



Application of Brain Neuroscience in the Discussion of Multimedia English Teaching Mode

Min Zhang

ABSTRACT

With the deepening of brain science research, more and more educators have begun to pay attention to the sensitive period and plasticity of brain development and the application and transformation of relevant research results in multimedia English education. This paper describes the "window of opportunity" in brain development and the importance of early education, as well as the "plasticity" of the brain development and the meaning of lifelong education, also this paper explores the enlightenment of brain science research results on the English education. With the development of various neuroimaging technologies, the research boom of brain science has swept the world. Researchers have used various brain imaging technologies to conduct extensive researches on the development and changes in the development process of the human brain and achieved fruitful results. More and more educators began to pay attention to the brain research of educational issues and tried to apply their results into educational practice, which made this field show a vibrant scene. English education is an important part of education. In recent years, the brain research in the field of English education has also made some new discoveries and advancement, which gradually reveals the relationship between English education and the brain. This paper will discuss the implications of brain science research results on English education.

Key Words: Brain Neuroscience, Correlation Analysis Method, Multimedia, English Teaching Mode

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Introduction

With the multi-media teaching mode, learners can obtain and interact with the most appropriate language input from the first lesson without or with textbooks. For example, through presentation of a photo or image, learners can learn the English vocabulary with pronunciation, and know its meaning at the same time. Learners can also engage in language interaction and record their interactive learning process for discussion. Compared with the role of textbooks in traditional language teaching methods, this is indeed a meaningful development (Park *et al.*, 2009). The study of the brain clearly shows that there is a special part of the brain where the original concept originated. Studies have shown that during the process of language learning, changes occur in the brain (some changes happen quickly,

while some changes take days or weeks), and new synaptic connections will appear between the nerve cells. An important advantage of multimedia courses is that multiple parts of the brain are instantly activated (Saggio *et al.*, 2009). Learners listen to language input materials, watch a visual presentation, then process the language information, and record the language learning activities. This process activates the language processing area in the learner's brain and guarantees long-term learning, which makes learning easier. As the famous neuroscientist Hebb said in 1949, "Language learning is the process of burning and energizing with nerve cells." Multimedia courses in computer-aided language teaching can provide such learning and can repeat this process (Zhang *et al.*, 2014).

Corresponding author: Min Zhang

Address: School of Foreign Languages, Nanyang Institute of Technology, Nanyang 473000, China

e-mail ✉ naomi812@163.com

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As shown in Figure 1, there is a close relationship between neuroscience and teaching.

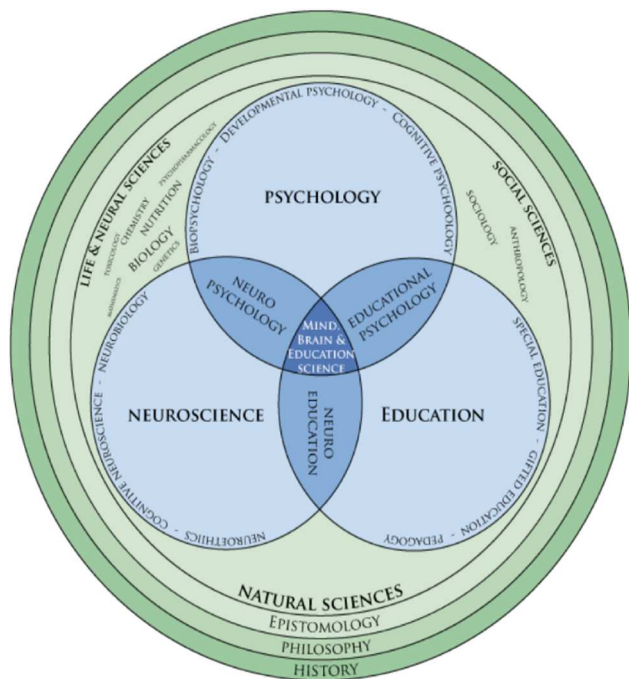


Figure 1. The relationship between neuroscience and education

If learners listen to multiple materials related to the text at the same time, their listening skills are hard to improve because these materials compete with each other in hearing conduction. Neuroscientist Restak said, “The competition between sensory transmissions has been proved to be disordered.” This disorder can make learners, especially beginners, feel at a loss and affect the effectiveness of their learning (Ramakrishnan *et al.*, 2014). What needs to be emphasized is that designing scientific multimedia teaching courseware can reduce learners' dependence on textbooks, and at the same time, they can test their learning effects within a very controllable range. Therefore, multimedia English teaching has many advantages over the traditional teaching mode (Kavasidis *et al.*, 2017). This paper will discuss the application of brain neuroscience in the multimedia English teaching mode from two aspects of application and influences, as shown in Figure 2.

Application of brain neuroscience in multimedia English teaching mode

Multimedia courseware can effectively activate the language processing area in the brain

The study of the brain clearly shows that there is a special part of the brain where the original

concept originated. During the process of language learning, changes will occur within the brain and new synaptic connections will emerge between nerve cells. An important advantage of multimedia courses is that multiple parts of the brain are instantly activated (Wang *et al.*, 2013). Learners listen to language input materials, watch a visual presentation, then process the language information, and record the language learning activities. This process activates the language processing area in the learner's brain and guarantees long-term learning, which makes learning easier.

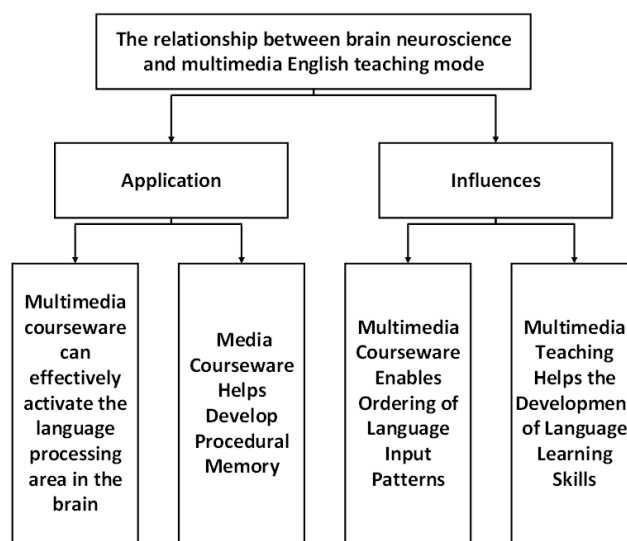


Figure 2. The relationship between brain neuroscience and multimedia English teaching mode



Figure 3. An example of multimedia English teaching

In addition, during the language learning process, the input of visual materials and context will play a key role. Displaying an image activates many areas of the brain, recognizing a familiar image causes the brain to connect various knowledge, concepts, and related things. Images can also be used to explain the meaning of a series



of sounds. As shown in Figure 3, using multimedia for English teaching can greatly improve the students' learning enthusiasm and initiative.

Media courseware helps develop non-declarative memory

Neuroscientists believe that people have two different types of memory: declarative (not clear) memory and non-declarative (clear) memory. Declarative memory is used to remember special events or facts. Non-declarative memory is the memory of a series of behaviors or skills. In language learning, vocabulary learning is an intellectual activity that relies on declarative memories that can remember the facts to complete; grammar learning is also an intellectual activity, but it depends on non-declarative memory to complete, because these two types of memory originated from different parts of the brain's nervous system (Guillen *et al.*, 2009).

Non-declarative memory solves various cognitive skill problems. It relies on a self-executing subroutine of a reticular neural structure. Studies of brain nerves have shown that these subroutines are particularly important for the rapid processing of linguistic rules, especially for the cultivation of learners' listening comprehension. The speed of language processing is very important for understanding the language, it's because in the language using process, people do not have time to carefully think about what they have heard, or to find out the language rules to explain what they have heard, what they need is unconscious behavior that requires language practice to gain this language understanding skill. Of course, if the learner's attention is not concentrated or he does not hear the language materials clearly, it will interfere with his language understanding to some extent. However, this language understanding is different from conscious knowledge learning.

Build the following model:

$$F(a_{mn}) = -\eta p_n(a_{mn}) \ln p_n(a_{mn}) \tag{1}$$

Normalization processing:

In order to obtain the weight ω_k of the k-th index, we need to conduct normalization to $R_k = B_k(1 - C_k)$ and get $w_k = \frac{R_k}{\sum_k R_k}$. Obviously, $\sum_k R_k = 1$, $\omega_k \geq 0$, in this paper, for the obtained ω_k , it is referred to as the weight of the k-th index.

Therefore, how to develop non-declarative memory and strengthen unconscious learning becomes the core of language learning, which is also the most effective language learning method. Of course, language activities such as retelling and interactive exercises will also play a significant role in language learning. Moreover, various language practice methods will be more personalized, which can enhance learners' confidence and make them continue to make progress in language learning. However, designing multimedia courseware to help develop non-declarative memory is one of the key factors for the success of multimedia courses (Le Callet *et al.*, 2013).

The influence of brain neuroscience on the exploration of multimedia English teaching mode

Multimedia courseware can sequence language input patterns and highlight the combined power of language items

Good language adjustments and explanations are based on topic-related information, context, vocabulary, and previous obtained knowledges, and at the same time some kind of symbolic thinking is needed, this kind of thinking exists only in us humans. As far as the speed of language processing is concerned, only minor adjustments can be made before thinking, but the results are very good (Bigdely-Shamlo *et al.*, 2008).

In this paper, we conduct analysis by constructing mathematical formula, first we take $C^* = [C_1^*, C_2^*, \dots, C_m^*]$ as the reference sequence, take $C = [C_1^i, C_2^i, \dots, C_m^i]$ as optimal comparison sequence, and use the correlation analysis method to find the correlation coefficient $\varepsilon_i(k)$ between the k-th index of the i-th company and the k-th optimal index, namely:

$$\varepsilon_i(k) = \frac{\min |C_k^* - C_k^i| + \rho \max |C_k^* - C_k^i|}{|C_k^* - C_k^i| + \rho \max |C_k^* - C_k^i|} \tag{2}$$

Language items play a big role as language elements and determine the meaning of words and phrases. In addition, the combination power of language items is huge. As we all know, five numbers "1, 2, 3, 4, 5" can be arranged in 120 different sequences, and ten numbers "1, 2, 3, 4, 5, 6, 7, 8, 9, 10" can be arranged in 3628800 different sequences. Similarly, a set of language items can be combined as such. However, if the learner has a bad command of the language items,



as the rule of “the minority is subordinate to the majority” in the barrel effect, the learner’s language combination ability will be greatly reduced, in this case his expression ability will be poor. Therefore, multimedia courseware that uses the appropriate language input sequence can help learners understand and master basic grammar, semantics, and language structure. When it comes to language, grammar can be compared to the trunk and branches of a tree, and words and phrases are the leaves (Grandchamp *et al.*, 2016). There are many leaves on a tree, but if there are no trunks or branches, these leaves would have no place to attach to.

Multimedia teaching helps the extension of language learning skills

In traditional language learning, the learning of a large amount of language knowledge is a conscious learning process. Of course, conscious learning will undoubtedly play a significant role in language learning, but learning grammar and remembering words is not the only effective way of learning, because it fails to solve a more important problem in the non-declarative memory, that is, how to obtain the language skills, and this is the core of language learning. Research shows that multimedia language teaching can help achieve this goal. The development of skills requires effective practice, and this practice must be conducted on a regular, periodic basis. As far as language learning is concerned, the most effective practice should include a variety of teaching modes and be coordinated with a series of language input. These language input include listening, speaking, reading and writing, namely the four skill-path (Kaul, 2007). Multimedia courses play an important role in this language practice. Studies of long-term memory formation in the brain show that retelling enhances or even establishes new synaptic connections between various nerve cells and promotes a combination of local brain functions, and these connections and functions can process the languages. However, retelling cannot be interpreted as a parrot talk, because retelling includes various forms, one of which is called surface retelling, that is, rephrasing an exact phrase or a group of phrases.

The influence of multimedia English teaching application on students' English scores

In order to better explore the role of brain neuroscience in multimedia English teaching, we compared the performance through two semester

teaching experiments. We use the small class teaching mode for the experimental teaching. There are 5 students in the small class teaching. Their English scores are uneven. The best score is 85 points, and the worst score is 48 points. In general, these students have good or bad English scores, we can use brain neuroscience to conduct systematic analysis and adopt the multimedia English teaching. Through the joint efforts and persistency of teachers and students, after exploring multimedia English teaching methods for a semester, we will analyze the changes of English performance of these 5 students before and after using multimedia English teaching methods. The specific details are shown in Table 1.

Table 1. Performance analysis

| Student name | Before using multimedia English Teaching | After using multimedia English Teaching |
|--------------|--|---|
| Haier | 70 | 87 |
| Jack | 67 | 80 |
| Ima | 85 | 92 |
| Tom | 48 | 68 |
| Stephen | 77 | 89 |

Through the above table, it can be found that the English scores of all 5 students have been improved after the multimedia English teaching. The highest score has risen to 92 points and has achieved excellent English performance. For those students who failed to pass the exam and used the traditional English teaching method before, through the use of multimedia English teaching for one semester, their achievements also successfully achieved a pass score of 68 points. Therefore, through experiments, we have proved that the effective analysis based on neuroscience and the use of multimedia English teaching mode can effectively improve the students' English learning pleasure, and can greatly improve each student's English performance. Therefore, we will prepare to promote the multimedia English teaching mode to the whole class teaching mode.

Conclusions

With the continuous development of China's foreign exchange, the traditional language teaching mode has been unable to meet the needs of the current development of English teaching. This has prompted the education institutions and language research institutions to start developing large-scale research programs that aim to reorient the role of language teachers and seek to use various technological methods to increase the



effectiveness of language learning. Therefore, English language education has shifted from traditional method to multimedia teaching. As the advantages of multimedia courses in computer-assisted language teaching become more apparent, English language teaching will evolve toward the mode of integrating computers and classrooms; computers provide necessary language input and practical activities, and classrooms provide human factors—the affinity, flexibility, and extensibility of natural language among people, and the core of this mode is to design and produce multimedia courseware that is more in line with the laws of the brain and neuroscience.

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