電腦輔助教學中視覺與聽覺刺激對華人學生
學習英文單字之效果比較

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摘 要

本研究比較電腦輔助教學軟體中視覺刺激與聽覺刺激對華人學生學習英文字彙的效果。根據文獻結果，研究者推論：以中文為母語的學生在學習英語單字時，視覺的刺激與呈現比聽覺的刺激來得有效，並依此假設進行實驗設計與分析。

四十位就讀於美中地區一所綜合型州立大學的華人學生自願參與研究。參與成員被隨機分派成兩組，兩組成員接受應用不同學習加強策略（聽覺刺激與視覺刺激）的電腦輔助教學以記憶英文單字並接受測驗。實驗結果顯示視覺刺激加強學習組的學生在記憶英文單字上的表現優於聽覺刺激加強學習組的學生。

實驗結果支持研究者的理論假設，研究者再依此推論，此實驗結果應該適用於其他以符號表徵為基礎的母語的學生。然而，語言的學習過程複雜而且須考慮的層面甚廣，聽覺刺激對華人學生學習英文上也有一定的重要性，教學媒體設計者應交互應用多種不同媒體以及不同學習策略，以協助具不同認知與學習型態的學生做更有效率的學習。

（關鍵字：電腦輔助教學；英文單字；視覺刺激；聽覺刺激）

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ABSTRACT

This study compared the effects of visual presentation and auditory presentation in computer-assisted instruction (CAI) for Chinese-speaking learners of English as a second language on their English vocabulary learning. The researcher assumed that Chinese-speaking learners might benefit more from the visual presentation than the auditory one in CAI for learning new English words.

Forty Chinese-speaking graduate students at a mid-west university were randomly assigned to two CAI programs, both were developed by the researcher. One program was enhanced with visual presentation and the other with auditory presentation. After the participants finished their learning, a spelling test of 20 new words presented in both programs was administrated. T-tests for independent samples were applied to determine the significance of the mean differences between groups.

The results of this study provided support for the assumption that Chinese-speaking learners (or native speakers of other logographic-based languages) may benefit most from the visual presentation learning strategy in computer-assisted instruction for learning English vocabulary. However, it must be acknowledged that the learning of any language is a complex area that involves many aspects. The importance of the learners’ phonological awareness or the auditory effects in a computer-assisted learning environment should not be ignored. However, the
application of multiple media and learning strategies is the better solution for learners with different cognitive styles and learning types.

(KEYWORDS: CAI; Visual Stimuli; Auditory Stimuli; ESL; Chinese Students)

I. Introduction

Over the past several decades, there have been many studies about visual effects and auditory effects in learning English vocabulary (e.g., Meyer, Schvaneveldt, & Ruddy, 1974; Gathercole & Baddeley, 1990; Goswami & Bryant, 1990; Booth, Mac Whinney, Harasaki, & Yasuaki, 2000; Miller, 2001). Phonological ability has been proven to be a critical factor to determine children’s reading ability to read alphabetic scripts such as English (Huang & Hanley, 1995; Hensil & Whittaker, 2000). However, as Huang and Hanley (1995) indicated, the phonological ability was not significantly related to Chinese children’s reading performance. Instead, it required excellent visual memory and identification skills to read Chinese characters, a logographic writing system.

Learning becomes more complicated when English is a second language for the Chinese-speaking learners. Is the cognitive process for those native speakers of logographic-based languages the same as those of alphabetic-based ones? Goswami and Bryant (1990) suggested that there should be a considerable difference between those people who have learned logographic scripts and thus have not been taught to divide English words into sounds and others who have learned alphabetic scripts. Following this theory, Huang and Hanley (1995) found visual skills was significantly related to the reading ability of the children in Hong Kong and Taiwan, whose native language Chinese is a logographic writing system, but not to the reading of the British children. They also discovered that for students in Taiwan and Hong Kong, phonological awareness is not as closely related to the ability to learn to read Chinese as it is to learning English. It is therefore conceivable that Chinese-speaking learners of English as a Second Language (ESL) may depend more on the ability to make appropriate visual distinctions than on phonological skills.
Based on the assumption above, the present study therefore compared the effects of visual and auditory presentation in a computer-assisted learning environment for Chinese-speaking learners of ESL, and attempted to provide suggestions to improve the pedagogy of computer-assisted instruction of English learning for Chinese-speaking learners.

II. Literature Review

Phonological awareness has been found to be closely related to children’s reading development for children whose native language is alphabetic-based scripts such as English (Goswamie & Brant, 1990; Yoshiko, 1998; Booth, Mac Whinney, & Harasaki, 2000; Miller, 2001). However, an increasing amount of interest has been focused on the importance of visual stimuli to native English speakers’ reading development (e.g., Huang & Hanley, 1995; Service & Kohonen, 1995; Gu & Johnson, 1996; Park, 2000). Park (2000) conducted a survey and found Southeast Asian students had different perceptual learning style preferences to white students. Arnold (2000) also indicated that visualization strategies effectively improved ESL learners’ listening comprehension.

Evidences from other researchers (e.g., Chikamatsu, 1996; Park, 1997; Henry & Simpson, 2001) also indicated that visual learning is an effective tool in teaching English vocabulary. The advantages include:

1. it is easier to attend to visual symbols than to auditory ones in a noisy environment,
2. there is greater consistency in representation of visual/manual signs than auditory/vocal symbols,
3. the temporal duration of visual symbols can be adjusted with little distortion, and
4. visual/manual signs are more easily associated with visual referents than are spoken symbols.

According to Goswami and Bryant (1990), there are three ways for American children to learn English words. The first is grapheme-phoneme relations. Children using this method would, for example, decipher the word “string” first by converting each of its six letters into a sound and then by putting these six letters together. The second is intro.-syllabic units. Children who use
this version of the phonological code would read “string” by recognizing that “str-“ represents a particular opening sound and “ing” a particular ending sound and then combine these two sounds. Another is so called “global strategy”, which is also named “visual strategy”. Children see written words “string” over and over. It seems quite a reasonable idea that these words will eventually become distinctive and easily recognizable patterns to them. Visual skills play an important role even for reading alphabetic script such as English.

Visual skills were found to be more important than phonological ones for Chinese-speaking learners to learn their native language (Huang & Hanley, 1995). Chinese characters are logographic scripts. Each character represents a complete meaning with a single sound. It was estimated that native Chinese speakers must learn at least 4000 different Chinese characters by the time they reach 12 years old. Huang and Hanley (1995) stated that, “Consequently, it would appear possible that whereas learning to read English depends on phonological skills, learning to read Chinese may depend more on the ability to make appropriate visual distinctions than on phonological skills” (p. 74).

Markham (1993) conducted a study to examine the effects of captioned video material of varying difficulty on intermediate and advanced English-as-a-Second-Language (ESL) students’ comprehension with videotaped episodes. Captioned video material was found to be more effective than the video material without caption. He (1996) examined Chinese students’ approaches to learning English from the psycholinguistic and sociolinguistic perspectives. The results showed visual cues was one of affective factors for Chinese learners when learning new English words.

Based on the studies above, the researcher therefore predicted that Chinese-speaking learners of English as a second language might benefit most from the visual-enhanced design features in CAI when learning new English vocabulary. The present study was thus designed to examine this hypothesis.
III. Methodology

A. Participants

The participants were 40 Chinese-speaking graduate students at a state university in the mid-west of the United States. The participants consisted of 21 from Taiwan, 11 from People’s Republic China, and 8 from Hong Kong. They had an average age of 28.57 years (ranging 26-35) and were comprised of 16 female and 24 male participants. Most of the participants were students of Engineering, Biology, Education, Forest and Chemistry. The participants volunteered to participate this study and had self-reported normal eyesight and hearing.

It should be noted that participants from People’s Republic China were taught an alphabetic-based spelling system (Pinyin) before they started schooling. Participants from Taiwan also learned a phonetic script “Zhu-Yin-Fu-Hao” before they began to read Chinese characters. In Pinyin, letters from the Roman alphabet comprises the written symbols that spell the pronunciation of a Chinese character. Zhu-Yin-Fu-Hao is similar to Pinyin, but unique characters represent the written symbols. Participants from Taiwan could also speak Taiwanese (a widely used dialect in Taiwan), while participants from Hong Kong could also speak Cantonese (a dialect used by most of the people in Hong Kong). Both Taiwanese and Cantonese have their origins in Ancient Chinese (Huang and Hanley, 1995).

B. Design

This experiment was designed to include 20 participants in each of these two study strategies for English vocabulary learning: visual-enhanced CAI and auditory-enhanced CAI. Participants were randomly assigned to one of the two groups for learning 20 new English words. A preliminary test was conducted to exclude learners who had had acquainted themselves with those new words. Their performances were measured by the computer-assisted testing system included in the program.
C. Materials

Two CAI programs were developed by the researcher using Authorware Professional v. 1.6. Both of them contained five sections: (1) Introduction, (2) Reading, (3) Practice, (4) Test, and (5) Post-questionnaire. Below are the details of each section.

1. Introduction. A brief introduction about the purpose of the program and how to proceed with the program.

2. Reading. This section consisted of six essays that covered six topics: culture, art, geography, botany, history and biology. In each of them, there were three to five underlined new words. By clicking the underlined word, a small window appeared at the lower-right corner of the screen providing the explanation of that word. In the auditory-enhanced CAI program, participants could also hear the pronunciation of the word, while the visual-enhanced one gets the letter display.

3. Practice. This section was designed to help participants remember the 20 new words, which would be tested later. In auditory group, participants were provided with the definition of a word first, and they were asked to hear the pronunciation. Participants could hear the pronunciation repeatedly. After they were familiar with the word, they were asked to type it and the typing would show on the screen. In the visual group, participants were also provided with the definition of a word first, and then every letter of the word displayed on the screen one by one using large-size font and bright colors.

4. Test. After all participants had completed the practice, both groups were tested over 20 questions with the same pattern. The computer program recorded each subject’s performance, including the answers they typed and the time they spent on each item. An individual performance file was created and stored automatically in the system folder of the computer with the name that subject inputted at the beginning of the program. The performance file contained two major parts: (1) participants’ total correct items, total correct percentage, and the total time they spent on the program, and (2) a list of record for every question. The items included in every record were
correct answers, the answer that subject inputted, responses status (correct or wrong) and subject’s response time.

5. Post-questionnaire. The purpose of the post-questionnaire was to ascertain subject’s English learning background, their personal habits in learning Chinese and English vocabulary, and their attitude toward the learning strategy employed in the program they were using. Results were recorded by the computer for later analysis if needed.

D. Procedures

Experiments were administrated individually to each subject in a quiet and private room where one Macintosh computer was set up to run the program. After the researcher helped them start the program, the participants went through the program according to the order of the sections. Each subject’s performance was recorded and could be printed out after he/she finished the program. They were also provided with the correct answers and the testing results. Before they started the program, all the participants were informed that they could work on the program on their own pace and as long as they needed. The researcher stayed with the participants to help with the technical problems when needed.

E. Results and Discussion

Mean scores of the auditory and visual groups were compared using t test to determine if the visual group significantly outperformed the auditory group in the English vocabulary learning. Table 1 shows the computation results.

<table>
<thead>
<tr>
<th>Group</th>
<th>Subject #</th>
<th>Mean</th>
<th>SD</th>
<th>t-value</th>
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<tbody>
<tr>
<td>Visual</td>
<td>20</td>
<td>13.3</td>
<td>3.26</td>
<td>4.11*</td>
</tr>
<tr>
<td>Auditory</td>
<td>20</td>
<td>9.85</td>
<td>1.88</td>
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* p<.01
The mean score for the visual group was 13.3 out of 20, with a standard deviation of 3.26. The auditory group had a mean score of 9.85 out of 20, with a standard deviation of 1.88. The obtained t-value (t=4.11) exceeded the critical value (t=2.75). A positive significant difference was found between the two groups at the .01 level. It indicated that the visual group achieved better performance than the auditory group in computer-assisted learning environment for English Vocabulary learning.

<table>
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<tr>
<th>Group</th>
<th>Subject #</th>
<th>Mean</th>
<th>SD</th>
<th>t-value</th>
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</thead>
<tbody>
<tr>
<td>Visual</td>
<td>20</td>
<td>82.1</td>
<td>12.8</td>
<td>0.38</td>
</tr>
<tr>
<td>Auditory</td>
<td>20</td>
<td>72.85</td>
<td>16.25</td>
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The visual group spent an average of 82.1 minutes on the program, with a standard deviation of 12.8. The auditory group spent an average of 72.85 minutes on the program, with a standard deviation of 16.25. No significant difference was found at the .01 significance level. The result showed that the visual group achieved higher performance than the auditory group when both groups spent the same time on the learning matter. However, as evidence in Table 2, the visual group did have a higher mean of spent time (82.1 minutes) than the auditory group (72.85 minutes). That was probably because the speed for the letter to display on the screen was slower than the speed for the sound to spread.

**IV. Conclusion**

The present study produced two findings: (1) the learners who used the visual-enhanced CAI program outperformed the learners who used the auditory-enhanced CAI program in learning English vocabulary, and (2) there was no significant difference in time spent on the program between the visual- and auditory-enhanced groups. The results provided experimental support for
the hypothesis in the present study that Chinese-speaking learners may benefit most from the visual effect when they are learning English vocabulary.

The result of this study supports a CAI design feature, which focuses on the visual stimuli for Chinese-speaking learners to improve their English vocabulary. However, it should be keep in mind that language learning is a complex area that involves many aspects—writing, reading, listening, speaking and others. The results of this study exposed the importance of visual stimuli for Chinese-speaking learners (or other people whose native languages are not alphabetic scripts) in English vocabulary learning. However, the importance of phonological awareness in learning English as a second language should not be ignored.

V. Implications and Recommendations

Based on the findings of the study, implications and recommendations were offered as follows:

Learning English as a second language involves many complicated issues such as the learner’s culture background, learning environment and the learner’s attitude toward English. A number of studies have been reported about those issues mentioned above, but few research has been focused on the analysis of the characteristics of learners’ native language (especially the non-alphabetic based languages), and the learners’ cognitive process when learning their native language. It is highly recommended that further research should focus on the analysis and comparison of the cognitive process in the language learning between people whose native language is alphabetic writing system and those people whose native language is a logographic-based one.

Multimedia has been found an effective delivery platform for many different learning participants. It provides the learners with a variety of learning media such as visual stimuli, sound effects and animation effects. The researcher thus suggests that ESL educators integrate multimedia computers with the ESL curriculum design and instructional implementation. However, multimedia need not necessarily be presented and controlled by a computer. When information is presented via two or more delivery media, it is a multimedia presentation. When a learning environment provides varied learning media to facilitate students’ learning, it is called a multimedia learning environment. Teachers, or even learners themselves, can be the managers of
a multimedia learning environment. Therefore, if a multimedia computer is not available, ESL educators are encouraged to create a human-controlled multimedia learning environment for ESL learners.

References


