strategies among students with different levels of English proficiency, researchers have paid much attention to the number of types of strategies and the number of times students use them, so this study also first analyzed the types of vocabulary learning strategies used in the diaries of the six students.

The types of vocabulary learning strategies used by the students are shown in Table 2, and the number of times the students used vocabulary learning strategies is shown in Table 3. There is a gap between the two groups of students with different levels of English proficiency (Group A and Group B) in terms of the types of vocabulary learning strategies used and the number of times they used them. The total number of types of vocabulary learning strategies used by the students in Group A is more than 20 and more than 60 times, while the number of times used by the students in Group B is less than 15 and less than 50, and the students with high English proficiency (Group A) have more types of vocabulary learning strategies used and more times used than the students with low English proficiency (Group B).

There are great differences in the flexibility of using vocabulary learning strategies among students with different levels of English proficiency, which are reflected in the differences in the choice of vocabulary strategies, the differences in the degree of proficiency in using the strategies, and the differences in the combination of using different vocabulary learning strategies. Among them, the differences in the choice of vocabulary learning strategies among students with different English proficiency levels are mainly reflected in the level of knowledge reprocessing of the selected strategies, the differences in the proficiency of using strategies are mainly due to the differences in the students' English knowledge levels and the differences in their familiarity with the strategies themselves, and the differences in the combination of different vocabulary learning strategies are mainly reflected in the question of whether or not to supplement the combination of vocabulary learning strategies with reasonable cognitive strategies and modulation strategies. Cognitive and regulatory strategies.

**Table 2.** The use type of the student's lexical strategy

| Students | Resource strategy | Cognitive strategy | Memory strategy | Regulatory strategy | Active strategy | Total |
|----------|-------------------|--------------------|-----------------|---------------------|-----------------|-------|
| A1       | 6                 | 7                  | 4               | 5                   | 3               | 25    |
| A2       | 5                 | 6                  | 6               | 5                   | 3               | 25    |
| A3       | 5                 | 4                  | 5               | 4                   | 2               | 20    |
| B1       | 4                 | 5                  | 2               | 0                   | 1               | 12    |
| B2       | 3                 | 5                  | 4               | 1                   | 0               | 13    |
| B3       | 1                 | 3                  | 2               | 1                   | 1               | 8     |

**Table 3.** The use frequency of the student's lexical strategy

| Students | Resource strategy | Cognitive strategy | Memory strategy | Regulatory strategy | Active strategy | Total |
|----------|-------------------|--------------------|-----------------|---------------------|-----------------|-------|
| A1       | 22                | 24                 | 18              | 8                   | 5               | 77    |
| A2       | 20                | 21                 | 17              | 7                   | 4               | 69    |
| A3       | 17                | 26                 | 11              | 5                   | 6               | 65    |
| B1       | 12                | 15                 | 10              | 3                   | 1               | 41    |
| B2       | 8                 | 14                 | 13              | 5                   | 2               | 42    |
| B3       | 2                 | 12                 | 4               | 3                   | 0               | 21    |

### 3. Analysis of lexical processing and students' learning effects in the English language

#### 3.1. Word association memory model based on linguistic lexical processing

This subsection designs a word association memory model based on the generalization of AI-assisted semantic processing of English.

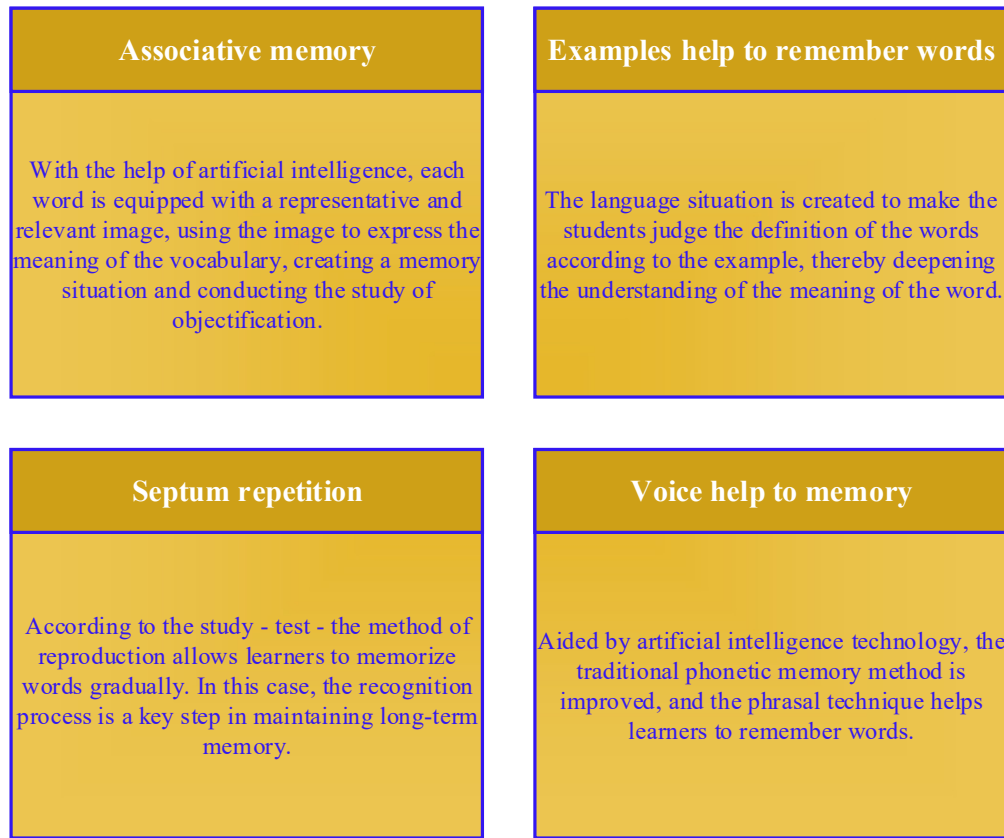
3.1.1. Artificial Intelligence-Assisted English Word Sense Processing. In English learning, vocabulary expansion always plays a vital role. With the continuous development of artificial intelligence, vocabulary software has received more and more attention. The way of English word sense processing with the assistance of artificial intelligence is shown in Figure 1, including associative memory, example sentence assistance, interval wealth memory and phonological assistance.

Associative Memorization. With the assistance of artificial intelligence, let each word be equipped with a representative and relevant picture, and use the picture to express the meaning of vocabulary, create a memory situation and carry out three-dimensional learning. Learners form associative memories in their brains through association based on the vivid images. This method not only improves the efficiency of vocabulary learning, but also stimulates the learners' interest in memorizing words.

Example Sentence Assisted Memorization. Through artificial intelligence assisted technology, the words learned are presented in the form of phrases, with example sentences, creating a language situation, allowing students to judge the interpretation of vocabulary according to the example sentences, thus deepening the learners' understanding of the meaning of words, assisting learners in understanding the usage of the word, and improving the learners' active vocabulary reserves.

Interval Repetition Memorization. With the assistance of artificial intelligence, newly learned vocabulary is categorized according to criteria such as the number of errors, the length of study, and the frequency of review, and appears at different time intervals (every 5 minutes, 20 minutes, and two days), which provides learners with a scientific review function. In addition, if some vocabulary words are still not memorized in the "Reproduction" session, learners can bookmark these words and find them in the software's "Vocabulary Book" for review in the future. This not only allows learners to grasp the vocabulary learned more firmly, but also improves the learning efficiency.

Voice-assisted memorization. With the aid of artificial intelligence, the traditional phonetic memorization method has been improved to help learners memorize words by voice-assisted memorization. The page can automatically play the standard pronunciation of the word and automatically divide syllables into phonetic symbols of the word, which provides a convenient and more scientific method of word memorization for learners who are not proficient in mastering phonetic symbols and pronouncing the words correctly.



**Fig. 1.** English semantic processing in artificial intelligence

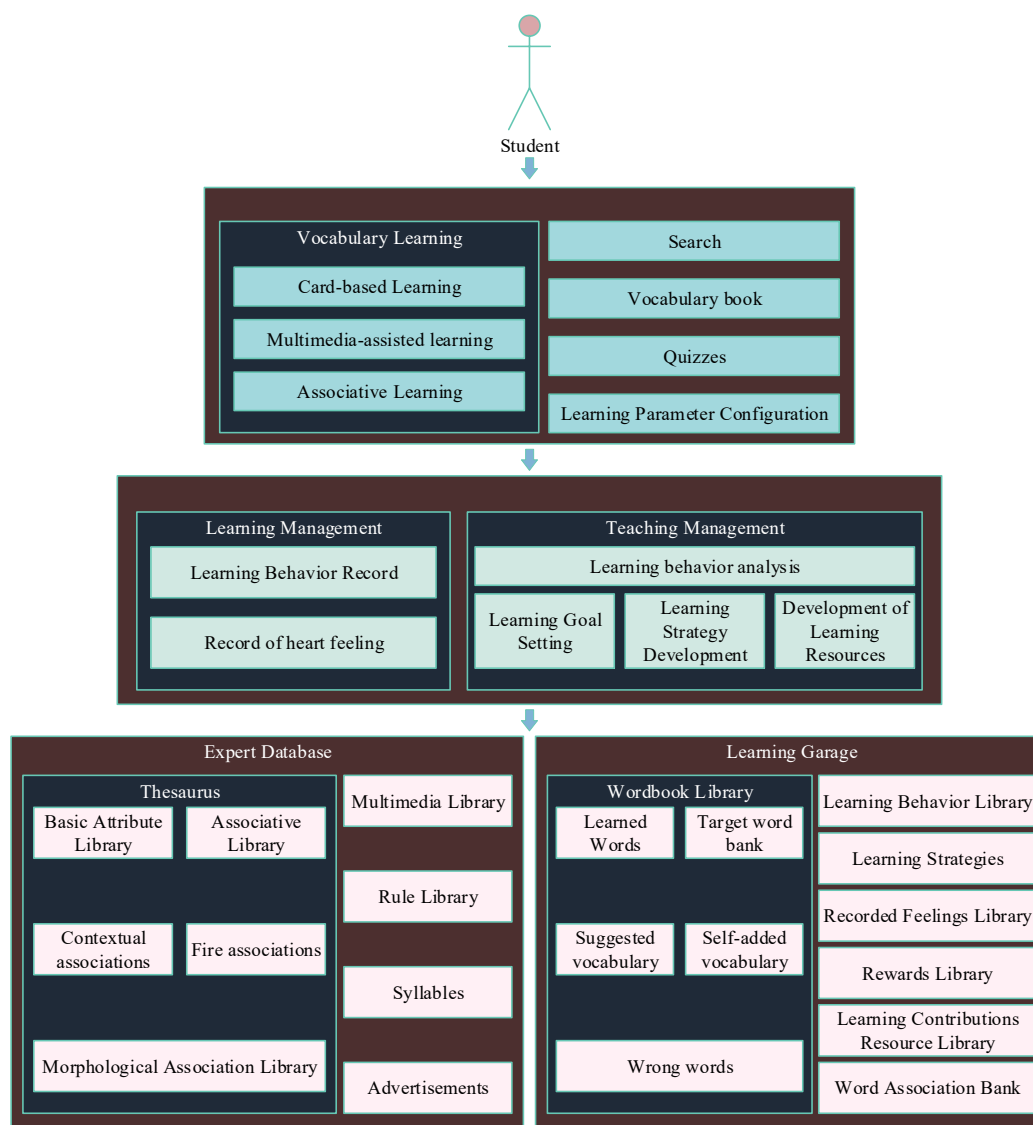
3.1.2. Word association memory models. In the field of English teaching, it has been recognized that learning words is not simply rote memorization of some isolated lexical items. This paper proposes a word association memory model based on the English semantic processing method assisted by artificial intelligence technology. The general framework of the word association memory model is shown in Fig. 2, which introduces associative memory into the memorization of word sense items, and associates isolated words through their sounds, shapes, meanings, and scenarios to form a word network, in which the nodes in the network are independent words, and the edges associated between words are the associative relationships between words. Based on this network, various scenarios are constructed, and related words are presented in the same scenario. By reproducing the words through the scenarios, the learners will consciously and happily accept the rememorization of the words.

For long words that are difficult to memorize, word slice associative memory can be recommended. The main idea is to split the word into several substrings, use the pronunciation of these substrings and the common words that are close to the pronunciation of the native language to make associations, as well as the English words represented by these substrings or similar English words to make associations, and finally link these associations together to achieve the purpose of memorizing the word.

Providing some meaningful linguistic background in learning vocabulary words, the process of constructing contexts for vocabulary words accompanied by semantic processing can evoke different imaginations in students' minds, and subconsciously students will search for the storage of vocabulary words, storing enough hints for future memory extraction.

In addition to the learning of the words themselves and vocabulary association, through the aid of multimedia materials in various forms, showing the words in three dimensions from the aspects of sound, color, light, shadow and shape, and setting up multimedia and game sessions, the boringness of memorizing words and the passivity of learners can be avoided.





**Fig. 2.** The overall framework of the word association memory model

The word associative memory model is implemented through app applications in practice. The app will synchronize the students' learning materials and realize the memory association of the target learning words. Students can only see the words of the word and see the association of word memory.

### 3.2. Analysis of Student Learning Effectiveness Assisted by Artificial Intelligence

Apply the word association model based on linguistic lexical processing in 3.1 to teaching practice and analyze the effect of the model on students' learning of English vocabulary.

**3.2.1. Research design.** The subjects of this study are the students of the senior class 203 and 205 of a middle school, 51 students in each class, with class 203 as the experimental class and class 205 as the control class. The experimental class is tutored by artificial intelligence with the word association memory model. And the comparison of the word associative memory model of the experimental class is adopted by artificial intelligence, and the comparison class only use the word memory method in the class, and the use of any intelligent auxiliary tool is forbidden.

When preparing the test paper, this paper fully combines the students' learning level at this stage and combines the question types and examination requirements of the college entrance examination, and prepares a vocabulary test paper that meets the English level of the research subjects, to test the

vocabulary learning of the experimental subjects. The test paper includes four knowledge dimensions: vocabulary spelling, English-Chinese translation, fixed phrase collocation, and word guessing in English context.

The pre-test paper was used to find out the basic vocabulary level of the students to determine whether they could be used as research subjects for the experiment. The post-test paper was used to test the effect of vocabulary learning of the research subjects after using the word association memory model for learning. The delayed post-test paper was used to test the vocabulary memory of the research subjects one month after the end of the experiment to determine the durability of the effect of using the word association memory model for learning.

3.2.2. Vocabulary test paper pre-test analysis. In order to understand the vocabulary starting level of the students in class 203 and class 205 and to ensure the validity of the experimental subjects, a vocabulary pre-test was to be administered to the students of the two classes before the experiment.

The results of the frontside data of the two classes are shown in Table 4. The mean score of Class 203 is 76.94 and Class 205 is 76.57, which is only a difference of 0.37, and the mean scores of the pre-test scores of these two classes are close to each other. The standard deviation of the two classes is also similar. Also through the SPSS software, an independent samples t-test was conducted on the pre-test scores of these two classes. Based on the results of the test, it can be seen that  $P=0.871 > 0.05$ . Therefore, there is no significant difference between the scores of class 203 and class 205. Therefore, it can be stated that the vocabulary levels of Class 203 and Class 205 were comparable before the experiment and a comparative experimental study can be conducted.

**Table 4.** The previous data of the two classes

| Group statistics scale    |                                 |         |                           |           |                    |
|---------------------------|---------------------------------|---------|---------------------------|-----------|--------------------|
| Class                     | Case number                     | Average | S.E.                      | S.E. mean |                    |
| 203                       | 51                              | 76.94   | 10.374                    | 1.638     |                    |
| 205                       | 51                              | 76.57   | 10.451                    | 1.663     |                    |
|                           | Levin variance equivalence test |         | Average equivalent T test |           |                    |
|                           | F                               | Sig.    | T                         | Df        | Sig. (double tail) |
| Assumed equal variance    | 0.023                           | 0.871   | 0.232                     | 98        | 0.834              |
| Unassuming equal variance |                                 |         | 0.232                     | 97.156    | 0.834              |

3.2.3. Post-test analysis of vocabulary test papers. The post-test of the experiment was conducted in class 203 and class 205. The post-test paper was of 100 marks and the exam lasted for 40 minutes with the same marks, question types and exam duration as in the pre-test. The statistical results of the post-test of class 203 and class 205 were obtained through SPSS software.

The results of the post-test data of the two classes are shown in Table 5. The mean score of the post-test of Class 203 is 86.44, and the mean score of Class 205 is 78.39, and the mean score of Class 203 is 8.05 points higher than that of Class 205, which indicates that the English vocabulary level of Class 203 is higher than that of Class 205, and the learners' ability of personalized learning has been improved through the use of the word-associated memory model, which leads to better vocabulary learning. In addition, the standard deviation of class 203 and class 205 decreased by 2.482 and 0.417 respectively, indicating that the degree of dispersion between class 203 and class 205 became smaller.

From the Levine's test of equivalence of variances, it can be seen that the p-value of the chi-square test for the variance of the post-test scores of classes 203 and 205 = 0.134 > 0.05, so the hypothesis of equality of variances is valid. On this basis, the independent samples T-test was used to test the difference between the mean values of the posttest scores of classes 203 and 205, according to the



hypothesis that the equations are equal to this set of data, in which  $T\text{-value} = 2.284$ ,  $\text{Sig. (two-sided)}/P\text{-value} = 0.002 < 0.05$ , so that it is considered that there is a difference in the mean values of the posttest scores of classes 203 and 205, i.e., the experiment has an effect, which proves the success of this teaching experiment.

**Table 5.** Test data results after two class experiments

| Group statistics scale    |                                 |         |                           |           |                    |
|---------------------------|---------------------------------|---------|---------------------------|-----------|--------------------|
| Class                     | Case number                     | Average | S.E.                      | S.E. mean |                    |
| 203                       | 51                              | 86.44   | 7.892                     | 1.037     |                    |
| 205                       | 51                              | 78.39   | 10.034                    | 1.586     |                    |
|                           | Levin variance equivalence test |         | Average equivalent T test |           |                    |
|                           | F                               | Sig.    | T                         | Df        | Sig. (double tail) |
| Assumed equal variance    | 2.356                           | 0.134   | 2.284                     | 98        | 0.002              |
| Unassuming equal variance |                                 |         | 2.284                     | 96.637    | 0.002              |

3.2.4. Delayed Posttest Analysis of Vocabulary Test Papers. In order to ensure the accuracy of this experiment, one month after the end of the post-test, the vocabulary test will be conducted again in Classes 205 and 203 as the data of the delayed post-test, with the aim of further examining the effect of independent learning of vocabulary using the mobile learning software. The vocabulary test paper will have the same score and question types as the pre-test, a closed-book exam, uniformly proctored by the English teacher in the class, and the statistical results of the post-test for Class 203 and Class 205 will be obtained through SPSS software.

The results of the delayed posttest data of the two classes are shown in Table 6. The average score of Class 203 is 82.512, while the average score of Class 205 is 77.324. The average score of Class 203 is 5.118 points higher than that of Class 205, which illustrates that one month after the end of this experiment, although the overall vocabulary scores have slightly decreased, the English vocabulary level of Class 203 is still higher than that of Class 205, and it also proves that One month after the end of this teaching experiment, the learning effect of independent vocabulary learning using the word association memory model is still better than that of class 205.

The chi-square test of the variance of the delayed posttest scores of class 203 and class 205  $p\text{-value} = 0.135 > 0.05$ , thus satisfying the hypothesis that the variances of the two groups are equal. According to the hypothesis that the equations are equal for this set of data, where  $T\text{-value} = 2.537$  and  $\text{Sig. (bilateral)}/P\text{-value} = 0.003 < 0.05$ , it is therefore considered that there is a difference in the mean values of the posttest scores of the classes 203 and 205, i.e., a difference between the classes 205 and 203 has been observed in this teaching experiment. The students utilized the word association memory model to obtain the learning resources that best suited the students' individual situations, thus the students learned better and remembered more firmly.

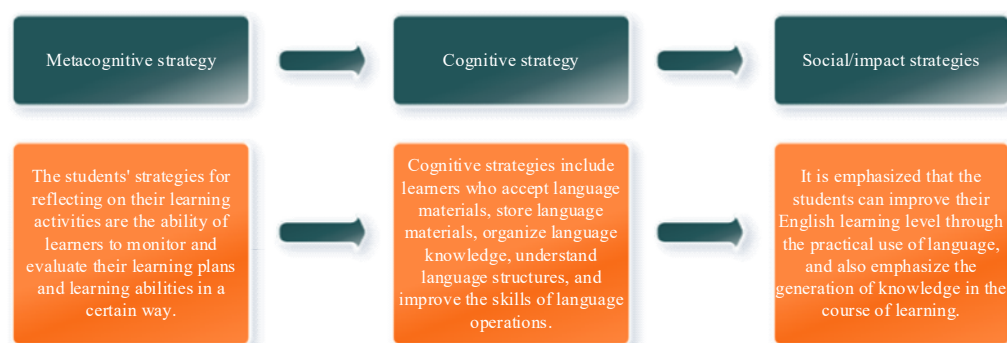
**Table 6.** The result of the delay test of the two classes

| Group statistics scale |                                 |             |         |                           |                    |       |
|------------------------|---------------------------------|-------------|---------|---------------------------|--------------------|-------|
| Class                  |                                 | Case number | Average | S.E.                      | S.E. mean          |       |
| 203                    |                                 | 51          | 82.512  | 8.138                     | 1.135              |       |
| 205                    |                                 | 51          | 77.324  | 10.274                    | 1.278              |       |
|                        | Levin variance equivalence test |             |         | Average equivalent T test |                    |       |
|                        | F                               | Sig.        | T       | Df                        | Sig. (double tail) |       |
| Assumed equal          |                                 | 2.168       | 0.135   | 2.537                     | 98                 | 0.003 |

|                              |  |  |       |        |       |
|------------------------------|--|--|-------|--------|-------|
| variance                     |  |  |       |        |       |
| Unassuming<br>equal variance |  |  | 2.537 | 97.634 | 0.004 |

#### 4. Skillful analysis of English cognitive learning

The core issues involved in linguistic cognitive strategies are cognitive structure and transfer of language learning, and the main cognitive strategies for English learning are shown in Figure 3, which include three main types: metacognitive strategies, cognitive strategies, and social (affective) strategies. The pronunciation and spelling forms of words are the basis of their existence and the first element that distinguishes individual words from each other. Utilizing concrete situations to master the pronunciation and semantics of words. Concrete situations refer to life situations, simulation situations, performance situations, visual aids, and imaginative situations. Not only can we overcome the shortcomings of memorizing words in isolation, but we can also cultivate students' ability to use words flexibly and learn to use words in communication.



**Fig. 3.** The main cognitive strategy of English learning

1) Metacognitive strategies. Metacognitive strategies include a series of processes such as selecting relevant learning information independently according to specific learning tasks, formulating a learning plan and maintaining a high degree of concentration according to the plan, self-managing and monitoring one's own learning activities, and self-evaluating learning activities. In the process of vocabulary learning, the meta-cognitive strategy mainly manifests in the learning of English: determine the scope and method of the word practice -- focus on the practice of mindfulness -- the self-monitoring of the practice of the practice -- the degree of improvement of the vocabulary level based on the feedback information, and adjust the existing policies according to the evaluation results.

2) Cognitive strategies. Cognitive strategies include a series of processes in which the learner receives language materials, stores them, organizes language knowledge, understands language structures, and improves the skills of language manipulation. The main cognitive strategies in English learning include the following: 1) retelling, i.e., organizing and reproducing the thematic content of a text in one's own language. 2) comprehension, i.e., suggesting deep semantics from the surface structure of English in comparison with Chinese. 3) organizing, reorganizing and deepening the memorization of linguistic materials, e.g., consolidating and deepening the memorization by making up English tongue twisters, English songs, etc. 4) referencing, i.e., referring to contexts to get information feedback. 5) Synthesizing, i.e. summarizing and focusing the thematic ideas in a text. 6) Deducing, i.e. mastering the linguistic laws of English and understanding the meaning of vocabulary, e.g. the meaning expressed by some words with prefixes changes. 7) Transferring, i.e. using the original information to process new information, e.g. transforming and applying the known sentence patterns in a new scene to make a new conversation. 8) Translating, i.e. translating from one to another between Chinese and English. 9)

Translating, i.e. translating between Chinese and English. .

3) Socialization (Influencing) Strategies. The social (influence) strategy is a further sublimation of the first two, emphasizing students' further improvement of English learning through the practical use of language, and also emphasizing the generation of knowledge in the learning process. Many English teachers neglect the fact that students themselves are knowledge generators because they overemphasize the memorization of knowledge and skills.

## 5. Conclusion

After investigating the use of strategies in English vocabulary learning, the study proposes a word association memory model based on linguistic word meaning processing with the assistance of artificial intelligence, and designs teaching experiments to analyze the learning effects of the model application, and finally conducts a skillful analysis of English cognitive learning.

1) Vocabulary learning strategies are ranked from high to low: cognitive strategy, resource strategy, memorization strategy, modulation strategy, and active strategy, the average value of active strategy is less than 3, and the average value of the other four strategies is more than 3. There are great differences in the use of vocabulary learning strategies by students with different levels of English proficiency.

2) After the teaching experiment using the word association memory model, the vocabulary level of the experimental class is 8.05 points higher than that of the control class, and the test data are less discrete. The Sig.(two-sided)/P value of the difference test =  $0.002 < 0.05$  indicates that the English vocabulary level of the experimental class was improved after using the word association memory model. And in the delayed test, the average score of the experimental class is 5.118 points higher than that of the control class, Sig.(bilateral)/P value =  $0.003 < 0.05$ , which verifies the lasting effect of vocabulary learning using the word association memory model.

3) English teaching should focus on guiding students to master scientific learning skills while teaching them knowledge and skills, and should emphasize three kinds of language cognitive learning skills, namely, metacognitive strategies, cognitive strategies, and communicative/influential strategies, to promote the improvement of students' English learning level.

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