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Editors

Ahmad Fauzi Mohd Ayub

Ben Chang

Krittaya Leelawong

Fu-Yun Yu

Tsukasa Hirashima

Gautam Biswas

APSCE

NECTEC a member of NSTDA

TCU THAILAND CYBER UNIVERSITY

MAEJO UNIVERSITY

Chapter 1

Technology Enhanced Language Learning

Preface

The aim of this workshop is to provide a forum where international participants can share knowledge on the technology enhanced language learning (TELL). With the integration of pedagogy theories and careful design, TELL has the capability of providing learners with favorable conditions for language learning, such as independent and targeted skill practice, immediate corrective feedback, portability, social interactivity, context sensitivity, connectivity, individuality, and immediacy. As various kinds of exploration and implications have been emerging, more efforts should be devoted to make further understanding about the reasonable integration of language learning theories and latest technology development. We have accepted 7 papers covering a variety issues related to TELL. The two-hour workshop will provide a forum where international participants can share knowledge, experiences and concerns on related issues in TELL, understand new era trends and strategies, as well as explore directions for future research collaborations.

Organizers
Tzu-Chien Liu, *National Central University, Taiwan*
Yu-Ju Lan, *National Taiwan Normal University, Taiwan*

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The Developments of EFL Vocabulary Sizes of High School Students in Taiwan

Hong-Fa Ho
National Taiwan Normal University, Taipei, Taiwan, R.O.C.
jackho@ntnu.edu.tw

Abstract: EFL students tend to have a common problem of insufficient vocabulary. Some studies argued that English vocabulary was one of the most difficult areas in terms of learning English. The participants (*N*=1938) were asked to take the English vocabulary tests in spelling, reading, and listening. After the tests, vocabulary Quotient (*VQ*) was used to estimate the actual size of English vocabulary of the participants. The findings of this study were generalized as the following: (1) the growing rate of English vocabulary in spelling was about 1197 words per year, the growing rate of English vocabulary in reading was about 1443 words per year, and the growing rate of English vocabulary in listening was about 1402 words per year, (2) the growth of vocabulary size in spelling was the least, and (3) the growth of vocabulary size in reading was the greatest. Results of this study suggested that English learners did not tend to equally develop their vocabulary sizes in the areas of spelling, reading, and listening.

Keywords: EFL, vocabulary size, vocabulary quotient

1. Introduction

The importance of having proficient English ability has been emphasized nowadays. Based on Johnson's statement, there were about one billion people learning English in the world, and English has become a first or an official language in most countries [3]. In addition, English is considered as students' priority to learn a foreign language in the world [13].

Reading ability has an impact on learning ability. There was a reciprocal causation between students' individual cognition and their reading ability. Students' reading abilities was associated with their learning abilities [23]. This is the well-known Matthew's effects in reading.

If one wanted to learn English well, it would be necessary to acquire sufficient English vocabulary. The more sufficient English vocabulary one had, the more proficient one's English ability would be [1]. Most college students were required to read different kinds of English documents, such as online information and textbooks. Therefore, acquiring sufficient vocabulary was an important element of building English ability.

Several assessments were used to measure English learners' vocabulary size, such as the Eurocentres Vocabulary Size Test [16, 17], and the Vocabulary Levels Test [19, 20]. Meara proposed the concept of V-Size, and the computer software was developed to test English learners' vocabulary ability [15]. When the software e-rater was measuring English learners' writing ability, their vocabulary size was measured as well [1, 5]. It was noticed that the English vocabulary tests were mostly focused on spelling, recognition, and usage in previous studies. For instance, Yes/No question was used to test whether the participants

could recognize the word [2, 6, 11, 18]. However, since the guess rate was 50%, Yes/No question was not considered as a perfect measurement. Meara and Buxton presented another way of assessment: the method of multi-choice [16]; however, no study had yet included the test of listening to measure the vocabulary acquisition of English learners. Therefore, when Ho and Lin proposed the concept of Chinese character quotient [9], they included the test of listening as one of the evaluation methods.

In terms of reading, it was indicated that reading was one of the important methods of knowledge acquisition. A total of one million words was found in Brown corpus [21], and 200 million words in Collins Cobuild corpus were analyzed. If the number of learned vocabulary was about 1000 words, the text coverage would be 72%. Therefore, the context was commanded about 72%. If the number of learned vocabulary was 15851 words, the text coverage would be commanded more than 97.8% [8, 14]. Therefore, the vocabulary size really had a great impact on one's reading ability.

Listening comprehension was playing an important role in a conversational context [22]. The unique characteristic of a dialogue had an effect on listening comprehension, that is, the features of pronunciation-reduced [7, 12]. The word would not be recognized when different pronunciations were presented at the same time [4]. Therefore, listeners would need to have strong listening abilities in order to recognize the spoken word.

Ho and Huong proposed the vocabulary quotient (*VQ*) as a KPI (Key Performance Indicator) of EFL teaching and learning [10]. *VQ* was a quantitative indicator for the acquisition of English vocabulary in multiple aspects, including spelling, visual recognition, and audio recognition. Based on *VQ*, one's vocabulary sizes could be estimated.

The purpose of this study was to investigate the developments of English vocabulary sizes of junior and senior high school students in Taiwan. This study used *VQ* and its computer software tool to assess vocabulary sizes from the aspects of spelling, reading, and listening.

Three research questions are directing this study:
R1: How do EFL high school students' vocabulary sizes grow in multiple aspects?
R2: Which vocabulary size of spelling, reading, and listening do students grow the least?
R3: Which vocabulary size of spelling, reading, and listening do students grow the most?

The hypotheses of this study are:
H_1: The growths of EFL high school students' vocabulary sizes in multiple aspects are greater than 4800 words.
H_2: The growth of vocabulary size of spelling is the least.
H_3: The growth of vocabulary size of reading is the most.

2. Method

2.1 Participants

The participants in this study were selected from the contestants of the National Spelling Competition in 2010 (N=1938). 1156 elite students came from 169 junior high schools, and 782 elite students came from 107 senior high schools. Table 1 showed the composition of the participants. From each school, ten or less students with good English ability were recommended by the English teachers to participant in the spelling competition. The prerequisite for selection was: junior high school students had to complete at least three

years of mandatory English classes. Senior high school students had to complete at least five years of mandatory English classes. All the contestants had no known hearing problems, and had normal or corrected-to-normal vision.

Table 1: Participants of two groups (N=1938)

Grade	Grade 7th~9th	Grade 10th~12th
n	1156	782

2.2 Material

The Ministry of Education in Taiwan had recommended a vocabulary list of 2200 words for junior high school students. Basically, all the junior high school English textbooks were edited according to this vocabulary list. Thus, this vocabulary list was used as the lexicon to test the junior high school students. According to the College Entrance Examination Center in Taiwan, 7000 English words were recommended for senior high school students to acquire. Between the vocabulary list of 2200 words and the vocabulary list of 7000, there were 4800 words in difference. These 4800 new words were used as the lexicon to test the senior high school students in the competition.

2.3 Tools

The software of the English vocabulary test based on *VQ* was used to test the participants. Table 2 presents three test models of English Vocabulary Test software [10]. Symbols were defined as the following: E_t was the target English vocabulary. E_x, E_y, and E_z were non-target English vocabulary, and $x \neq y \neq z \neq t$. $C_p(E_t)$ was the corresponding Chinese meaning of E_t. $V(E_t)$ was the English pronunciation of E_t. $Len(E_t)$ is the length of E_t, that is, the number of letters used to spell a target English word.

The aim of these test models was to explore the vocabulary acquisition of EFL learners from multiple aspects. The purpose of the spelling test was to find out if the examinee could correctly spell the English vocabulary when the pronunciation was given. The reading test was to test whether the examinee could understand the meaning of the target English vocabulary or not. The listening test was to examine the examinee's listening ability and comprehension of the target English vocabulary.

Table 2: The test models of English vocabulary test

Test Model	Description
Spelling test	Given $C_p(E_t)$, $Len(E_t)$, and $V(E_t)$. Examinee is asked to key-in E_t.
Reading test	Given E_t and the choices of $C_p(E_t)$, C_q, C_r and C_s in random sequence. $C_p(E_t)$ was the target choice, and C_q, C_r and C_s were the wrong choices. Examinee was asked to choose the target choice.
Listening test	Given $V(E_t)$ and the choices of $C_p(E_t)$, C_q, C_r and C_s in random sequence. $C_p(E_t)$ was the best choice which matched the given $V(E_t)$. C_q, C_r and C_s were the wrong choices. Examinee was asked to choose the target choice.

The Statistical Package for the Social Science (SPSS) v.18 for Microsoft Windows was used to provide descriptive statistics and the distributions of scores. For research question 1, 2, and 3, descriptive statistics were utilized to provide mean scores and standard deviations of three tests for both samples.

2.4 Design

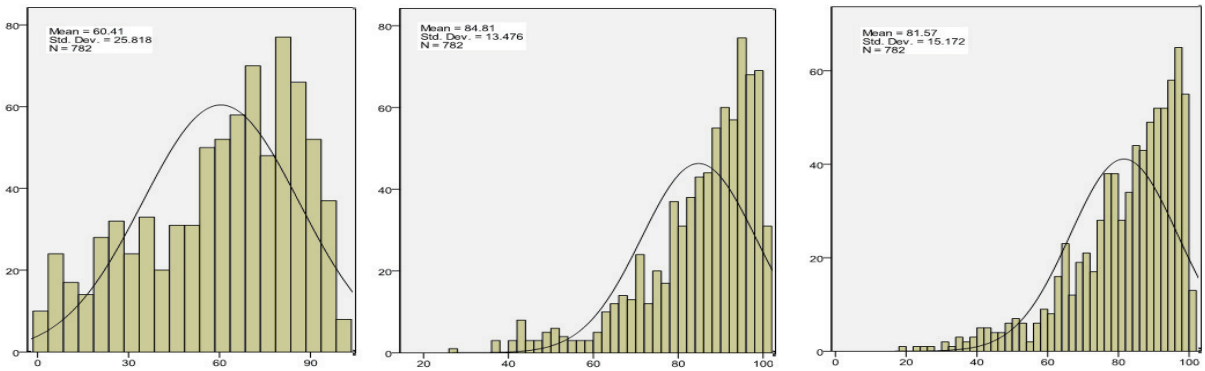
This study was a normative survey. The researcher was interested to investigate the current phenomena of English vocabulary acquisition among elite Taiwanese junior and senior high school students. *VQ* would be used to estimate the size of English vocabulary of the participants.

2.5 Procedure

The experiment was embedded in the National Spelling Competition in 2010. Three different types of English vocabulary tests were used to evaluate the participants. Every test had 100 questions and was worth 100 points. Before the tests, participants had already known how to use the software. Spelling test had to be finished in 20 minutes, while the reading and the listening test had to be finished in 10 minutes, respectively. After the test, the scores of English vocabulary tests would be collected by computers.

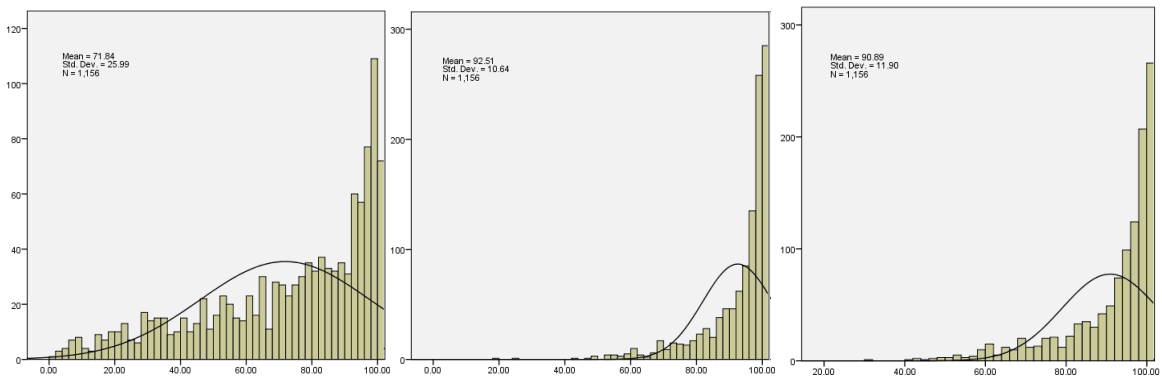
3. Results

Fig. 1 presented the histograms of scores of three English vocabulary tests for all senior high participants. Fig. 2 illustrated the test results of all junior high participants. The horizontal axis was the scores of the tests and the vertical axis was the number of participants. Distribution curves were also illustrated in Fig. 1 and 2. Results showed that the distribution of scores of spelling, reading and listening tests were all negative skewed.



(a) Distribution of Spelling. (b) Distribution of Reading. (c) Distribution of Listening.

Figure 1. Distribution of three aspects for senior high participants



(a) Distribution of Spelling. (b) Distribution of Reading. (c) Distribution of Listening.

Figure 2. Distribution of three aspects for junior high participants

Table 3 presented the means of the two groups, their standard deviations, and the scores of spelling, reading, and listening. It was found that the standard deviations of spelling were the greatest among the three tests, and that the means of spelling were the smallest among the three tests. From the viewpoint of the mean scores, the sequence of hard-level was spelling, listening, and reading. These outcomes appeared both in the group of junior high school students and senior high school students.

Table 3: Descriptive statistics for the all participants (*N*=1938)

Group	*n*	Spelling		Reading		Listening	
		M	*SD*	*M*	*SD*	*M*	*SD*
Grade7th~9th	1156	71.84	25.99	92.51	10.64	90.89	11.90
Grade10th~12th	782	60.41	25.82	84.81	13.48	81.57	15.17

Based on data in Table 3 and the method of estimating vocabulary sizes proposed by Ho and Huong [10], the estimated vocabulary sizes were calculated in Table 4 for both groups. Note that estimated vocabulary sizes of spelling, reading, and listening were all different. Senior high school students and junior high school students also differed in the areas of spelling, reading, and listening.

The difference of the means showed the growth of average vocabulary size between senior high students and junior high students. These results were for research questions 1, 2 and 3. The growth of vocabulary size of spelling between junior and senior high school students was 3591 words. The growth of vocabulary size of reading between two groups of the participants was 4328 words. The growth of vocabulary size of listening between the two groups was 4206 words. Thus, H_1 was not supported. H_2 and H_3 were supported.

Table 4: Estimated vocabulary sizes for the all participants (*N*=1938)

	n	Spelling			Reading			Listening		
		min	*max*	*M*	*min*	*max*	*M*	*min*	*max*	*M*
Grade7th~9th	1156	22	2200	1509	418	2200	1943	682	2200	1909
Grade10th~12th	782	2248	7000	5100	3496	7000	6271	3112	7000	6115
Difference of *M*				3591			4328			4206

Figure 3 presented the minimum, the maximum, and the mean of vocabulary sizes of three tests for each group of the participants. It was found that some participants performed better in reading and listening, but not in spelling. The range between the maximum and the minimum was large in every aspect of each group of the participants.

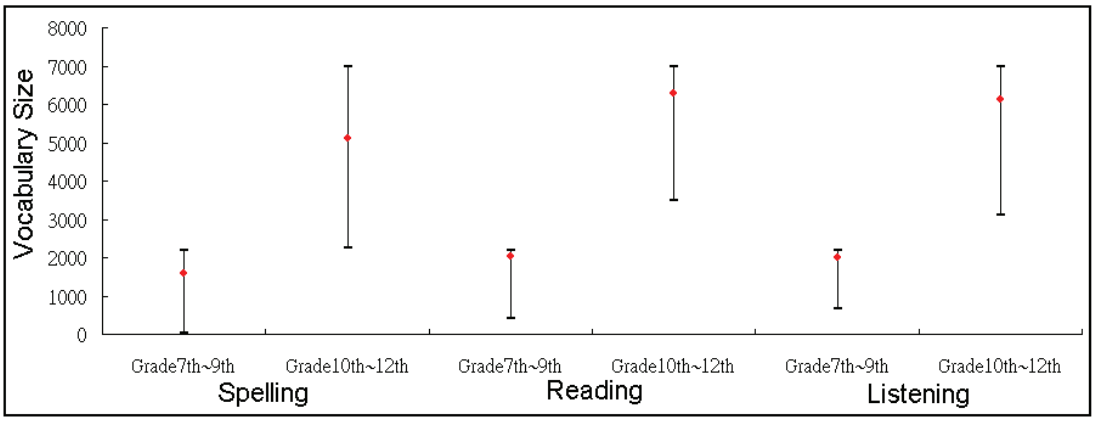


Figure 3. The min, max and mean of vocabulary sizes of three aspects

4. Discussion

Based on data in Table 4, the growth of vocabulary size of spelling was 3591 words. The growth of vocabulary size of reading was 4328 words. The growth of vocabulary size of listening was 4206 words. The growing rate of spelling was about 1197 words/year. The growing rate of reading was about 1443 words/year. The growing rate of listening was about 1402 words/year. They were far from the native speakers. The growths of EFL high school students' vocabulary sizes in multiple aspects were not found to be greater than 4800 words. Thus, H_1 was not supported. The growth of vocabulary size of spelling was found to be the least. H_2 was supported. The growth of vocabulary size of reading was the greatest. H_3 was supported.

Based on Fig. 1, 2, and 3, there were many junior and senior high students who had low vocabulary sizes. These students might have Matthew effects in reading [23]. Using *VQ* software tool, EFL teachers could find out if the students had low vocabulary sizes. After identifying the problems, necessary teaching and learning could be carried out to solve problems.

There were some limitations in this study. The number of participants was small, and only three linguistic aspects of English vocabulary were investigated. Since the lexicons in this study were set as 2200 words for junior high school students, and 7000 words for senior high school students, the estimated vocabulary sizes were within these boundaries. If any participants had the lexicon greater than 7000 words, this study would not be able to measure the actual the size of the lexicon.

This study could have both theoretical and practical contributions. Vocabulary quotient could become an effective indicator to estimate the actual vocabulary size of English learners. As the research results had showed that English learners might not grow equally in the areas of spelling, reading, and listening, English teachers might want to consider offering more instructions for students to strengthen their weakness in spelling.

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References

[1] Attali, Y., & Burstein, J. (2006). Automated essay scoring with e-rater v. 2. *Journal of Technology, Learning, and Assessment, 4*(3), 1–30.

[2] Beeckmans, R., Eyckmans, J., Jansens, V., Dufranne, M., & Velde, H. (2001). Examining the Yes/No vocabulary test: some methodological issues in theory and practice. *Language Testing, 18,* 235-274.

[3] Chang, W. C., Yeh, H. N., Joe, S. G., You, Y. L., Chern, C. L., & Liao, M. L. (2007). The investigation of the influence of English teaching from the policy of Taiwan English education. *Selected papers from the proceedings of 2007 international conference and workshop on TEFL & applied linguistics compiled by Department of Applied English Ming Chuan University* (pp. 672-686). Taipei, Taiwan: Crane.

[4] Chen, H. M., & Cheng, S. H. (2007). An investigation on the listening difficulties of technical college students in Taiwan. *Journal of China Institute of Technology, 36*, 335-361.

[5] Enright, M., & Quinlan, T. (2010). Complementing human judgment of essays written by English language learners with e-rater scoring. *Language Testing, 27*(3), 317–334.

[6] Eyckmans, J. (2004). *Measuring receptive vocabulary size*. Utrecht, the Netherlands: LOT.

[7] Field, J. (2003). Promoting perception: lexical segmentation in L2 listening. *ELT Jounral, 57*(4), 325-334.
[8] Hirsh, D., & Nation, P. (1992). What vocabulary size is needed to read unsimplified texts for pleasure? *Reading in a Foreign Language, 8*(2), 689-696.
[9] Ho, H. F., & Lin, P. Z. (2010). Chinese character Learning Review System with Item Response Theory Analysis, *Proc. of Research in Reading Chinese (RRC) Conference.*
[10] Ho, H. F., & Huong, C. (2011). A multiple aspects quantitative indicator for ability of English vocabulary:vocabulary quotient, *Journal of Educational Technology Development and Exchange, 4*(1), 15-22.
[11] Huibregtse, I., Admiraal, W., & Meara, P. (2002). Scores on a yes/no vocabulary test: correction for guessing and response style. *Language Testing 19,* 227-245.
[12] Ito, Y. (2001). Effect of reduced forms on ESL learners' input-intake process. *Second Language Studies, 20*(1), 99-124.
[13] Johnson, K. (2003). *Designing language teaching tasks*. Basingstoke, HA: Palgrave Macmillan.
[14] Laufer, B. (1989). What percentage of text-lexis is essential for comprehension? In C. Lauren & M. Nordman (Eds.), *Special language: From humans thinking to thinking machines* (pp. 316-323). Clevedon: Multilingual Matters.
[15] Meara, P. (2005). Designing vocabulary tests for English, Spanish and other languages. In C.S. Butler, M. G. -Gonzalez & S. D. -Suarez (Eds.), *The Dynamics of Language Use: functional and contrastive perspectives* (pp. 271-285). Amsterdam: Benjamins.
[16] Meara, P., & Buxton, B. (1987). An alternative to multiple choice vocabulary tests. *Language Testing, 4,* 142-154.
[17] Meara, P., & Jones, G. (1990). *The Eurocentres Vocabulary Size Test.* Zurich: Eurocentres.
[18] Mochida, A., & Harrington, M (2006). The Yes/No test as a measure of receptive vocabulary knowledge. *Language Testing, 23,* 73-98.
[19] Nation, P. (1983). Testing and teaching vocabulary. *Guidelines, 5*, 12–25.
[20] Nation, P. (1990). *Teaching and learning vocabulary*. New York: Newbury House.
[21] Nation, P., & Waring, R. (1997). Vocabulary size, text coverage and word lists. In N. Schmitt & M. McCarthy (Eds.), *Vocabulary: Description, acquisition and pedagogy* (pp.6-19). Cambridge: Cambridge University Press.
[22] Rosa, M. (2002). Don't cha know? A survey of ESL teachers' perspectives on reduced forms instruction. *Second Language Studies, 21*(1), 49-78.
[23] Stanovich, K. E. (1986). Matthew effects in reading: Some consequences of individual differences in the acquisition of literacy. *Reading Research Quarterly, 21,* 360-407.

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The Application of Multimedia Strategies for Learning Chinese Characters

Ming-Puu CHEN, Hsiu-Ju CHEN, Yu-Chu CHEN
Graduate Institute of Information & Computer Education
National Taiwan Normal University, Taiwan
mpchen@ice.ntnu.edu.tw

Abstract: The purpose of this study was to examine the effects of multimedia instructional strategies on foreign novices' learning performance and cognitive load in learning Chinese characters. Two types of multimedia strategies, including visual-cue (ViS) and voice-cue (VoS), and two types of practice, including visual-cue (ViP) and voice-cue (VoP), were employed in the experimental instruction. Participants were 109 foreign novices and were randomly assigned to one of the four experimental groups. The results showed that the VoS –VoP learners performed better than their counterparts in Chinese character stroke and writing.
Keywords: Multimedia learning, Language learning, Instructional strategy

1. Introduction

In recent years, learning Chinese has become a pervasive need in the western societies. Accordingly, research on learning Chinese for non-native novices has been focused by researchers. With the increasing usage of information technology, the application of multimedia technology in learning Chinese has been a trend. Due to the fact that Chinese characters are the basic subjects for beginners, identifying Chinese characters and comprehending the meanings of Chinese characters has become a critical and also the very first learning task for foreign novices. However, each Chinese character just looks like a picture for foreign learners and it is hard for them to memorize the strokes and meaning of a Chinese character. According to the dual-coding theory [1], representing information, such as Chinese characters, with visual and verbal codes can enhance leaning performance. In light of these concerns, the purpose of this study was to examine the effects of type of multimedia strategy on foreign novices' learning of identifying Chinese characters and comprehending the meanings of Chinese characters.

2 Literature Review

2.1 Learning Chinese Characters

Chinese characters were developed by drawing pictures of objects' shape and form without their sound [2], and were known as picture-shaped words. Unlike alphabetic language system, Chinese characters have five main structures, including shape, radical, stokes, sound and meaning [3], [4]. Therefore, there are two challenges for non-native learners to learn Chinese characters, the first challenge is the complexity of the graphic configuration of Chinese characters and the other is the lack of obvious sound-script correspondence [4]. Therefore, for novices, Chinese characters are considered one of the most challenging languages to learn due to its graphical character nature [3]. Furthermore, Kuo and Hooper [2] pointed that in traditional Chinese language teachers often ignored the unique visual and verbal information of Chinese characters which always confuses non-native novices. Moreover, there have been many studies conducted the impact of cognitive processing on

character learning and there is evidence that providing visual cues for recall results in better performance [3]. Thus, it was important for Chinese language teachers to employ suitable teaching methods and learning strategies for non-native novices to learning Chinese characters better.

According to Shen's research [4], the most heavily used strategies are orthographic-knowledge-based strategies which making use of the three aspects of radical knowledge, including graphemics, semantics and phonetics. In this way, foreign learners could use the three aspects of radical knowledge as cues to encode characters and transform to their cognitive progresses. Taft and Chung [5] mentioned that emphasizing the radical structure at the time when learners encountered firstly is the most effective way to link the relationship of character and radicals. In addition, well-designed multimedia was suggested to be beneficial to novices [6]. Therefore, in the very beginning of learning Chinese language, multimedia has the potentiality to serve as a means of delivering the radical information of Chinese characters and, at the same time, providing rich cues for novices to link the relationship of character and radicals.

2.2 Multimedia Theory

The dual-coding theory referred to two parts of people's mental structure and information processing: verbal system and nonverbal system [1], [7]. The two systems construct verbal and picture representations separately. Therefore, the individual did encode when receiving information from sense organ with both of two systems. It was just like what Mayer and Moreno [8] cited that receiving words and pictures at the same time had better effect and encoded and store into long term memory more easily. Mayer and Moreno [9] mentioned that Multimedia instructions enhanced learning with presenting words and pictures, since multimedia attracted learners' attention. Therefore, Multimedia instructions applied words, pictures, sounds, videos, animations and so on to transmit contents to enhance the learning effect [10]. Moreover, multimedia instructions provided learners with making meaningful hyperlink to the contents. The principles which were offered by Meyer and Moreno [8] were: multimedia principle, spatial contiguity principle, temporal contiguity principle, coherence principle, modality principle, redundancy principle and personalization principle.

3 Methods

The participants were 81 Caucasian non-native novices who were new students of a mandarin training center located in Taipei, Taiwan. The participants had studied Chinese for less than two months. Two types of multimedia strategies were implemented in the instructional presentation, including character-radical-highlighted strategy (CRH) and character-stroke-sound strategy (CSS). Moreover, two types of multimedia strategies, including visual-cue (ViC) and voice-cue (VoC), were implemented in the practice session. Participants were randomly assigned to one of the four experimental groups.

An Internet-based e-learning course on learning "the Chinese character basics" was implemented and delivered using a Moodle platform. The experimental instruction consisted of three learning units, and each unit was designed for 2-hour self-paced learning. The content knowledge of the experimental instruction included (a) the 18 Chinese character strokes, (b) the formation of Chinese characters and (c) the 20 common Chinese

character radicals with 160 corresponding Chinese characters consisting of the common radicals.

3.1 The Chinese Characters Test

The purpose of the Chinese character test is a multiple-choice test consisting 25 questions designed to assess the participants' beginning behavior and prior knowledge of Chinese characters. Each question was 1 point and total scores were 25 points. The test was developed by the researchers and examined by the experts. The reliability coefficient were Cronbach's α = .878.

3.2 The Multimedia Chinese Characters Instruction

The multimedia Chinese characters instruction was developed by the researchers and examined by the experts. According to the two types of multimedia strategies (ViS and VoS) and two types of practice (ViP and VoP), the multimedia Chinese characters instruction was divided to four groups. Participants were randomly assigned to four groups. Table 1 showed the design of four groups:

Table 1: Introduction of multimedia instruction

Group	Types of multimedia strategies	Types of practice	Instructional features
1	visual-cue (ViS)	visual-cue (ViP)	Teaching components highlighted in red and exercise with components highlighted in red.
2	visual-cue (ViS)	voice-cue (VoP)	Teaching components highlighted in red and exercise with components sounded.
3	voice-cue (VoS)	visual-cue (ViP)	Teaching components with sound on strokes and exercise with components highlighted in red.
4	voice-cue (VoS)	voice-cue (VoP)	Teaching components with sound on strokes and exercise with components sounded.

3.2.1 Visual cue strategy (ViS) vs. Voice cue strategy (VoS)

The program spoke the sound of the character and the character's components in red while other strokes in black to be distinguished (see Figure 1). The system spoke the sound of the character firstly, and then spoke the sounds of every stroke (see Figure 2).

Figure 1. Visual cue strategies (ViS)

Figure 2. Sound on strokes strategies (VoS).

3.2.3 Visual cue of practice (ViP) vs. Voice cue of practice (VoP)

The practice program with visual-cue was given to learners after learners completed the Chinese characters courses. First the system showed the whole character, spoke the sound after learners pressed the button, and then showed the flash animation (see Figure 3). The practice program with voice-cue spoke the sound of the character, and then spoke the sound of each stroke with showing each stroke. The system stopped when the whole character was presented (see Figure 4).

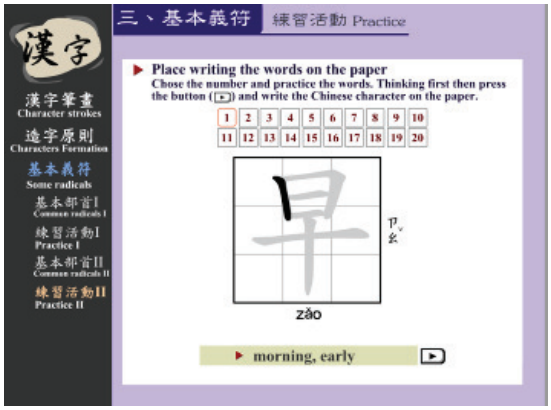

Figure 3. Visual cue of practice (ViP)

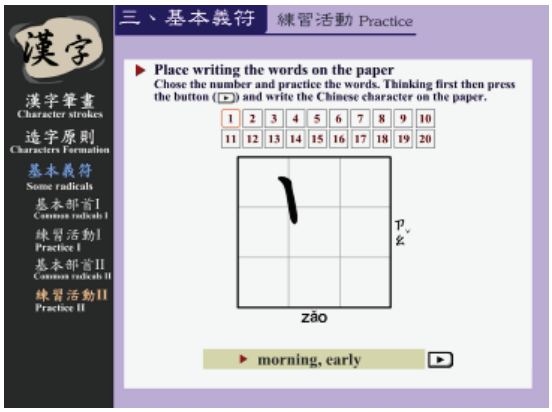

Figure 4. Voice cue of practice (VoP)

3.3 The Chinese Characters Performance Test

The Chinese characters performance test was given to students after they completed the multimedia Chinese characters instruction. The test was designed as a paper-and pencil test to access students' performance on three parts: (a) Chinese characters' strokes, (b) Chinese characters' components, and (c) Chinese characters' writing. The total questions were 30, each question was 1 point, and total scores were 30 points. The reliability coefficient were Cronbach's $\alpha = .885$.

4 Results

4.1 Analysis of Learning Performance

In order to understand the learners' learning performance on Chinese characters under different types of multimedia strategies and practice, the study used the MANCONA to analyze the learning performance on three parts: (a) characters' strokes, (b) characters' components, and (c) characters' writing. The MANCONA summary of learning performance on learning Chinese characters was shown in Table 2.

The MANCONA indicates a significant interaction for characters strokes ($F_{(1,76)} = 11.502$, $p = .001$) and for characters writing ($F_{(1,76)} = 18.280$, $p < .001$). However, no significant interaction effect for characters components ($F_{(1,76)} = 11.502$, $p = .001$) was found. The main effects for characters components ($F_{(1,76)} = 6.109$, $p = .016$) showed a significant effect.

Therefore, it revealed that types of display had a significant effect for learning the characters components.

The interaction effect of multimedia strategies and practice on learning performance was shown in Figure 5. In learning characters' strokes, the group 4 (VoS-VoP) had better learning performance. Moreover, in learning characters' writing, the group 1 and group 4 had better learning performance.

Table 2 MANCOVA summary of learning performance on learning Chinese characters

Variables	Type of questions	Type III Sum of Squares	df	Mean Square	F	Sig.
The Chinese characters prior test	Characters' strokes	29.474	1	29.474	9.733*	.003
	Characters' components	28.996	1	28.996	14.501*	.000
	Characters' writing	287.830	1	287.830	75.559*	.000
Type of multimedia strategies	Characters' strokes	9.723	1	9.723	3.211	.077
	Characters' components	12.216	1	12.216	6.109*	.016
	Characters' writing	4.004	1	4.004	1.051	.309
Type of practice	Characters' strokes	.282	1	.282	.093	.761
	Characters' components	1.069	1	1.069	.534	.467
	Characters' writing	1.064	1	1.064	.279	.599
Type of multimedia strategies × Type of practice	Characters' strokes	34.833	1	34.833	11.502*	.001
	Characters' components	.228	1	.228	.114	.737
	Characters' writing	69.634	1	69.634	18.280*	.000
Error	Characters' strokes	230.155	76	3.028		
	Characters' components	151.967	76	2.000		
	Characters' writing	289.510	76	3.809		

*p< .05

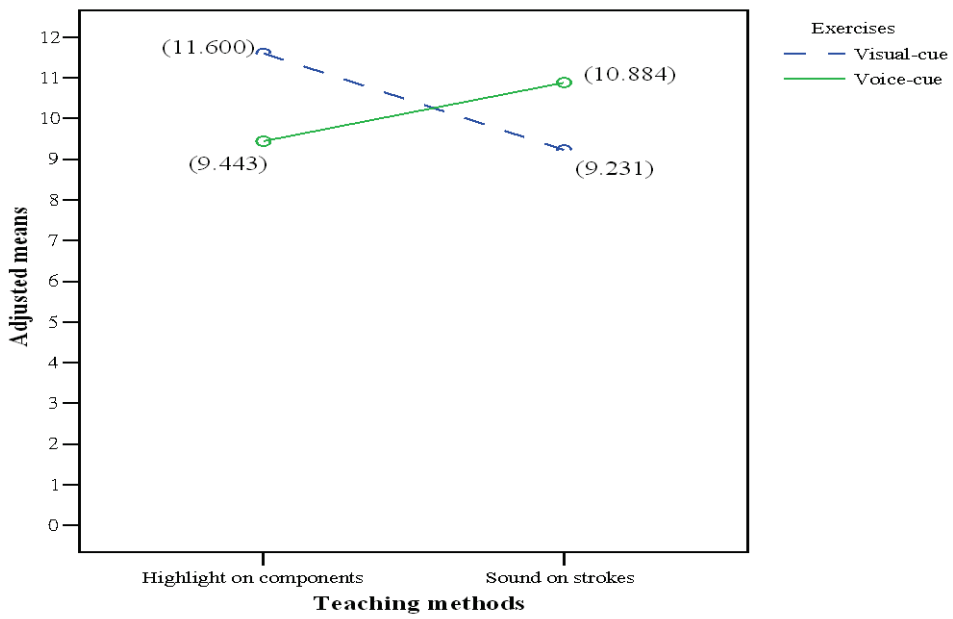

Figure 5. The interaction effect of the multimedia strategies and practice on learning performance in characters' writing

5 Conclusions and Suggestions

The findings of this study present two implications for the design of multimedia Chinese characters instruction. First, in the dimension of learning performance, learners of group 4 (VoS-VoP) had better learning performance in characters' strokes and writing. It implied

that VoS and VoP provided learners with necessary demand and inform the names of strokes at the proper time which could be easily memorized. Therefore, VoS and VoP supported learners' learning on strokes and writing. Second, it may imply that the application of VoS and VoP gave learners real-time information which mentioned how to write the whole characters with voice-cue of strokes [11]. The voice-cue may help learners became more focus on their learning on multimedia instruction and sustained their attention. Thus, learners resulted in better performance. In conclusion, the results suggested that multimedia instruction with voice presentation and practice (VoS and VoP) could enhance learners' learning performance on strokes and writing.

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References

[1] Paivio, A. (1986). *Mental representations: A dual coding approach*. Oxford, England: Oxford University Press.
[2] Kuo, M. L. A. & Hooper, S. (2004). The effects of visual and verbal coding mnemonics on learning Chinese characters in computer-based instruction. *Educational Technology Research and Development*, *52*(3), 23-38.
[3] Shen, H. H. (2004). Level of cognitive processing: effects on character learning among non-native learners of Chinese as a foreign language. *Language and Education*, *18*(2), 167-182.
[4] Shen, H. H. (2005). An investigation of Chinese-character learning strategies among non-native speakers of Chinese. *System*, *33*(1), 49-68.
[5] Taft, M. & Chung, K. (1999). Using radicals in teaching Chinese characters to second language learners. *Psychologia*, *42*(4), 243-251.
[6] Lee, C. P., Shen, C. W. & Lee, D. (2008). The effect of multimedia instruction for Chinese learning. *Learning, Media and Technology*, *33*(2), 127-138.
[7] Clark, J. M. & Paivio, A. (1991). Dual coding and theory and education. *Educational Psychology Review, 3*(3), 149-210.
[8] Mayer, R. E. & Moreno, R. (2002). Animation as an aid to multimedia learning. *Educational Psychology Review, 14*(1), 87-99.
[9] Mayer, R. E. & Moreno, R. (2003). Nine ways to reduce cognitive load in multimedia learning. *Educational Psychologist, 38*(1), 43-52.
[10] Mayer, R. E. (2001). *Multimedia learning*. New York: Cambridge University press.
[11] Van Merriënboer, J. J. G., Kirschner, P., & Kester, L. (2003). Taking the load off a learner's mind: Instructional design for complex learning. *Educational Psychologist, 38*(1), 5-13.

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The influence of digital storybooks to the learning attitudes of students with reading disabilities

Wen-Chen Chiang,Yu-Jen Hsu,Ju-Ling Shih,
Department of Information and Learning Technology,
National University of Tainan, Taiwan
juling@mail.nutn.edu.tw

Abstract: In this study, the researcher used multi-sensory teaching methods to design three digital story books as teaching materials in order to enhance the reading abilities of children with reading disabilities. The content of digital storybooks focused on the differentiation of word sounds, word forms, use of punctuation marks, and reading comprehensions. It is hoped that through the interactive reading practices, students with reading difficulties can be improved in those aspects. The results showed that digital story books teaching for dyslexic children learning attitude has improved significantly. All students gave the teaching with digital storybooks positive feedbacks and said that they like such learning method. They all hope to apply it to other subjects.
Keywords: Digital Storybook, Reading Disabled, Multi-Sensory teaching

1. Introduction

Reading is the spirit of education, and fundamental for a country's development. Reading is the means for gathering information and developing knowledge. According to The Program for International Student Assessment (PISA), those with higher reading ability have higher ability to gather, comprehend, and judge information to achieve personal goal and discover potential. They can effectively use information to participate in the complex mechanism of the modern society. Taiwan is also promoting reading exercises hoping the young students can have good reading habit and interests and enhance their creative thinking ability. Since it is the basic ability for lifelong learning, it is essential to foster good reading habits since childhood.

However, many children have learning disabilities. They might have normal intelligence, but with reading disabilities (RD), they grow to dislike learning and even against learning. Reading disability is a common learning disability. In Taiwan, 7.5% of children have the symptoms (Stevenson, Stigler, Lucker, Lee, Hsu, & Kitamura, 1982). Among them, more than 80% have reading difficulties which refers to the difficulties in reading words, spellings, and writing.

In order to foster reading motivations of those RD students, it is important to design reading materials that can enhance their interests. One of the best ways is to use multi-sensory stimulations to strengthen their memory and comprehension abilities. Multimedia has the function to allow the interaction between readers and the interface that can stimulate multiple sensories. At the same time, adding in stories to attract their attentions is one way to intrigue their reading motivations. Simmons (2002) stated that story is one of the ancient communication tools which have great power. Therefore, this research tries to create digital

storybooks for RD students. The digital storybooks are designed to have text, graphics, animations, and audio narrations to stimulate children's multi-sensory learning purported to increase the effectiveness of their learning outcome, and encourage positive learning attitude.

2. Literature Review

Story is the first and most used text for every child before going to school. Everyone likes stories since stories allow readers to be involved in a scene outside of their everyday life, and be moved with the plot. Using multimedia and interactive designs to tell stories can help readers to participate the stories. Multimedia can stimulate learning connections with texts, sounds, graphics, and videos. Therefore, the design, production, and creation of digital storybooks become innovative challenges for teachers.

However, reading is not easy and interesting for everyone. For those with reading disabilities, reading is rather difficult and uninteresting. According to Lerner and Kline (2006), 80% of students have reading difficulties; not only their GPAs are low, they cannot fluently read or comprehend reading materials. Reading difficulties include word recognition, reading speed, word sound memory, word combination, phrase recognition, recitation, and find implications. According to Perfetti (1992), reading difficulties also include reading comprehension, oral presentation, letter recognition, phonetic activation, and semantic encoding. Children with reading disabilities (RD) can have symptons such as writing words upside down, mix words, or pronunce them wrongly.

These difficulties cannot be attributed to mental ages, sight problems, or learning environment. When children have such reading problems, they not only have learning problems, they would also have problems on motivation and ability to adapt to social situations. When children have reading problems, they would often feel anxious, have poor self concept, and low self identity problems. In order to eliminate those reading difficulties, multi-senrory instructions can act as remedies by adding sound stimulation and visual impressions.

Sensory learning refers to using different sensory to enhance learning process. Since the human body use visual, audio, physical sensories to learn, it is natural to combine these stimulations to strenghthen learning effects. Nevertheless, everyone has different sensibilities to those sensories so that everyone needs different ways of learning. For children with special needs, they can use their stronger senses to support weak ones so that they can conquer learning difficulties they meet.

3. Content and design of storybooks

3.1. Instructional Design

The design of digital storybooks has various criteria including story plots, scripts, narration tones, caption displays, music selections, and the combination of texts, graphics, animations

and special effects. But the most important is whether the overall design can achieve the instructional goals. The stories created in this research have their educational implications such as bravity, confidence, and happiness respectively. All are surrounded with circumstances of family, friends, and love.

In each story, word recognitions, phonetic distinction, and reading comprehension are placed. For Chinese words, word sounds, word looks, and punctuations were important parts of texts which are all considered in the design of storybooks. The content is targeted to third to six grade primary school RD students. Words in the storybooks were specially chosen from the official word frequency report published by the Ministry of Education. The range was defined in the first 1000 frequently used words by primary school students. The corresponding design principles of storybooks for multi-sensory learning are as Table 1.

Table 1 Design principles for multi-sensory learning

Visual	Using flash cards with graphics and text explanations
	Disassemble words into components (Chinese words are graphical that every word is combined with roots and parts)
	Using animations to increase learning motivations
Audio	Using captions and narrations
	Provide oral hints for contents that require memories
Oral	Require to point out components of words
	Require to repeat learning content heard
Motor Skills	Require to write out words with fingers
	Require to show meanings of words and phrases with body movements

3.2 Story and system design

The three digital storybooks are: Mouse Dinky Got Lost; Beauty Pageant of Angel Whity; Green Light Legend of Alligator Ganga. These stories were created for this research, edited by primary school teachers, and proofed by professors in Chinese department. Besides reading abilities, students can reflect on their own life about family, friends, and love through the story content. The detail descriptions are as follows.

Unit 1：Mouse Dinky Got Lost

Plot：Mouse Dinky is an absent-minded little mouse. He always wants to go into town to take adventure. One day he sneak out when mommy is out, but encounter bad guys. He hided in an old temple when he got lost in town until was found by his family. He finally understand that family is the warmest place in the world.

Story Word Count：76

Unit 2：Beauty Pageant of Angel Whity

Plot：Nurse Whity is a kind and tender pig. When her hospital is holding the beauty pageant, she has no confidence to participate. She then finds out that she can help people when she is full of love, and understands that beauty comes from inside.

Story Word Count：75

Unit 3：Green Light Legend of Alligator Ganga

Plot：Alligator Ganga hears from the swallow about the green light legend that whoever has it can have happiness. He decides to take the trip to find the green light. When he reached the destination, he realizes that the real happiness is home.

Story Word Count：82

The characters, scenes, and objects in the storybooks were all graphed with Adobe Illustrator CS4, and then imported into Adobe Flash CS4 to make animations. The main functions of the storybooks include four parts: story monopoly (upper left), story content (upper right), Q&A (lower left), tests (lower right)(See Figure 1). All scenes have functional buttons to allow human-computer interactions and guide students through the learning tasks.

Figure 1 Screenshots of digital storybooks

4. Methods

This research uses pre- and post-tests to understand students' learning achievements. The process is as Figure 2. The tests used have the same content but the questions were given in different order.

Research subjects include five students (Anonymous as Adam, Brian, Colin, David, and Edison) from three primary schools in Tainan. They are students identified with medical

evaluations as RD students. They have various degrees of reading difficulties in word recognitions and reading comprehensions.

The research collects both quantitative and qualitative data. The pre-, post-, and postponed-tests are self-made questionnaires that are evaluated by specialists of special education. The evaluation includes four parts: pronunciation, word sound recognitions, word shape recognition, and reading comprehension. Most questions were to be answered by choosing the right answer. There were 25 questions about word sounds and shapes, and 4 questions about reading comprehension; the two parts were graded seperately. During the storybook reading sessions, observation is conducted to record students' learning process. The section was followed with interviews to know students' thoughts and feelings toward the overall learning process.

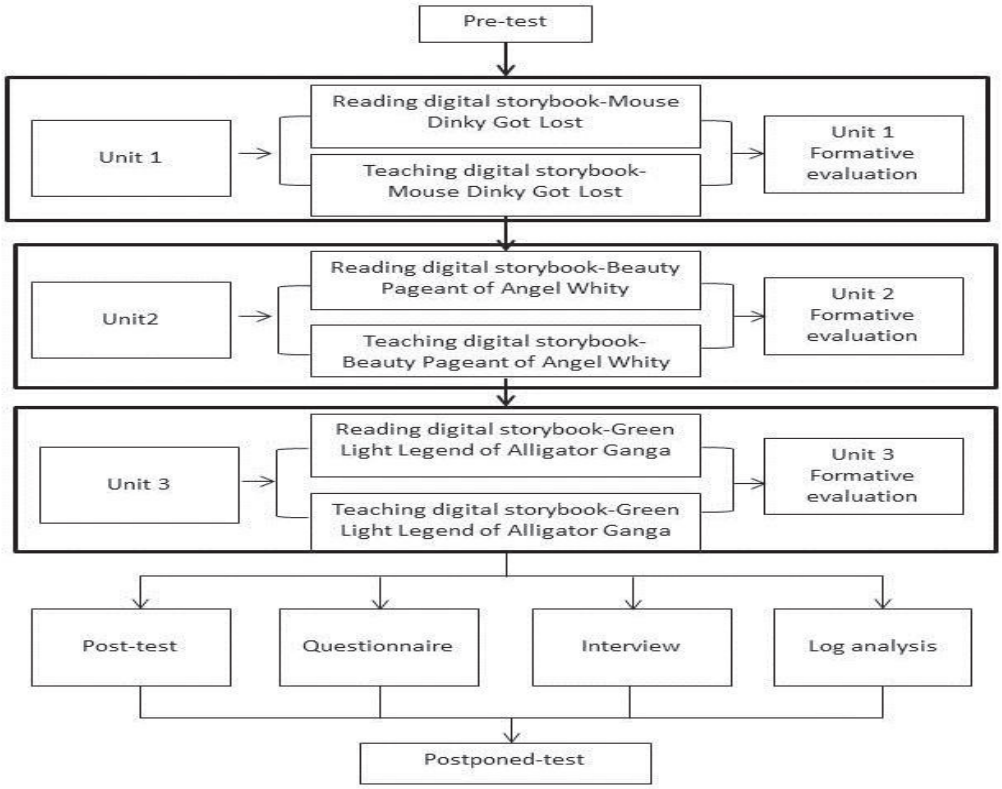

Figure 2 Research Flowchart

5. Results

Students' learning achievement was evaluated by the tests. The results show that the average scores of the post- and postponed-tests do not reach significant differences with the pre-test although both tests were obviously higher than the pre-test.

On the other hand, the questionnaire has positive results on learning attitudes. The questionnaire consisted of three aspects: the content of digital storybooks, the instruction of digital storybooks, and the intrinsic motivation of users. 4-point scale was used in the questionnaire. It shows that all children accept the teaching method of digital storybooks and favor them.

In terms of the content comprehension, the averages of all items were above 3.2 (Table 2). In "I carefully read every line in the storybooks" (t=-0.316, p=0.768), Edison expressed in the interview that he cannot pay attention to every line because he has very short attention span. (sq-20110322-stu05.doc). It shows that showing reading materials in small pieces is every important. Stories should be told in short sentences and the language delivery should be more concise and clearly stated especially for RD students. In "I pay attention to the content of storybooks" (t=-0.224, p=0.834), Edison said that he sometimes cannot think of the correct answers, and when he hesitated, he cannot pay close attention to the following content of the storybooks (sq-20110322-stu05.doc). Other possibilities include the interference of researchers sitting next to them during the testing sections. This can bring some level of pressure to push them to proceed to the next question without paying much attention to the teaching content.

Table 2 T-test results of the content of digital storybooks aspect (N=5)

Item	M	S.D.	t	p
1. I can understand the implied content in the stories	3.60	0.837	0.267	0.802
2. I carefully read every line in the storybooks	3.40	0.707	-0.316	0.768
3. I pay attention to the content of storybooks	3.20	1.000	-0.224	0.834
4. I can understand the animation with text explanations in the storybooks.	3.20	0.447	3.500*	0.025
5. I can understand the animation with oral explanations in the storybooks.	3.20	0.548	1.225	0.288

* $p<0.05$

In the question "I can understand the animation with text explanations in the storybooks" (t=3.500, p=0.025), Brian thought that the presentation of digital storybooks can help him to comprehend more of the learning content, and the animation attract his attention to the screen which leads him to learn the content in the stories (si-20110315-stu02.doc). Lai (2000) said that animation with texts can assist students to obsorb learning content and many studies also proved multimedia materials have better effects than pure text materials.

In the instruction of digital storybooks, students were all agree on "I can fluently read the words in the storybooks". Since the digital storybooks were designed to help students to distinguish word sounds and shapes, students can read more fluently after the learning tasks. It proves that developing the ability to distinguish words can enhance reading comprehensions proved by Calfee and Piontkowski (1981). In the question "I can accurately read the words in the storybooks" (t=3.500, p=0.025), students can read accurate pronunciations especially with words that have various sounds when in different situations.

Table 3 T-test results of the instruction of digital storybooks aspect (N=5)

Item	M	S.D.	t	p
1. I can fluently read the words in the storybooks	4.00	0.000	--	--
2. I can accurately distinguish the phonetic sound of the words in the storybooks	3.20	0.447	0.500	0.643
3. I can accurately read the words in the storybooks	3.80	0.447	3.500*	0.025
4. I can accurately distinguish the shape and strokes of the words in the storybooks	3.40	0.548	1.225	0.288
5. I can accurately distinguish the punctuations in the sentences in the storybooks	3.20	0.837	0.267	0.802

* $p<0.05$

Last, in the intrinsic motivation aspect, students were very agreed about "The storybooks provide me a lot of learning opportunities", ". Learning with digital storybooks is much more interesting than reading traditional books", and "I would suggest my friends to read these digital storybooks". That shows they have very high acceptance rate to digital storybooks, and believe they have more opportunities to practice with digital storybooks. In traditional classrooms, multimedia were seldom used. For RD students, they need more stimulation to multiple sensory. Animations with stories not only can increase learning motivation, they generally feel the digital storybooks to be interesting. Therefore, the result of the question "Learning with digital storybooks is much more interesting than reading traditional books" ($t=3.500$, $p=0.025$) reached significant level. Through the digital storybooks and in the near future to have gaming learning tasks can students obtain knowledge or restore the false knowledge in the learning process.

However, in "I would suggest my friends to read these digital storybooks" ($t=-0.612$, $p=0.573$), the average is 2.8 because one of the students answer "very disagree"; reversely, he answer "very agree" to the question "The storybooks are attractive to me." In the interview, he stated that because some students said these stories were not true stories so he would not want to recommend them to read these storybooks (sq-20110315-stu01.doc); but for those friends who like stories, he would suggest them to try these digital storybooks.

Table 4 T-test results of intrinsic motivation of users (N=5)

Item	M	S.D.	t	p
1.The storybooks give me a lot of fun.	3.80	0.447	3.500*	0.025
2. The storybooks are attractive to me.	3.60	0.548	2.041	0.111
3. The storybooks can increase my reading motivation	3.40	0.548	1.225	0.288
4. The storybooks provide me a lot of learning opportunities	4.00	0.000	--	--
5. Learning with digital storybooks is much more interesting than reading traditional books.	4.00	0.000	--	--
6. I would suggest my friends to read these digital storybooks	2.80	1.095	-0.612	0.573
7. I like reading more than before after reading these storybooks	4.00	0.000	--	--

* p<0.05

In the Pearson Correlation analysis to see the correction level between the four aspects (Table 5), it shows significant correlation between "storybooks" and "intrinsic motivation". The more the students like the storybooks, the more intrinsic motivation they have. Not only they would actively attend to reading, they start to show positive attitude to overall learning.

Table 5 Correlation between factors of digital storybooks

		Digital Storybooks	Content of Storybooks	Instruction of Storybooks	Intrinsic Motivation
Storybooks	Pearson Correlation	1			
	Sig. (2-tails)				
Content of storybooks	Pearson Correlation	.515	1		
	Sig. (2-tails)	.374			
Instruction of storybooks	Pearson Correlation	.553	.704	1	
	Sig. (2-tails)	.334	.185		
Intrinsic motivation	Pearson Correlation	.924*	.742	.804	1
	Sig. (2-tails)	.025	.151	.101	

* p<0.05

The students have positive attitude to reading digital storybooks can be attributed to the story-based reading materials. They accept more arrangements of learning tasks when reading stories, and can show positive improvement of learning effects.

6. Conclusion

Electronic books have become the trend today. But most of them are traditional text presented digitally on the digital book readers without much human-computer interaction. Especially for RD students, learning without appropriate instructional design can make learning more difficult for them. Using multi-sensory instructional design in the digital storybooks has proved by this research to help RD students to increase learning motivation. By completing the learning tasks in the storybooks, students can enhance their recognition of word sounds, shapes, use of punctuations and content comprehension.

It is suggested to let more children with or without special needs to test these digital storybooks to know how much such instructional design can help for enhancing reading abilities. Various difficulty levels of reading materials can be developed for different learning needs. It can also be considered to add more materials to enhance reading abilities such as writing and voice recognition since we have gained positive results from this research.

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References

[1] Calfee, R. C., & Piontkowski, D. C. (1981). The reading diary: Acquisition of decoding. Reading Research Quarterly, 16, 346-373.

[2] Lerner, J., & Kline, F. (2006). Learning disabilities and related disorders: Characteristics and teaching strategies. Boston: Houghton Mifflin.

[3] Perfetti, C. A. (1992). The representation problem in reading acquisition. In P.B. Gough , L.C. Ehri, & R. Treiman (Eds.), Reading acquisition (pp. 145-174).

[4] Stevenson, H., Stigler, J., Lucker, G., Lee, S., Hsu, C., & Kitamura, S. (1982). Reading disabilities: The case of Chinese, Japanese and English. Child Development, 53, 1164-1181.

[5] Simmons, A. (2002). The story factor: Inspiration, influence and persuasion through the art of storytelling. Cambridge, MA: Perseus Publishing.

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Technology Implementation: A Conceptual Framework derived from the Use of Audio Podcasting and EFL Student Perceptions

Aubrey Neil LEVERIDGE*, Mei-Jen Audrey SHIH & Jie-Chi YANG
Graduate Institute of Network Learning Technology, National Central University, Taiwan
*neill@lst.ncu.edu.tw

Abstract: The implementation of technology is a daunting task. Much research has focused on either the implementation of the technology itself, or taken a standpoint from the instructors' perspective. With this in mind, research as of late, has seldom adapted a learner perspective or focused on issues related more closely to the learners' requirements. In this vein, the current study qualitatively gathered student perceptions and central concerns regarding technology implementation in an EFL listening comprehension class. From the findings, a conceptual framework was created which will enable EFL instructors and course designers to make informed choices on how best to implement technology, benefiting all students regardless of their academic proficiency.

Keywords: EFL, podcast, TAM, learner perceptions

Introduction

Technology implementation for instructional purposes has always created interest amongst administrators and instructors since researches have suggested various potential benefits of incorporating computer technology into language learning. However, while research foci have been on the overall benefits of implementation, the individual needs of learners has all but been overlooked. Apparently, the disregard of students' needs while using implemented technology, are the reasons that cause the gap between instructors' expectations and students' actual learning outcomes. Nicholson, Irvine, & Tooley have pointed out that the mere provision of technology does not ensure that learning will occur [1]. Moreover, without the consideration of student involvement and participation, even the best developed system cannot be successful [2]. Since the learners are an integral part of implemented educational technology, Dillen & Gabbard have called for more research on technology-rich learning environments with a particular emphasis on the learner as receiver [3]. In this vein, the current study aimed to employ a mixed methods study to further investigate and assess Taiwanese students' perceptions and central concerns of technology implementation (in this case, audio-podcasting) in their school contexts of English language learning classes.

1. Background of the study

Listening comprehension is an important skill for learning a foreign language; according to current research, the use of authentic material to aid second language listening is the most appropriate means for learning. However, many English as a Foreign Language (EFL) learning environments, Taiwan in particular, lack authentic listening materials. Consequently, gathering such resources is difficult [4] and, as a result, Taiwanese students may not have equal chances to practice listening as compared to other English skills, i.e. reading [5]. With recent advances of internet technology, such as high speed internet and digital storage, there has become an abundance of learning resources online, particularly audio material in the forms of MP3s and podcasts. With these resources readily available, instructors and course designers have easy access to authentic materials for listening instruction and may thus provide students with a variety of learning opportunities.

Khadimally stated that, "…technological implementations in the classroom can be a powerful means to help students acquire a new language…" [6]. However, "… learners with different levels of prior knowledge require different kinds of instructional approaches" [7]. Moreover, the learning content must be delivered in not only an appropriate manner but in an appealing one. As Nayak & Rai pointed out, lessons are generally created for a target audience: those students who are classified as academically average [8]. Moreover, lessons are also delivered in a manner which best suits the target audience, further compounding the problem for non-average learners. Consequently, those whom are classified as either higher or lower academically, fail to receive adequate attention [8] and are faced with unappealing delivery methods.

Furthermore, research into learning preferences show that while learners with a greater degree of prior knowledge show more control over the media, those with a lesser degree of prior knowledge require additional support. With this in mind, audio podcasting has become a popular medium for instructional delivery as it holds mass appeal to a more general audience. Nevertheless, for it to be an effective instructional delivery medium, it must be appealing to students, regardless of their academic abilities. Still, as much of the research on technology implementation has focused on the potential for enhancing students' learning achievement [9] [10] as well as the strategies of implementation technology in a particular subject areas. There has been a limited body of literature centering specifically on the students' perspective of technology implementation. To this end, the aim of this study is to assess students' perceptions of classroom technology implementation, more specifically, audio podcasting. A particular focus will be given to lower academic achievers, as they tend to require additional support. From their perceptions, determinations as to the best possible enhancements to instructional audio podcasting are deduced, in turn creating a more appealing and effective instructional environment applicable to a greater range of students.

2. Methodology

2.1 Sample and Setting

Participants included 121 students, enrolled in the twelfth grade of an English language program at a private senior high school in northern Taiwan in the spring of 2011. Seventy-seven percent (77%) of the participants (N=121) were females and all participants were aged 17 or 18.

2.2 Procedures

The mixed-method study addressed the effectiveness of implemented technology (audio-podcasting) with learner satisfaction in the form of acceptance using a triangulation strategy with multiple resources of data collection. Primary data sources included three questionnaires: the first concerning participants' prior exposure to English as a foreign language instruction; the second regarding their preferred method of communication in English (reading, writing, listening, speaking); and the third, an open-ended questionnaire concerning their learning needs which mirrored the desired enhancements for audio-podcasting. The first questionnaire contained an additional subscale measuring students' acceptance of the implemented technology was modified from the Technology Acceptance Model (TAM) developed by Davis [11] and consists of twelve 7-point Likert scale items where 1 indicated "strongly unlikely" and 7 indicated "extremely likely".

3. Results and Discussion

To permit a more vivid understanding of the different perceptions students held, two distinct clusters were formed according to the TAM results: Cluster A comprised approximately the 10% of respondents with the lowest acceptance ratings; while Cluster B was comprised of approximately 10% of respondents with the highest TAM acceptance ratings. In effect, all participants who returned responses indicating acceptance of the technology implementation but did not indicate any particular central concerns, were removed from statistical analysis as they neither augmented nor diminished the outcome, but obscured it. With this more distinct grouping, four specific themes emerged: 1) the addition of subtitles or captions; 2) the addition of user controlled audio speed; 3) the addition of single word support; 4) and the addition of translation support. Each theme is described in the following section.

Qualitative Findings

The data from the open-ended questionnaire generated four key themes that support and further clarify the quantitative results. The first one deals with *the addition of subtitles or captions* (i.e. the redundant text in the learners' native language: subtitles, or in the target language: captions). Those students who were classified as "lower academic achievers" believe that audio-podcasting provides a valuable means to enhance their listening ability; however, many were not able to grasp particular utterances or words. For instance, Student A said, "Students who do not understand the listening content can get the ideas from the additional information (Chinese or English text)." Likewise, Student B stated that the addition of Chinese text would facilitate understanding of the "…more difficult vocabulary" and in some instances, the "Chinese meaning…" should be given. According to Vandergrift, lower prior knowledge in second language learning rely on "bottom-up" processing to garner

understanding from listening content [12]. Consequently, these students may have difficulty inferring the meaning of particular words from the phrasal context in which it is given. Thus, as Student C commented, the provision of visual content (i.e. text, graphics or pictures) "… may give a deeper impression or understanding…" of the listening content.

The second theme to emerge was the *addition of user controlled audio speed* (i.e. the ability to increase or decrease the rate of speech (wpm)). Interviewees described confusion when the content was presented too quickly for them to process. As Student D stated, "I think the addition of a function which can adjust the speed, either fast or slow, would be good: since I feel that some parts are too fast to understand well". Some students, particularly lower academic achieving students, rely on "bottom-up processing" and thus need time to: 1) process each word individually, 2) combine the individual words in the sentence, and 3) process the sentence as a whole.

The third theme to arise was the *addition of single word support* (i.e. similar to dictionary-like function to check word definitions). Several students mentioned that although full attention was given during the listening process, some contextual keywords were still missed. Student E reflected, "…vocabulary explanation is needed, especially for some [words] with difficult or multiple meanings". Coming across such words created a period of slower processing followed by confusion. This confusion was further compounded when the subsequent sentences were not processed due to the continued processing of previous items.

The fourth theme to become apparent was the *addition of translation support* (i.e. the provision of immediate English-to-Chinese interpretation).Those participants, categorized as lower academic achievers in English listening, needed an alternate aid to check the word and/or phrase meaning during states of confusion caused by the listening content, without interfering with ensuing sentences or interrupting the lesson flow. For instance, Student F commented, "…if there was a Chinese translation, I would better comprehend the context". Also, Student G noted that a supplement of whole text Chinese explanation would be beneficial to quickly clarify the meaning of context. An optional translation will allow for faster processing and permit students to continue without contextual confusion.

Table 1 Conceptual framework

Theme	**Low Academic Achievers**			Technology Implementation (Audio-podcasting)	**High Academic Achievers**		
	Characteristics	Requirements	Enhancement		Characteristics	Requirements	Enhancement
1	Low level of prior knowledge	visual cues: textual or pictorial; to gain contextual knowledge	provision of contextual-graphical cues	learner control of caption/subtitle availability	High level of prior knowledge	n/a	No additional support needed
2	Slower processing	Slower audio at a speed which may be processed	Ability to slow down content to avoid confusion	variable speed control	Faster processing	Faster audio which content is delivered more efficiently	Ability to speed up content to avoid boredom

3	Uses bottom-up processing	available meanings of singular words	optionally target language dictionary support	Link to online dictionary, or pop-up dictionary	Uses top-down processing,	meaning gathered from context,	no additional support needed
4	Low level of prior knowledge	available translation of translation	optionally native language support	Link to online translator, or pop-up translations	High level of prior knowledge	n/a these student can deduce meanings from context	no additional support needed

4. Conclusion

The overall findings from the current study show that students, regardless of academic achievement tend to perceive audio-podcasting as a useful deployment of technology integration. The results of the statistical analysis illustrate that perceived levels of acceptance are positively associated with the type of learning supports required as well as the level of prior knowledge. The indications are thus two-fold: first, this indicates that students with greater prior knowledge need fewer additional supports, however they would benefit from acquiring individual control over the speed of delivery which in turn will expedite learning; second, students with less prior knowledge require additional support which will enable faster processing of meaning and overall comprehension, i.e. visual cues in the forms of either text, graphics or both, as well as individual control over the speed of delivery which will slow the learning as to facilitate the additional time required to process the content. Furthermore, low academic achievers will further benefit from the implementation of an online dictionary in the target language as well as having translation support available. The aim of this study was to assess students' perceptions of classroom technology implementation, specifically audio podcasting. From this assessment themes emerged concerning the students' learning needs and a conceptual framework was created. This framework will assist instructors and course designers to generate a more appealing learning environment, which addresses the learning requirements of a wider spectrum of students, in answer to the students' principal concerns.

References

[1] Nicholson, G. Irvine, H., & Tooley, S. (2010). A test of podcasting effectiveness for lecture revision. In Proceedings of 24th Annual Australian and New Zealand Academy of Management Conference: Managing for Unknowable Futures, December, 2010.

[2] Catchpole, M. J. (1993). Interactive media: the bridge between distance and classroom education. In T. Nunan (Ed.), Distance education futures (pp. 37-56). Adelaide: University of South Australia Press.

[3] Dillon, A., & Gabbard, R. (1998). Hypermedia as an educational technology: A review of the quantitative research literature on learner comprehension, control, and style. *Review of Educational Research, 68*(3).

[4] Tsou, W. & Chen, F. (2004). Strategy Training and Foreign Language Instruction. *Language Association Journal, 55*(3), 8-12.

[5] Li, Y. J. (2008). The Effects of Different Types of Listening Support on the Listening Performance of Elementary School Students-A Study of Chang-Shing Elementary School. Unpublished Master's Thesis. National Pingtung University of Education. Retrieved from http://etd.npue.edu.tw/ETD-db/ETD-search-c/view_etd?URN=etd-0709108-184234 on 09/10/2011.

[6] Khadimally, S., (2011). Integration of technology into adult ESL classes in Turkey: Adult ESL students; and ESL teachers' perceptions about implementation of ICT in one English preparatory school (FDY) in Istanbul. Proceedings from the 11th International educational technology conference, May, 2011.

[7] Shin, E. C., Schallert, D. L., & Savenye, W. C. (1994). Effects of learner control, advisement, and prior knowledge on young students' learning in a hypertext environment. *Educational Technology Research and Development, 42*(1), 33-46.

[8] Nayak, S. K. & Rai, S. S. (2011). An analysis and design of knowledge based system for teaching and learning processes. In Proceedings of the 5th National Conference Computing For Nation Development, March, 2011.

[9] Belmont, I. A. & Verdugo, D. R. (2007). Using digital stories to improve listening comprehension with Spanish young learners of English. *Language Learning & Technology, 11*, 87-101.

[10] Stepp-Greany, J. (2002). Student perceptions on language learning in a technological environment: Implications for the new millennium. *Language Learning & Technology, 6*(1), 165-180.

[11] Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly, 13*(3), 319–340.

[12] Vandergrift, L. (2004). 1. Listening To Learn or Learning To Listen? *Annual Review of Applied Linguistics, 24*, 3-25.

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Analyzing Students' Eye Movements of their EFL Reading with Concept Mapping Strategy

Pei-Lin Liu[a*], Pang-Cheng Wen[b], Meng-Lung Lai[c] & Chiu-Jung Chen[d]
[ab] *Department of Foreign Language, Nation Chiayi University, Taiwan*
[c]*Department of Early Childhood Education, Nation Chiayi University, Taiwan*
[d]*Department of E-learning Design and Management, Nation Chiayi University, Taiwan*

*peilin@mail.ncyu.edu.tw

Abstract: The study aimed to investigate the effectiveness of applying concept mapping strategy by monitoring EFL students' eye movements during English reading process. The participants were divided into two groups: the one applied concept mapping strategy (N = 10), and the control group (N = 12). The experimental group received two reading materials with the aid of concept maps while the control group received the same reading materials without the aid of concept maps. Major findings included that participants in the experimental group spent less time significantly on the texts and the AOIs, and their fixation numbers on the AOIs were also less than the control group. It indicated that the concept mapping strategy could shorten learners' reading time and enhanced learners' reading effectiveness. The eye movement data provided concrete evidence to explain how concept mapping strategy could facilitate learners' reading of previous studies.

Keywords: concept mapping strategy; EFL reading ability; eye movements

Introduction

A concept map is a diagram showing the relationship among concepts (Liu, 2010; Guastello, 2000). It organizes the information and the concepts, usually formed with circles and boxes, and a connecting line linked two concepts together. Moreover, the link between the concepts can be on-way, two-way, or non-directional (Lanzing, 2004; Novak & Canas, 2008).
Concept mapping is a reading strategy which assists learners to conduct information about the reading content through visual aids. Previous studies also showed that concept mapping reading strategies had greater benefit for learners' reading comprehension (Cassata-Widera, 2008; Dyer, 1985; Liu, 2010; Stice & Alvarez, 1986). During the reading process, using concept mapping not only can help learners to organize information about the reading materials, but be easier to memorize (Chiu, 2004; Liu, Chen, & Chang, 2010) and summarize (Esiobu & Soyibo, 1995) the content which conveyed by concept mapping. Moreover, according to Liu's (2010) research, it was suggested that students were able to apply reading strategies such as "inferring", "enforcing", and "reviewing" while they used the concept mapping strategy. The listing strategy provided the organization ability for learners after they got the main point and understood the whole meaning of the context (Hidi an Andersin, 1986). For reviewing strategy, according to Liou & Chen(1999), they pointed out that learners could go back to content and try to recall the detail under the subtitle after they completed the reading. In addition to these reading strategies, Goodman (1989) also

mentioned that learners using inferring strategy could go thought the relevant paragraphs to confirm their inferences.

Although the previous studies showed that concept map is an important reading strategy via evaluating the learners' performance from paper-pencil tests (Chang, Sung&Chen, 2002; Dyer, 1985; Esiobu, & Soyibo, 1995; Stice & Alvarez, 1986), through questionnaire(Liu, Chen, & Chang, 2010)and observation(Cassata-Widera, 2008; Huang, 2005) However, there was no concrete evidence to explain the reasons why the learners got benefit from this strategy and how it change learners reading pattern.

Eye movements are part of the normal reading, this method allows readers read the reading without any interruption, and reader' reading pace and route could be monitored (Hyönä & Nurminen, 2006). Monitoring eye movements during reading can provide valuable information regarding reading comprehension processes (Rayner, Chace, Slattery, & Ashby, 2006). Base on the above reasons, this study recorded readers' eye movement pattern during their reading and aimed to provide the concrete evidence for explaining how concept maps affect learners' reading comprehension. The research questions were:

(1) What was the influence of the concept mapping strategy on learners' reading time in texts and AOIs?

(2) What was the influence of the concept mapping strategy on learners' fixation numbers in texts and AOIs?

1. Methods

1.1 Participants

The participants of this study were 22 Non-English majored students from one Universality in Taiwan. The participants have been studied English for over six years. In this research, 16 females were selected while 6 males participated in. The participants' English proficiency level was intermediate to high-intermediate. Moreover, the native language of all the participants is Chinese. All the participants attended this experiment voluntarily. Before the experiment, participants were divided into the experimental and the control groups. The participants in the experimental group (N=10) received two reading materials with the aid of concept maps, while control group (N=12) received the same reading materials without the aid of concept maps.

1.2 Apparatus

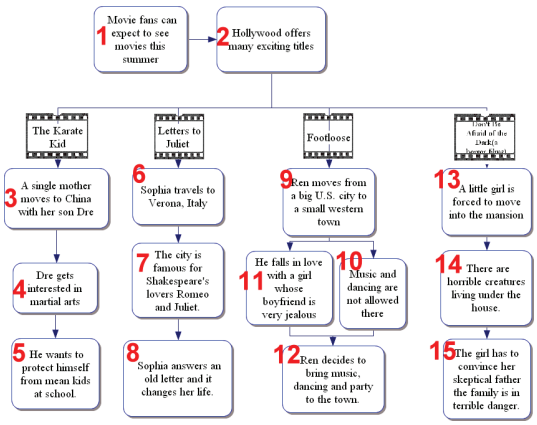
Eye movements/fixations were recorded during the solving of the word problems with the eye-tracker faceLAB4.5 which sampled the position of the participant's gaze every 16 ms (i.e., 60 Hz). The stimuli were presented by the software GazeTracker on a 19-in.Viewsonic (1280×1024 pixels) monitor. In addition, and the other (out of sight of the participant) for the experimenter to give feedback in real time about the participant's computed gaze position through the monitoring system overlay, which allows the experimenters to evaluate the system's accuracy and to initiate a recalibration if necessary. The stimuli were situated approximately 0.6 m from the subject. In order to avoid distracting the participant during experiments, a divider was set to reduce the empirical interference.

1.3 Materials

2.2.1 Reading articles: Two articles included in the high-intermediate proficiency level of an English magazine were selected as the reading materials in this research: *Some expecting movies* as Article 1 and *MBA programs in the US* as the Article 2. The first article talked about four upcoming movies in the summer, which are *The Karate Kid, Letters to Juliet, Footloose,* and *Don't Be Afraid of the Dark*. The difficulty levels of the articles were .32 (Article 1) and .54 (Article 2). Then the second article described an institution called MBA which can help students to have their further studies in the US. The basic vocabulary size required for the reader was 3000-5000 words. Moreover, the contents of these two articles are related to real life. In this case, participants do not necessary to have any pre-knowledge of any specific domain.

2.2.2 Concept map: the concept map is expert-constructed concept map which is developed by the instructor. This kind of concept mapping strategy provide leaners a guide to follow in a top- down approach to reading and finding the focus points in the text (Liu, 2010). The contexts of each box in concept map were associated with the knowledge in the articles.

In this research, two articles were included, and both of the articles were drawn AOIs. Area of interest (AOI), or called lookzone, usually refers to the area that the study is going to measure. In this study, the AOIs were drawn as the major concepts or focus points of the articles. The participants could find the focus point of the articles through these areas. In the first article, both the concept map and the text were drawn 15 AOIs while 11 AOIs were shown in article 2 (See *Figure 1*).



1 Movie fans know that Hollywood offers many exciting titles between May and August. Here's **2** some of what eager moviegoers can expect to see this summer. Kids will enjoy a remake of the 1984 film *The Karate Kid*. In the movie, **3** a single mother moves to China with her son Dre. Once there, **4** Dre gets interested in martial arts. **5** He wants to protect himself from mean kids at school. His teacher is a martial arts master, played by Jackie Chan. The drama *Letters to Juliet* follows **6** Sophia, a young American woman, as she travels to Verona, Italy. **7** The city is famous for Shakespeare's lovers Romeo and Juliet. **8** Sophia answers an old letter to Juliet seeking advice about love, and it changes her life. In *Footloose*, a family with a teenage son, **9** Ren, moves from a big U.S. city to a small western town, where **10** music and dancing are not allowed. This is a shock for Ren, and his difficulties increase when **11** he falls in love with a girl whose boyfriend is very jealous. **12** Ren decides to bring music and dancing back to the town, beginning with a party for students at the town's high school. If you like horror films, you won't want to miss *Don't Be Afraid of the Dark*. In this remake of a 1973 TV movie, **13** a little girl is forced to move into the mansion where her father and his new wife live. **14** The girl discovers that there are horrible creatures living under the house. Somehow **15** she has to convince her skeptical father that the family is in terrible danger.

Figure 1. AOIs and its correlation between concept map and text in Article 1: *Some expecting movies*

1.4 Procedure

The participants seated approximately 70 cm form the computer screen. Before the experiment, participants' eye movements were adjusted and calibrated by using a 9-point calibration grid that presented over the entire computer screen. The participants' eye movements were checked if this research is valid. After the adjustment, participants were asked to read two reading comprehension. Two articles were showed in the screen. The experimental group received two reading articles with the concept mapping strategy while control group read the two reading materials only. For the experimental group, the participants received the concept map of the article first, and then the next page was shown

both the concept map and the article. There is no time limitation during their reading. However, the participants usually took one hour to finish this experiment. After they read the articles with and without the aid of concept mapping strategy, they had to answer the following four reading comprehension tests for each article.

1.5 The eye tracking method

In the study, the eye-tracker was used to monitor the participants' eye movements through the EFL reading process. In this study, fixation points were identified by the number of 3 gaze points that fell within a certain dispersion, and were grouped within a radius of 40 pixels, and then gathered with a minimal duration of 200ms. Using Gazetracker the time and fixation data were exported to Microsoft Excel. The participants' fixation and total reading time were checked as a concrete evidence to see whether the concept map could assist their reading. In the reading materials, both the concept maps and texts were drawn AOIs. The AOIs were selected as the key knowledge or content in the articles. The AOIs between concept maps and texts were correlated. In this study, three eye movement data were corroborated: the total reading time were defined as (1) the spending time on the articles (2) and the time the participants spend on all the AOIs. In addition, (3) the fixation numbers that the participants fixated from the AOIs were illustrated as well. These variable data in two groups was compared to observe whether there is any significant difference between these two groups.

2. Result

2.1 Participants spent less time on the reading with the aid of concept maps

Several series of analyses were computed on the eye-movement data. The data investigated the amount of time that the participants spent on all the text, the total reading time in AOIs of two articles, time spent on the concept maps, and the fixation numbers in the AOIs and texts.

Table 1. *The Independent T-test and descriptive data of total reading time in texts*

Reading Material	Concept Map	*N*	*M*	*SD*	*t*	*df*	*p*
Article 1	with	10	106.75	99.89	2.73	20	.01*
	without	12	204.98	68.21			
Article 2	with	10	91.09	99.56	1.91	20	.07
	without	12	154.55	52.63			
Article1&2	with	10	197.85	196.52	2.41	20	.03*
	without	12	359.53	113.97			

Table 1 shows the number of the participants' mean and standard deviations of total reading time in Article 1 and 2. Independent T-test was conducted with concept mapping strategy and total reading time as the variables. The result showed the significant differences between the experimental group and control group ($p < .05$) in Article 1. It indicated the total reading time of experimental group of Article 1 ($M = 106.75$, SD = 99.89) was shorter than the control group in Article 1 ($M = 204.95$, SD = 68.21). Note that this result indicated participants reading with the aid of concept mapping strategies revealed shorter time on the Article 1. Then the data only shows little differences in Article 2. However, when took the articles together, the result showed the significant differences between the experimental

group and control group ($p < .05$). It indicated the total reading time of experimental group of two articles (M = 197.85, SD = 196.52) was shorter than the control group (M = 359.53, SD = 113.97).

Table 2. *The Independent T-test and descriptive data of total reading time in AOIs*

Reading Material	Concept Map	*N*	*M*	*SD*	*t*	*df*	*p*
Article 1	with	10	36.10	36.67	-2.68	20	.01*
	without	12	70.33	22.78			
Article 2	with	10	24.24	27.72	-2.17	20	.02*
	without	12	45.35	17.54			
Article1&2	with	10	60.34	63.25	2.53	20	.02*
	without	12	115.69	38.08			

Table 2 presents the number of the participants' mean and standard deviations of total reading time in AOIs. In this, independent T-test was conducted with concept mapping strategy and total reading time as the variables. The result showed the significant differences between the experimental group and control group ($p < .05$). It indicated the total reading time in AOIs of experimental group of Article 1 (M = 36.10, SD = 36.67) and Article 2 (M=24.24, SD=27.72) was shorter than the control group in both Article 1 (M = 70.33, SD = 22.78) and Article 2 (M = 45.35, SD = 17.54). In addition, when took the articles together, the result showed the significant differences between the experimental group and control group ($p < .05$). It indicated the total reading time in AOIs of experimental group of two articles (M = 60.34, SD = 63.25) was shorter than the control group (M = 115.69, SD = 38.08).

Figure 4 shows the mean of total reading time in AOIs of the texts from experimental group and control group, and it indicated the participants reading with concept mapping strategies spent less time on the texts.

Table 3. *The participants' means (and SD) of total reading time in concept maps*

Reading Material	Concept Map	*N*	*M*	*SD*
Article 1	with	10	19.54	14.70
Article 2	with	10	19.81	23.39
Article 1&2	with	10	39.35	34.34

Table 3 indicates the mean and standard deviations of total reading time in the concept maps. It showed that the participants in experimental group spent 19.54 second on the map in Article 1, and 19.81 second on the map in Article 2.

2.2 Participants had less fixation numbers on the AOIs with the aid of concept maps

Table 4. *The Independent T-test and descriptive data of fixation numbers in the texts*

Reading Material	Concept Map	*N*	*M*	*SD*	*t*	*df*	*p*
Article 1	with	10	201.00	203.93	2.58	20	.01*
	without	12	389.58	136.52			
Article 2	with	10	168.80	198.73	1.83	20	.08
	without	12	293.50	115.20			
Article1&2	with	10	369.80	396.65	2.28	20	.03*
	without	12	683.08	241.61			

Table 4 shows the number of the participants' mean and standard deviations of the fixation numbers in texts. Independent T-test was conducted with concept mapping strategy and the fixation numbers as the variables. The result showed the significant differences between the experimental group and control group ($p < .05$). It indicated the experimental group in Article 1 ($M = 201$, SD = 203.93) revealed less fixation numbers than the control group ($M = 389.58$, SD = 136.52) while it only showed little differences in Article 2. However, when took the articles together, the result showed the significant differences between the experimental group and control group ($p < .05$). It indicated the fixation numbers of experimental group in two articles ($M = 369.8$, SD = 396.65) was less than the control group ($M = 683.08$, SD = 241.61).

Table 5. *The Independent T-test and descriptive data of fixation numbers in AOIs*

Reading Material	Concept Map	*N*	*M*	*SD*	*t*	*df*	*p*
Article 1	with	10	113.90	119.45	2.53	20	.02*
	without	12	224.92	77.56			
Article 2	with	10	84.30	101.87	1.85	20	.07
	without	12	153.17	64.97			
Article1&2	with	10	198.20	216.70	2.37	20	.03*
	without	12	378.08	136.08			

Table 5 demonstrates the number of the participants' mean and standard deviations of the fixations. In this, independent T-test was conducted with concept mapping strategy and the fixation numbers as the variables. The result indicated the significant differences between the experimental group and control group ($p < .05$) in Article 1. It indicated the fixation in the AOIs of experimental group in Article 1 ($M = 113.90$, $SD = 119.45$) was less than the control group ($M = 224.92$, $SD = 77.56$). However, when took two article together, the result showed the significant differences between two groups ($p < .05$). It indicated the fixation of experimental group of the articles ($M = 198.20$, $SD = 216.70$) was shorter than the control group ($M = 378.08$, $SD = 136.09$).

Figure 7 and 8 present the fixation numbers and the reading route of two articles from two participants in different groups. It showed that the particpants read with the concept mapping strategy revealed less fixation numbers than the participant in the control group. The result indicated that the particpant in the experimental group fixated less on text and could find the key words or sentence easily. Moreover, the particpant read with the concapt map could use some reading strategies(listing, inferring, and reviewing) while the the particpant in control group read the atricle word by word.

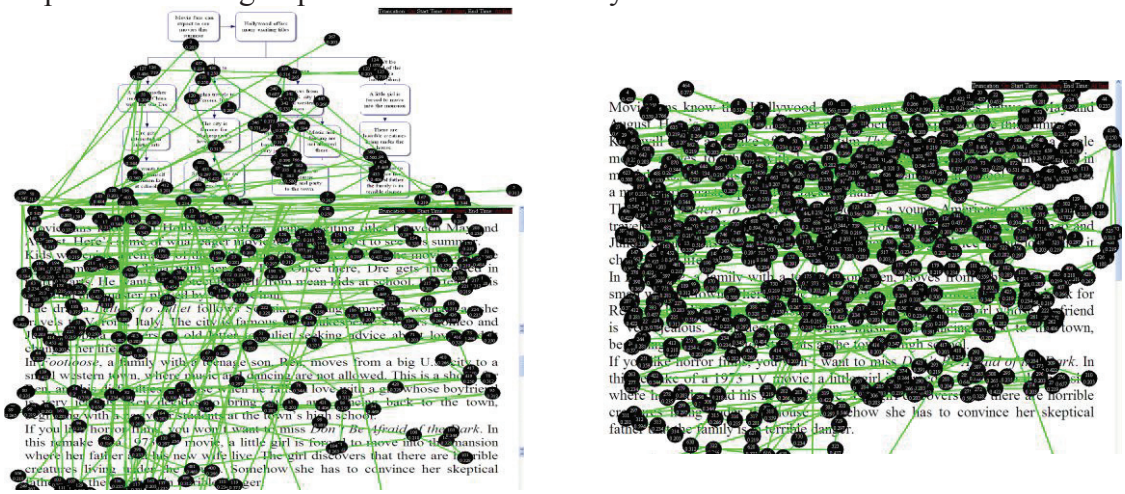


Figure 2. The fixation numbers in Article1 from the participants of two groups (Left: The experimental group; Right: The control group)

3. Disscussion

As the previous studies mentioned that the concept mapping strategy provided positive effects in learners' reading (Dyer, 1985; Esiobu & Soyibo, 1995; Liu, 2010). However, the evidence was not provided to prove how readers utilize concept maps when they read a text. In this case, the questions in this study explored whether the aid of concept mapping strategy would influence the students' eye movements on English reading time and pattern. The results of the eye tracking data suggested that the adopted concept mapping strategy help participants read more effectively. There were two pieces of evidence supporting the influence of concept mapping strategy. First, reading time either in texts or AOIs were shorter than the one without the aid of concept maps. Second, readers tended to skip over words in irrelevant sentences which were not included in the AOIs (see Fig 2.). More generally speaking, these results suggest that concept maps guides readers' visual attention in a selective manner (Anderson, 1982) and defines what information is processed to a deeper level and integrated to the developing memory representation (Kaakinen & Hyona, 2007).

4.1 Participants revealed less reading time with the aid of concept maps

The result corroborated that the participants read without the aid of concept mapping strategy revealed longer reading time and more fixation numbers than those read with the aid of the mapping strategy. The longer reading time appears to be due to a larger fixation numbers in texts.

According to Rayner et al.'s (2006) finding, they claimed that time and numbers of fixations are affected by texts difficulty of readers' self-awareness. It indicates that while readers read without concept map, they had more reading difficulties than reading with the aid of concept maps. In addition, from the aspect of concept mapping strategy, Cassata-Widera (2008) pointed out that concept map not only can develop learners' literacy skills but provide ways to represent and organize the knowledge from the separated context. Then, new linguistic forms were shown to express the concepts. When corresponding to the current study, the reason for the participants read with concept map spent less time on the articles is that the concept map helps learners to display whole relationship of the context. It indicated that the aid of concept maps helps learners to summarize the article, and then the participants could directly catch the focus point. In this case, the participants could spend less time to understand the article.

These results thus provide further confirmation that concept map could reduce readers' reading difficulties and reading time.

4.2 Participants tended to use some reading strategies with the aid of concept map during the reading process

From data showed in Figure 2, readers with the aid of concept maps had less fixation numbers on the AOIs and had more strategic processing mode during reading by paying particular attention to relevant information emphasized by concept maps. The participant in the experimental group would use some reading strategies through the reading process. This finding might correspond to Liu, Chen and Chang's (2010) study. In this study, the fixation numbers showed the participants read with the concept mapping strategy tended to use the reading strategies: listing, inferring, and reviewing. For listing and inferring, the participant read with the concept map put most of his attention to the sentences or the paragraph which

is related to the main points while the participant read without the concept mapping strategy only read the articles word by word. As for the reviewing strategy, from the participant's reading route, it showed that the participant in experiment group would go back over the content or glace though subtitle to recall the main idea after he read the whole article. When it comes to the participant in control group, read without the concept mapping strategy, his reading route was systematically from left to right, and he seldom went back to organize and clarify the article.

References

[1] Anderson, J. R. (1982). Acquisition of cognitive skill. Psychological Review, 89, 369-403.

[2] Ashby, J., Rayner, K., & Clifton, C. (2005). Eye movements of highly skilled and average readers: Differential effects of frequency and predictability. Quarterly Journal of Experimental Psychology, 58A, 1065–1086.

[3] Amadieu, F., van Gog, T., Paas, F., Tricot, A., & Mariné, C. (2009). Effects of prior knowledge and concept-map structure on disorientation, cognitive load, and learning. Learning and Instruction, 19, 376-86.

[4] Brown, H. D. (2004). Language assessment: Principles and classroom practices. White Plains, N.Y.: Pearson Education, Inc.

[5] Cassata-Widera, A. E. (2008). Concept mapping and early literacy: A promising crossroads. In Canas, A., Reiska, P., Ahlberg, M., & Novak, J.C. (Eds.) Proceedings of the Third International Conference on Concept Mapping. Tallinn, Estonia & Helsinki, Finland.

[6] Chang, K., Chen, I., & Sung, Y. (2002). The effect of concept mapping to enhance text comprehension and summarization. The Journal of Experimental Education, 71(1), 5-23.

[7] Chiu, C. H. (2004). Evaluating system-based strategies for managing conflict in collaborative concept mapping. Journal of Computer Assisted Learning, 20(2),124–132.

[8] Dyer, P. A. (1985). A study of computer assisted reading the effects of pre-reading mapping on comprehension and transfer of learning. Dissertation Abstracts International, 46(9), 26–41.

[9] Esiobu, G. O. & Soyibo, K. (1995). Effects of concept and vee mappings under three learning modes on students' cognitive achievement in ecology and genetics. Journal of Research in Science Teaching, 32, 971-995.

[10] Goodman, K.1989. Special Issues on Knowledge-Based Machine Translation, Parts I and II. Machine Translation, 4(1/2), 5-24

[11] Huang, 2005 Huang, L. I. (2005). *Using concept mapping as a strategy to improve the English reading comprehension*. Unpublished master's thesis, Tzu Chi University, Hualian City, Taiwan.

[12] Hyönä, J. & Nurminen, AM. (2006). Do adult readers know how they read? Evidence from eye movement patterns and verbal reports. British Journal of Psychology, 97, 31-50.

[13] Kaakinen, J. K., & Hyona, J. H. (2007). Perspective effects in repeated reading: An eye movement study. Momory & Cognition, 35(6), 1323-1336.

[14] Lanzing, J (2004). Everything you always wanted to know about concept mapping. In P. A. M.Kommers(Ed.), Cognitive support for learning: Imaging the unknown (pp. 47-72). Amsterdam: IOS Press.

[15] Liou, M. L., & Chen, C. L.(1999). *A whole new and practical English teaching method: Teaching manual for elementary and junior high school instructor.* Taipei, Taiwan: Caves.

[16] Liu, P. L., Chen, C. J., & Chang, Y. J. (2010). Effects of a computer-assisted concept mapping learning strategy on EFL college students' English reading comprehension. Computers & Education, 54(2), 436–445.

[17] Liu, P. L. (2010). COMPUTER-ASSISTED CONCEPT MAPS FOR ENGLISH LEADING AND SUMMARY WRITING. Crane, Taipei.

[18] Novak, J. D., & Cañas, A. J. (2008). The Theory Underlying Concept Maps and How to Construct Them (Technical Report No. IHMC CmapTools 2006-01 Rev 01-2008). Pensacola, FL: Institute for Human and Machine Cognition.

[19] Rayner, K., Chace, K. H., Slattery, T. J., & Ashby, J. (2006) Eye movements as reflections of comprehension processes in reading. Scientific Studies of Reading, 10, 241-255.

[20] Stice, C. F., & Alvarez, M. C. (1986). Hierarchical concept mapping: Young children learning how to learn (A viable heuristic for the primary grades) (Report No. 5). Nashville: Tennessee State University, Center of Excellence, Basic Skills for the Disadvantaged, Reading/Writing Component. (ERIC Document Reproduction Service No. ED 274 946)

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Mobile Assisted Game-based Chinese Character Recognition

Lung-Hsiang WONG[a] & Ching-Kun HSU[b*]
[a]*Learning Sciences Lab , National Institute of Education, Singapore*
[b]*Department of Information and Leaning Technology, National University of Tainan, Taiwan*
[*]d09608002@stumail.nutn.edu.tw

Abstract: This paper reports on the effects of two different dynamic grouping strategies in a mobile-assisted Chinese character learning game. The game application assigns each student a component of a Chinese character through their smartphones and requires them to form groups that can assemble a legitimate Chinese character using the components held by the group members. Sixteen Primary 3 (3rd grade) students taking Chinese as a second language (L2) class involved in the study. Video-recordings of the game and the transcriptions of focus group interviews were qualitatively analyzed. The study aims to explore the patterns of social interactions during the game, especially on the varied impacts of the two different grouping rules (allowing versus not allowing each student to join more than one group at one time) on the students' game behaviors and their learning gains.
Keywords: Mobile-assisted Language Learning (MALL); game-based learning; Chinese character learning; Computer-supported Collaborative Learning (CSCL)

1. Introduction

Chinese has long been regarded as one the most challenging languages to learn. One major challenge to the non-native learners is the complexity of the logographic configuration of Chinese characters [15][23]. There are two categories of Chinese characters in terms of their physical structures. One is called an integral character which contains only one component, such as 口, and the other one is named compound character, which includes at least two components [15]. Most Chinese characters are composite made up of multiple reusable components that fit into the square space. The spatial configurations of these compositions usually follow about 15 different patterns [7][28]. Taking 吾 as an example, there are many Chinese characters that fits the pattern, such as 吾, 尘, and so on. Some simple components can be combined to form more complex components or compound characters [7]. Psycholinguists have stressed the importance of the awareness of part-whole relations and component knowledge in the processing of language [17]. Previous studies have also concluded that it is hard to memorize the strokes in whole words [19]. Therefore, other studies favored the instructions on the structure and form of characters that require the students to pay attention to the association between character, form and meaning. Students are encouraged to add associations to the characters and their forms using their imagination and creative thinking [11].

In turn, we developed a game-based learning approach on collaborative Chinese character formation, namely, "Chinese-PP" (汉字，拼一拼). PP refers to 拼一拼 or "Pīn yì Pīn" in Chinese, which roughly means "trial assembling", and also colloquially means "striving for better (outcomes)". In playing the game, the students are assigned

smartphones in 1:1 (one-device-per-student) basis. The activity is conducted in multiple rounds. In each round, a set of Chinese character components is randomly assigned by the system server via 3G connections to individual students. The students have to recognize and compose legitimate compound characters by grouping with their peers who have different components. This paper focuses on analyzing the social interactions, collaborative behavioral patterns and competitive strategies that were emerged during several game playing sessions. In particular, we will discuss the different impacts of two different grouping rules (allowing or not allowing the players to join more than one group at each time) on the students' game behaviors and their learning time.

2. Related Literature

2.1. Chinese character learning

Many studies emphasized the importance of Chinese character recognition. For example, previous research indicated that the students' mastery of components and their vocabulary have direct impact on character learning. Other studies also noted that novel students should focus on learning character recognition which is more important than writing [1]. Shen and Ke (2007) stated that component information is involved in word recognition in the area of morphological processing of Chinese character [16]. For example, some scholars found that characters can be recognized by the activation of submorphemic (radical) information [18].

A Chinese character consists of three tiers: whole character, components and strokes. Moreover, the middle part, the components, is the core and the base for the formation of a Chinese character [20]. While Chinese characters are composed from a limited number of common components, previous scholars had successfully used computer technologies to help students to develop such structural awareness about Chinese character [10]. Teaching the structures of characters and simultaneously addressing the relationship between parts and wholes would generate positive effects on character learning [2][12].

2.2. Mobile Assisted Language Learning

Mobile learning makes diverse possibilities of innovative instructional method be carried out in the general classroom in more effective and efficient ways. Scholars noted that mobile-assisted language learning (MALL) provide students with rich, real-time, convenient, social contact, collaborative, contextual learning opportunities no matter inside and outside the classroom (Kukulska-Hulme,& Shield, 2008). The paradigm has also been applied to Chinese Language learning in recent years. A previous study explored the feasibility of using of a wireless handheld system (WHS) that supports the individual and co-operative reading activities in Chinese language classes, and found that WHS improved students' Chinese language and facilitated co-operative learning in the Chinese class [4]. Another study on Chinese vocabulary (idiom and conjunction) learning placed an emphasis on learner created contexts and contents, and found that the students' ongoing, open-ended, personal-to-social meaning making processes showed potential of transforming language learning into an authentic learning experience [22][24][26][27].

2.3. Game-based Learning

The purpose of new interactive models in learning environment is to involve students in their learning tasks. Games are regarded as effective tools for enhancing learning [5][14]

because Game-based learning assists students to learn the material by overcoming challenges in games. Game-based learning has the characteristics of helping learners enthusiastic, focused, and engaged. As a result, the students can be interested in and enjoy the tasks they do [13]. The students do their best to achieve their goals by insisting on the end of playing game without forces [6]. The Chinese-PP approach in the study was designed on the foundation of the games and learning model which is illustrated in Figure 1 proposed by Garris et al. (2002). In the beginning of the game cycle, the judgments of users are based on free will, and their intentions representing engagement and enjoyment. User behaviors are triggered in exert intense effort and concentration. The feedback is critical to support performance and motivation [3][21]. Research suggested that the effects of feedback on performance are highly variable; especially well feedback can improve performance [8].

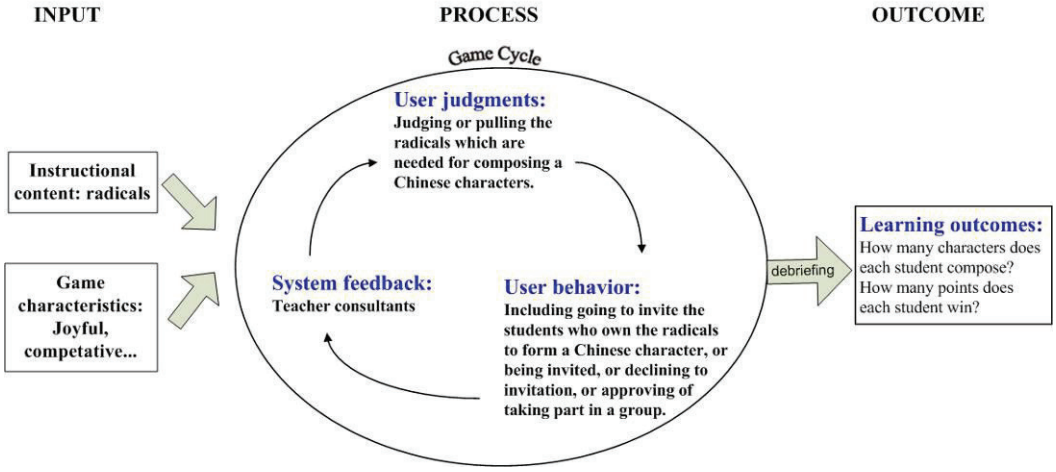

Figure 1. The Input-Process-Outcome Game Model used in ChinesePP (Garris et. al., 2002)

3. Method

3.1 Procedure

Sixteen P3 students who were learning Chinese as second language in Singapore in a primary school participated in the empirical study. Six one-hour Chinese-PP learning sessions were designed with the involvement of the researchers and teachers. Each learning session consisted of three sections, namely, warming up (about 15 minutes), game playing (about 30 minutes), and recalling (about 15 minutes). The learning sessions were enacted between May-September, 2011.

More specifically, in the warming up section, the teacher delivered brief instructions with Powerpoint files on specific knowledge of Chinese character structure, such as *pictophonetic character* (a character that composes of a component indicating the pronunciation and another representing the semantics, e.g., 晴 [means "sunny", pronounced as 'qíng'], with 日["sun"] representing the semantic meaning or 'picture' of the character, while 青 [similarly pronounced as 'qīng'] indicating the pronunciation), and enacted relevant paper-based group activities. The aim was to equip students with prerequisite knowledge for the subsequent (two to three rounds of) mobile-assisted game playing. After the game, the teacher facilitated a recalling activity where students were asked to relate the characters that they had composed during the game with the character

structure knowledge that they learned from the teacher (e.g., relating 晴 to 'pictophonetic character').

3.2. Design of game-based learning activities

Figure 2 shows the framework of the Chinese-PP game. At least two game-based factors and three learning theories are integrated in the system. The Chinese-PP game was designed by means of integrating mobile learning in the general classroom setting with the aim of promoting interactions and collaborations among learners. The game approach can be characterized as spontaneous, dynamic grouping game as no fixed student group is determined before each game round. Each student is equipped with a smartphone in which they can see what components they have and what components the other classmates are assigned. The students will identify their partners in order to collaboratively compose the components into a legitimate Chinese character. When one game advances to the next round, the existing groups are all disbanded and a new set of components are assigned to the students.

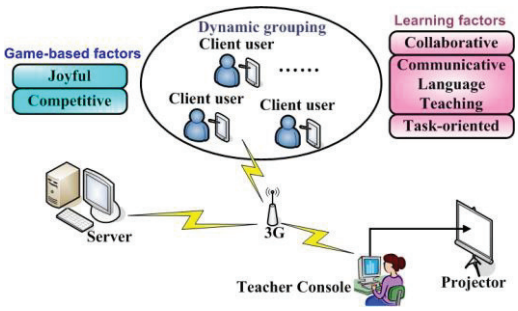

Figure 2. Framework of Chinese-PP in class

The setting and devices used in the study consists of a projector, the 3G wireless connection, a laptop with the Chinese-PP teacher console being installed, 16 smartphones installed with the client application of Chinese character recognition game. The facilitator (usually teacher) prepares several sets of Chinese components that are equal to the number of participating students in advance. When the game starts, the client application on the smartphone displays all the components for a student to select and configure (spatially) in order to form a Chinese character (see the left of Figure 3). Upon submission of her composed character to the server, the other students who "own" the components that the student has selected will receive the character on their "My Groups" window as a proposal for grouping. However, the proposed student cannot take for granted that her peers will join her group as the other students might have also formed their own characters or receive other proposals. This is the point where she will need to negotiate with the peers to join her group.

In addition, the system allows the teacher to tweak the game rule of whether to allow an individual student to form or join more than one group at a time (known as "single-group mode" and "multi-group mode" respectively). For example, a student who is assigned the component "五" ("five") submits a character "吾" (I). At the same time, another student may propose "伍" ("group") and invites the former to join them. During the single-group mode, she will have to choose one between the two options. Otherwise, she can join both groups if she thinks the two proposed characters are legitimate ones. During the learning sessions, the teacher complied to our advice by alternating between

the two modes across different game rounds in order to experiment their effects on the students' collaborative patterns and game behaviors.

The group which is organized by the students themselves based on their requirement. At the right of Figure 3, the teacher not only checks the characters which the students compose on the teacher console (projected on the screen), but also explains and gives just-in-time feedback to all the students. Moreover, the students can know the characters composed by other students and the scores they win (see below) in the teacher console.

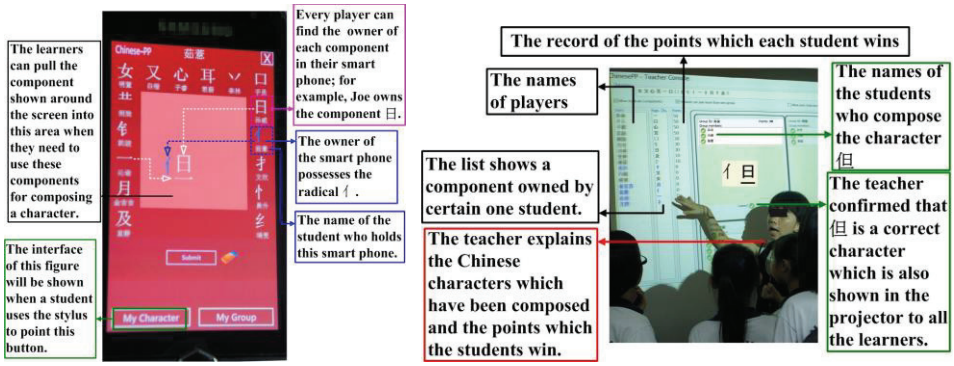

Figure 3. The user interface of the smart phone client (left), and the teacher console (right)

A scoring scheme is applied in the game in order to motivate the students to strive for greater game achievement. Students earn and accumulate scores by forming legitimate groups – 10 points for a 2-component character, 20 points for a 3-component character, 30 points for a 4-component character, and so on (same score to be awarded to each member of the group). This is to encourage the students to form bigger legitimate groups for identifying more complex characters. During the multi-group mode, a student who joins more than one group will earn accumulated scores from all the groups carrying the legitimate characters.

4. Results and Discussions

4.1. The social interactions in the game-based learning

The dynamic collaborative grouping strategy enabled by mobile information exchange and face-to-face interaction had successfully motivated learners' active desire in finding out what components can be put together to form a Chinese character in Chinese-PP. In terms of peer collaboration, competition, and tutoring, the higher-achievement (HA; in terms of their academic achievements in the Chinese Language course) students who have indomitable characteristics become the leaders and advisors of the group to guide other students in determining which are legitimate characters and which are not, or suggesting alternative characters by replacing one or more components. For example, in the study, a HA student Wendy (pseudonym) often took the initiative to advise other groups in their game playing. After two Chinese-PP learning sessions, her peers became more inclined to seek for her assistance. Albeit taking place in a general classroom, we rearranged the student chairs and desks to set aside an empty space and encouraged the students to walk around, form and re-form ad-hoc physical clusters to ardently discuss with different peers so as to explore alternative possibilities of characters, as shown in Figure 4. As for the lower-achievement (LA) students, we observed that they were not left alone during the game. This was because the more proactive students (who were not necessarily HA

students) would search for partners to compose their own groups. When other students needed the components which the LA students had, they would explain their proposed characters and invite the LA students to join their groups. As a result, the Chinese character knowledge of the HA could be transferred to their counterparts.

Figure 4. The students carry smart phone with them and go around to discuss with others

4.2. Different impacts of two grouping modes on the game playing and learning

In this section, we compare the effects of the two collaborative grouping modes, single-group mode and multi-group mode, to the students' game playing and interactional patterns in the game. According to our analysis on the video and server logs, during the single-group game rounds, most of the students usually spend more time to figure out the most complex characters that they could recall from the given components before making their submissions. Conversely, during the multi-group rounds, they would attempt to submit more alternatives of characters and were engaged in interactions with more peers to confirm the legitimacy of those characters. The game had also become more competitive as students who submitted multiple characters were more likely to gain higher scores. As the scores and their overall rankings were dynamically updated in the teacher's console and projected to the students to refer to, that became one of the motivating factors for them to remain active in playing the game.

Indeed, the students were keener on attempting to compose more complex characters. Take one example that we observed within the single-group mode, four students formed the character 熟(literally means "cooked" or "ripe") whose configuration 𠙵 is not taught in P3. In turn, each of the four members won 40 points respectively at the same time.

Conversely, during the multi-group mode, students tended to perform frequent group re-forming to explore more possibilities. In one instance, five students formed the 5-component character 警 ("warn") and received 40 points each. They then gradually decomposed the character by removing one component each time, and "transformed" it to 敬 ("salute", 30 points each), 苟 ("thoughtless", 20 points) and 句 ("sentence", 10 points each). In another case, two students who received the components 艹 and 日 respectively first formed the character 昔 ("previous", 10 points), and then teamed up with two other students separately to form 借 ("borrow", 20 points) and 惜 ("cherish", 20 points) respectively. In turn, both of them earned 50 points respectively. Apparently, the students had applied the knowledge of pictophonetic character to figure out multiple characters that their components can compose.

It is important to note that during the warming up sections of the past sessions, the teacher had only taught ten most basic spatial configurations for composing Chinese characters to the participating students. Nevertheless, Chinese characters with more complex spatial configurations that were previously untaught had been identified and submitted by the students during the activities. The above-stated example of 熟 with the spatial configuration 𠙵 is one of such student-identified characters. Our video and audio

analysis shows that it was the intensive peer tutoring and collaboration during the games that resulted in such unexpected knowledge gains.

4.3 Focus groups interview

We selected nine students with equal number of HA, middle-achievement and LA students, including Wendy, for a focus groups interview. Seven students informed us that they were usually taking the initiative to form characters and invite peers to join their group, while the other two were more being invited. All of the students expressed that they enjoyed the activities and would like to take part in more Chinese-PP sessions in the future. Seven students indicated their perception of having learned new characters during the game activities while, the other two students stated that they made guesses most of the time in playing the game. In particular, Wendy expressed that she had been willing to assist other students whenever requested by them, even though the characters that she suggested or affirmed did not make use of her own components. In this regard, the Chinese-PP approach has indeed resulted in the students' enjoyment, competitions and collaborations.

In addition, the students agreed that the teacher console could help them confirm whether their answers or guesses were correct or not. It became an important feedback mechanism in the game. Typically, in the first two minutes of each game round, most of the students studied their own smartphones as they could browse through all the components available for the game round and proceed to trial-compose their first characters. After the first character which is composed and submitted to the teacher console, some of the students started to notice what was displayed on the projected screen. As the learning sessions progressed, the time they needed to trial-compose their first characters became shorter. In the final (sixth) learning session, the students submitted their first character composed in less than one minute.

5. Conclusion and Future Recommendations

We have developed and studied Chinese-PP, a game-based MALL approach to address the Chinese as L2 learners' need of enhancing their understanding in the structures of Chinese characters. Two different grouping modes, namely, single-group mode and multi-group mode, were implemented in the activities. Through our empirical study, we discovered that the students were more deliberate in composing more complex characters in one shot during the single-group mode. Conversely, during the multi-group mode, the students were more inclined to draw the sentence structure knowledge that they picked up during the warming up sections in the present and past learning sessions to trial constructing multiple characters. Both modes of game playing have resulted in different game patterns and learning gains. In the future, we will further analyze the game process data in order to distill various cognitive processes of their game playing. We will then make an attempt to map the cognitive processes to the relevant theories of second language acquisitions and Chinese character learning. It is hoped that such an effort will lead to the discovery of more effective pedagogy and learning strategies for younger Chinese L2 students in understanding the structure of Chinese characters.

Reference

[1] Allen, J. R. (2008). Why learning to write Chinese is a waste of time: A modest proposal. *Foreign Language Annals, 41*(2), 237-251.

[2] Anderson, R.C., et al. (2002). *Shared-book reading in China*. In W. Li, J. Gaffney and J. Packard, eds,

Chinese Language Acquisition: Theoretical and Pedagogical Issues (pp. 131–155). Kluwer Academic Publishers: Amsterdam.

[3] Annett, J. (1969). *Feedback and human behavior*. Middlesex, UK: Penguin.

[4] Chang, K. E., Lan, Y. J., Chang, C. M., & Sung, Y. T. (2010). Mobile-device-supported strategy for Chinese reading comprehension. *Innovations in Education and Teaching International, 47*(1), 69-84.

[5] Cordova, D. I., & Lepper, M. R. (1996). Intrinsic motivation and the process of learning: Beneficial effects of contextualization, personalization, and choice. *Journal of Educational Psychology*, *88*, 715-730.

[6] Garris, R., Ahlers, R., & Driskell, J. E. (2002). Games, motivation, and learning: A research and practice model. *Simulation & gaming, 33*(4), 441.

[7] Ki, W. W., et al. (2003). Structural awareness, variation theory and ICT support. *L1 – Educational Studies in Language and Literature, 3*, 53–78.

[8] Kluger, A. N., & DeNisi, A. (1996). The effects of feedback interventions on performance: A historical review, a meta-analysis, and a preliminary feedback intervention theory. *Psychological Bulletin*, *119*, 254-284.

[9] Kukulska-Hulme, A., & Shield, L. (2008). An overview of mobile assisted language learning: From content delivery to supported collaboration and interaction. *ReCALL, 20*(3), 271-289.

[10] Lam, H. C., Ki, W. W., Law, N., Chung, A. L. S., Ko, P. Y., Ho, A. H. S., et al. (2001). Designing CALL for learning Chinese characters. *Journal of Computer Assisted Learning, 17*(1), 115-128.

[11] Li, W. M. (1989). Qite Lianxiang Shizifa de Tansuo yu Shijian [*The investigation and implementation of creative thinking learning Chinese characters*]. Beijing: People's Education Publisher.

[12] Nagy, W.W., Kuo-Kealoha, A., Wu, X., Li, W., Anderson, R.C. & Chen, X. (2002). *The role of morphological awareness in learning to read Chinese*. In W. Li, J. Gaffney and J. Packard, eds, Chinese language acquisition: Theoretical and pedagogical issues (pp. 59–86). Kluwer Academic Publishers: Amsterdam.

[13] Prensky, M. (2001). *Digital game-based learning*. New York: McGraw-Hill.

[14] Ricci, K., Salas, E., & Cannon-Bowers, J. A. (1996). Do computer-based games facilitate knowledge acquisition and retention? *Military Psychology*, *8*(4), 295-307.

[15] Shen, H. H. (2005). An investigation of Chinese-character learning strategies among non-native speakers of Chinese. *System, 33*(1), 49-68.

[16] Shen, H. H., & Ke, C. (2007). Radical awareness and word acquisition among nonnative learners of Chinese. *The Modern Language Journal, 91*(1), 97-111.

[17] Taft, M., & Chung, K. (1999). Using radicals in teaching Chinese characters to second language learners. *Psychologia, 42*, 243–251.

[18] Taft, M., & Zhu, X. (1994). *The presentation of bound morphemes in the lexicon: A Chinese study*. In L. Feldman (Ed.), Morphological aspects of language processing (pp. 293–316). Hillsdale, NJ: Erlbaum.

[19] Tse, S. K., Marton, F., Ki, W. W., & Loh, E. K. Y. (2007). An integrative perceptual approach for teaching Chinese characters. *Instructional Science, 35*(5), 375-406.

[20] Tse, S.K. (ed.). (2001). Gaoxiao Hanzi Jiao yu Xue [*Effective teaching and learning of Chinese characters*]. Hong Kong: Greenfield Enterprise Ltd.

[21] Wexley, K. N., & Latham, G. P. (1991). *Developing and training human resources in organizations* (2nd ed.). New York: HarperCollins.

[22] Wong, L.-H., & Looi, C.-K. (2010). Vocabulary learning by mobile assisted authentic content creation and social meaning making: two case studies. *Journal of Computer Assisted Learning, 26*(5), 421-433.

[23] Wong, L.H., Chai, C.-S., & Gao, P. (2011). The Chinese input challenges for Chinese as second language learners in computer-mediated writing: An exploratory study. *TOJET, 10*(3), 233-248.

[24] Wong, L.-H., Chen, W., & Jan, M. (in-press). How artefacts mediate small group co-creation activities in a mobile-assisted language learning environment? *Accepted by: Journal of Computer Assisted Learning*.

[25] Wong, L.-H., & Chin, C.-K. (in-press). Development of a curriculum design framework for the mobile-assisted idiom learning process through design-based research. *Chinese Language Education, 10*(2).

[26] Wong, L.-H., Chin, C.-K., Tan, C.-L., & Liu, M. (2010). Students' personal and social meaning making in a Chinese idiom mobile learning environment. *Educational Technology & Society, 13*(4), 15–26.

[27] Wong, L.-H., Song, Y., Chai, C.-S., & Zhan, Y. (in-press). Analyzing students' after-school artifact creation processes in a mobile-assisted language learning environment. *Proceedings of the International Conference on Computers in Education 2011*, Chiangmai, Thailand.

[28] Zhang, Z.G. (1987). Chinese characters and reading. *Reading News, 8*, 7–8.

Mohd Ayub A. F. et al. (Eds.) (2011). Workshop Proceedings of the 19th International Conference on Computers in Education. ChiangMai, Thailand: Asia-Pacific Society for Computers in Education.

A Study of Mobile-assisted Photo-taking for English Phrase Learning

Pei-Lin Liu*, Li-Huei Ju, Chiu-Jung Chen & Pang-Cheng Wen
National Chia-yi University, Taiwan
peilin@mail.ncyu.edu.tw

Abstract: Owing to the rapid advance of mobile technologies, numerous studies about the use of mobile phone in education have been reported. Although most mobile phones have photo-taking function, not many research have applied this function in language learning. The study aims to explore the influence of integrating MALL photo taking activity on the learner's English phrase learning performance. A total of 116 students enrolled in a college in central Taiwan participated in this study. Participants were divided randomly into two groups: control group and experimental group. The control group is assigned the traditional sentence making activity for phrase learning. The experimental group is assigned the activities of taking photos through participants' mobile phone for phrase learning. The study primarily connected to their daily encounter with newly acquired phrases by using mobile phone to take photos and associate to the sentences they made. The college students were assigned a one-to-one basis on taking photos in their daily encounter substance in order that construct sentences with newly acquired phrases. The results indicated that the experimental group had significant gigher scores than the control group on the post test and delayed post test.

Keywords: mobile-assisted language learning (MALL), English phrase learning, Photo-taking

Introduction

"Phrase is a group of words that are used together in fixed expression" (Macmillion, 2007, p.1119). Phrases can help writers illustrate their own ideas more clearly and enrich the meaning of the sentences, rather than creating word by words, and easier their writing task (Li & Schmitt, 2009). To help learners better comprehend and remember these lexical units of phrases, most teachers would ask students to make a meaningful sentence for memorizing the corresponding phrases and learn how to use phrases well in the sentence.

However, some learners make sentence through observing the sample sentences provided by instructors and then modeling what sample sentences do. Other learners may copy similar sentences from dictionaries or websites. These learners perform the desire task while modeling others do without creating association to their personal experience. As a result, the meaning of phrases do not fully comprehended and actively processed from sensory memory to long-term memory through the traditional sentence making activity. Therefore, effective memory strategies and tool are needed to improve phrases proficiency (sentences wrote by Liu, P. L., 2011/5/25).

Oxford (1990) provided three effective memory strategies for instructors to promote phrase learning: creating mental linkages (i.e., placing a new phrase in a meaningful sentence), employing action (i.e., physically acting out a meaningful relating expression), and applying images (i.e., relating new phrase by meaningful visual imagery in the mind or in actual drawing) (Oxford, p.39). However, the applying images strategy can be used through associating phrases with a visual symbol or picture of a concrete object, but drawing might be a frustrating aspect to learners who were not good at drawing and increase their cognitive load. To capture the physically acting features of phrases concretely and efficiently, plug-in

cameras of mobile phones can make learning more efficient to take photographs and further collect data for their retention. The researchers named the activity used plug-in camera of mobile phone as MALL (Mobile Assisted language learning) photo-taking.

For knowing the effect of using MALL photo taking on English phrase learning and sentence making performance, the researcher adopted Nation's (2001) learning general processes (noticing, retrieval, and generative use) as the base for designing the English phrases learning activities. The four activities includes: phrases learning instruction (Activity 1), MALL photo taking (Activity 2), sentence making (Activity 3), and online voting (Activity 4). Both control and experimental groups received Activity 1, 3, and 4. However, only the learners in the experimental group had the MALL photo taking activity (Activity 2) and needed to make sentences according to the photos they took (Activity 3) (sentences wrote by Liu, P. L., 2011/6/1).

The major purpose of this study was to investigate the application of Oxford's (1990) three effective memory strategies of using MALL photo taking activity to assist English phrase learning. The secondary purpose of this study was to investigate the difference of the learners' attitudes toward phrases learning activities whether they used the MALL photo taking or not. The following research questions were investigated:

RQ 1 What is the influence of integrating the MALL photo taking activity on the learner's English phrase performance?

RQ 2 What are the differences on learners' attitudes toward phrases learning activities?

Literature Review

One of the critical problems in traditional phrase learning instruction is that such instruction are fragmented, and tend to be teacher-centered and separated from the students' daily life and interests (Cullen, 1994; Wong & Looi, 2010). There is significant potential in the portability and versatility of mobile devices in promoting a pedagogical shift from instructor centered to learner-centered learning (Jeng, Wu, Huang, Tan, & Yang, 2010; Wong & Looi, 2010; Wong, Chin, Tan, & Liu, 2010) (sentences revised by Liu, P. L., 2011/6/3, 2011/6/6). Numerous studies about the use of mobile technology in education have been reported, in which these technology-enhanced learning approaches are referred to as mobile learning by the researchers (Hwang & Tsai, 2011).

In the past decade, various studies concerning mobile learning have been conducted in museums, classrooms or labs (i.e., Hwang & Chang, 2011; Reynolds, Walker, & Speight, 2010). In addition to these indoor activities, an increasing number of mobile learning activities have been conducted in the fields (i.e., Chu, Hwang, & Tsai, 2010; Hung, Lin, & Hwang). However, there are only few research focused on the applications of mobile photo taking function in language learning. The studies which applied the mobile photo taking can be categorized into two different categories by the learning focus of the study: vocabulary (Joseph, Bisted, & Suthers, 2005; Hasegawa, Ishikawa, Shinagawa, Kaneko, & Mikakoda's, 2008), and phrase (Pemberton, Winter, & Fallahkhair, 2009; Wong & Looi, 2010; Wong, Chin, Tan, & Liu, 2010) (sentences wrote by Liu, P. L., 2011/9/23).

Joseph et al. (2005) is focus on the word-image paired associated wired PhotoStudy system for learners to upload images from a shared database for viewing the learning content with related photos through context and photo viewing and reviewing multiple choice activities. In Hasegawa et al.'s (2008) study, learners can create their own learning materials register to the data base for sharing, and assessed to others' creating materials for vocabulary learning by using their favorite images or movies. The researchers compared the teacher-created and student-created learning materials by using PSI (Personal SuperImposer) system. The result indicated that memory retention of the participants who

learned through creating their own learning materials is much higher than who only used PSI system.

In Pemberton et al.'s (2009) study the learners learned the culture-related content in their daily life through sound, image, sound and videos. Learners also build up different scenarios to illustrate the phrases they don't know through combining the text, sound, image, and even a videos for providing in more interesting ways. Wong & Looi (2010) present two novel case studies of MALL that emphasize learner-created content. In learning English prepositions and Chinese idioms, respectively, the primary school students used the mobile devices assigned to them on a one-to-one basis to take photos in real-life contexts so as to construct sentences with the newly acquired prepositions or idioms. Subsequently, the learners were voraciously engaged in classroom or online discussion of their semantic constructions, thereby enhancing their understanding of the proper usage of the prepositions or idioms. The photo blogging project described by Wong et al. (2010) involved students using iPhones to take photos to illustrate Chinese idioms being studied and to share their photos and comments with the class through a wiki. Students were encouraged to take photos based on their daily lives using their immediate surroundings. This use of the student's actual environment improves upon similar projects that have used an artificial space such as a lab or a classroom (sentences wrote by Liu, P. L., 2011/9/23).

So far, no previous studies conducted MALL photo taking on English learning. Thus, this study complements previous studies in three ways:

(1) This study measure learners' English pareses and extended sentence making performance via MALL photo taking, whereas previous MALL photo taking studies only focus on Chinese learning performance (sentences wrote by Liu, P. L., 2011/5/26).

(2) Learning gains were measured by means of a pre-test and a post-test while previous studies only had one post-test.

(3) Quasi-experimental design was used for comparing the effects of Phrase learning MALL photo taking, while previous studies usually used observation and survey (sentences wrote by Liu, P. L., 2011/6/2).

Method

Participants

The participants were 116 English as second language (EFL) students in a university in central Taiwan (68 females and 48 males). The participants were from two intact classes enrolling in General English classes. The average age of the participants is 20. The length of participants' English learning experience ranged from six to eight years, from middle school to high school. The English proficiency level of participants was intermediate level, which is regarded as a person who was able to read short stories, private letters, or fax mails. The total number of already-learned word for participants can be reached to 7000 (sentences revised by Liu, P. L., 2011/5/3).

The experiment of this study was a quasi-experimental study. The participants from two intact classes were divided randomly into the control group (CG: N=48) and the experimental group (EG: N=68). The researcher further paired participants into small groups according to participants' willing for English phases learning activities. There were 24 pairs in the control group and 32 pairs in the experimental group.

Instrument

English phrase preliminary test

The English phrase preliminary test consisted of 35 fill-in items which where delivered from Common American Phrases in Everyday Contexts: A Detailed Guide to Real-Life Conversation and Small Talk (Spears, 2002). Twenty English phrases were chosen by the correct rate of learner's answers.

English phrase learning activities

The English phrase learning activities were designed by Nation's (2001) three general learning process for remembering words: noticing, retrieval, and generative use. The processes of the activities are described below.
Activity 1 - Phrases learning instruction: It offered an aid for visually by explaining the meaning of the sentences, and instructor also asked learners orally repeating the sample sentence.
Activity 2 - MALL photo taking: It was an activity for experimental group. The EG learners worked as pairs and illustrated the 20 phrases with photo taking functions of their own mobile phones.
Activity 3 - Sentence making: All learners were worked in pairs to make new sentence for new learned phrases. The learners in the EG made sentences to describe the photos they took in Activity 2.
Activity 4 - Online voting: All the sentences were posted on the class website for voting the " top five excellent sentences".

Table 1 *General Process*

	Noticing		Retrieval			Generative use
	Activity 1 (week 2)	→	Activity 2 (week 3-4)	→	Activity 3 (week 5)	→ Activity 4 (week 6)
	Phrases learning instruction		MALL photo taking		Sentence making	Online voting
EG	○		○		○	○
CG	○		x		○	○

Note: Table 1 was designed by Liu, P. L.
Note: EG = Photo-taking group; CG = No photo-taking group.
Note: The CG searched three related phases while the EG did the Activity 2.

English phrases immediate and delay post tests

The content for the English phrases immediate and delay post tests were the same. The tests were containing three parts: translation (N = 20), fill-in blanks (N = 10), and multiple choices (N = 20). The purpose of the tests was designed to evaluate participants' recognition, comprehension, and application of target phrase. Specifically, the purpose of the English phrases immediate and delay post tests were to detect the participants' short-term memory and long-term memory of the phrase learning (wrote by Liu, P. L., 5/13/2011). English phrases immediate post test was conducted in week 7, and the English phrases delay post test was conducted four weeks later (week 11).
Translation (2 points): Participants were required to write down the English phrases according to the corresponding Chinese meaning, measuring the recognize ability to target phrases.
Fill-in blanks (2 points): Participants had to fill in 10 phrases in the blanks of each sentence to make the sentence completely, measuring the ability to comprehend the English phrases.

Multiple choices (2 points)*:* Participants were required to answer 10 items in the multiple choices parts. In the multiple choice part, each item included one correct answer with three distracters, measuring the ability to apply the English phrases to new language contexts.

Phrase learning survey

The survey was 9-item, five- point Likert-scale evaluation questionnaire; which elicited the concerning information about participants' motivation. This questionnaire (α = .85) was to evaluate learners' attitude toward three English phrases learning activities (*Activity 3: sentence making*, *Activity 4: online voting*). For example: Q1-Q3: I think that learning through *sentence making* /*online voting* promotes my phrase learning interests; Q4-Q6: I think that learning through *sentence making* /*online voting* increases my phrase learning opportunities; Q7-Q9: I think that learning through *sentence making* /*online voting* increases my discussion opportunities with peers.. The goal was to investigate learners' attitude about the effects toward four English phrases learning activities on their motivation, the learning opportunity increase, and the involvement of cooperative discussion (wrote by Liu, P. L., 5/18/2011).

Procedure

The whole experiment took place over 11 weeks, and the data sources included English phrase preliminary test, sentence making assignments, online voting , English phrases post-test, English phrases delayed post-test, and phrase learning survey.
The English phrase preliminary test was conducted in week 1. In week 2, all participants received the phrasing learning instruction regarding the 20 phrases. In the following two weeks (week 3-4), the EG learners had to do the assignment as MALL photo taking activity related to the sentence that they would made, and the CG learners tried to find three related phrases for each phrase with derived from the same verb by searching on the web. After completed their MALL photo taking activity or derived phrase searching assignment, all learners were asked to completed sentence making activity as class assignment in week 5.
In week 6, the on-line voting activity would be conducted. All learners then voted the top five excellent sentences for each phase from paired learners. In week 7 and 11, the English phases delayed post-test was used for testing their delayed memory of learned phrases.

Table 2 *Mall Photo-taking and Sentence Making Activities for the Experimental and Control Groups*

Experimental Group		Control Group
MALL photo taking	Sentences making	Sentences making
	The boy can sleep through fair and foul. 男孩可以在任何情況下睡著。	He never gives up through fair and foul. 在任何情況下他都不會放棄。
	He has passed on because he jumped from a floor. 他因為跳樓去世了。	I'm so sorry to hear the news that your father passed on. 我很抱歉聽到你父親去世的消息。

	He worked out a good answer. 他想出一個好答案。	Allen was beat up by the Ben because he kissed Ben's girlfriend. Allen 被 Ben 痛打,因為他親了 Ben 的女友

Result

The MALL photo-taking group had higher performance on the post and delayed post English phrases tests

Research question one asks if there is significant influence of integrating MALL photo taking activity on the learner's English phrase learning performance. The results of the *t*-test confirmed that there were no significant differences in the preliminary test of the two groups. (t= -1.15, p=.26). Students who received Mobile assisted photo-taking training and assignment gained significantly higher scores on post test (see Table 3) and delay post test (see Table 4).
According to the Independent *t*-test results shown in Table 3, there was no significant difference in the multiple choice section on the post-test. However, the experimental group performed better than the control group in the multiple choice part on the delayed post test. We may concluded that the experimental group performed better than the control group after the mobile-assisted photo-taking tasks in longer time rather than a short term period.

Table 3 English phrases post-test for the experimental and control groups

	Group	*N*	*M*	*SD*	*t*	*p*
Post-test	EG	68	73.72	23.70	1.86	.07
	CG	49	64.57	26.54		
Translation	EG	68	32.00	10.54	2.51	.01*
	CG	49	26.00	12.99		
Fill-in blank	EG	68	11.94	5.59	2.32	.02*
	CG	49	8.76	7.66		
Multiple choice	EG	68	29.78	10.393	-.01	.99
	CG	49	29.81	8.931		

Table 4 *English phrases delayed post test score for the experimental and control groups*

	Group	*N*	*M*	*SD*	*t*	*p*
Delayed Post-test	EG	68	57.71	25.33	2.51	.01*
	CG	49	46.06	23.80		
Translation	EG	68	38.88	28.47	4.20	.00*
	CG	49	22.53	12.61		
Fill-in blank	EG	68	16.60	14.51	4.29	.00*
	CG	49	8.20	5.73		
Multiple choice	EG	68	26.98	10.08	3.90	.00*
	CG	49	21.49	8.52		

The MALL photo-taking group had higher motivation on the phases learning survey

According to the Independent *t*-test results shown in Table 5, there was significant difference in the multiple choice section on the T-test result of English phrases. However, the experimental group performed better than the control group in the multiple choice part on the English phrases survey. We concluded that the experimental group performed better than the control group because experimental group motivated better than the control group.

Table 5 T-test result of English phrases survey for the experimental and control groups

	Group	*N*	*M*	*SD*	*t*	*p*
Motivation	Photo	29	3.86	0.41	11.94	.00*
	No photo	34	2.64	0.39		
Phrases learning	Photo	29	3.98	0.46	3.62	.06
	No photo	34	3.84	0.49		
Sentence making	Photo	29	3.86	0.57	2.05	.04*
	No photo	34	3.59	0.52		
Online voting	Photo	29	3.94	0.50	3.36	.00*
	No photo	34	3.45	0.64		

Discussion

This research conducted image and physically acting out a new expression for aiding learners recall and transform the phrases in long term memory. Mobile assisted photo-taking seems to be an effective way for learners to apply images which is more concretely and efficiently than drawing for a meaningful visual imagery. According to Oxford (1990) memory strategies for instructors to promote phrase learning includes creating mental linkages (with learner's personal meaning), applying images and sounds (linkage verbal material with image or sound), reviewing well (reviewing in intervals), employing action (linkage verbal material with motion or touch). Memory strategies are more effective as learners synchronously than using meta-cognitive strategies. On the other hand, mind storage capacity for visual material is better than verbal one, visual information is more effectively transformed to long term memory, and visual images aid recall of verbal material, and a great rate of learner prefer visual learning. The illustration explains the experimental group with mobile-assisted photo-taking tasks performed better than the control group in the translation. The fill-in blank sections need more memory loading to answer. In Chen, Hsieh, & Kinshunk (2008) study, the result describes learners with higher verbal and visual ability or lower verbal and visual ability learn easily by providing image annotation with written learning content through mobile language learning environment. The learners easy to create mental image by the meanings of the phrases turned phrases into photos. After the learners finished the photos and sentence making, they reviewed for online voting to enhance short term and long term memory. The lecture procedure design also followed Nation's (2001) three general learning process: noticing, retrieval, and generative use. The result shows that learner got better performance in experimental group because the delay post test and the mobile photo-taking task improved the learners English phrase ability even in a longer time period.

For further research, the application of mobile –assisted photo-taking may use for learning idioms, slangs, or sentences.

References

[1] Anderson, T. A. F., Hwang, W. Y., & Hsieh, C. H. (2008). A study of a mobile collaborative learning system for Chinese language learning. *Proceedings of International Conference on Computers in Education* 2008 (pp.217-222), Taipei, Taiwan.

[2] Brown, E. (2001). *Mobile Learning explorations at the Standford Learning Lab.* Retrieved May 7, 2010, from http://sll.stanaford.edu/projects/tomoprof/newtomprof/postings/289.html

[3] Cavus, N., & Ibrahim, D. (2009). M-learning: An experiment in using SMS to support learning new English language words. *British Journal of Educational Technology*, 40(1), 78-91.

[4] Chen T. S., Chang C. S., Liu J. S., & Yu, H. L. (2009) Context-aware writing in ubiquitous learning environments. *Research and Practice in Technology Enhanced Learning 4*, 61–82.

[5] Chiou, C.-K., Tseng, J. C. R., Hwang, G.-J. & Heller, S. (2010). An adaptive navigation support system for conducting context-aware ubiquitous learning in museums. *Computers & Education*, *55*, 2, 834–845.

[6] Chu, H. C., Hwang, G. J. & Tsai, C. C. (2010). A knowledge engineering approach to developing mindtools for context-aware ubiquitous learning. *Computers & Education*, *54*, 1, 289–297.

[7] Chu, H. C., Hwang, G. J. & Tseng, J. C. R. (2010). An innovative approach for developing and employing electronic libraries to support context-aware ubiquitous learning. *The Electronic Library*, *28*(6), 873–890.

[8] Cullen, R. (1994). Incorporating a language improvement component in teacher training programmes. ELT Journal 48/2 162-172. Oxford: Oxford University Press.

[9] Hasegawa, K., Ishikawa, M., Shinagawa, N., Kaneko, K., & Mikakoda, H. (2008). Learning effects of self-made vocabulary learning materials. *Proceedings of IADIS International Conference on Cognition and Exploratory Learning in Digital Age* . (pp.153–158).

[10] Hung, P. H., Lin, Y. F. & Hwang, G. J. (2010). Formative assessment design for PDA integrated ecology observation. *Educational Technology & Society*, *13*, 3, 33–42.

[11] Hwang, G. J. & Tsai, C. C. (2011). Research trends in mobile and ubiquitous learning: A review of publications in selected journals from 2001 to 2010. *British Journal of Educational Technology, 42*(4), E 65-E70.

[12] Jeng, Y.L., Wu, T.T., Huang, Y.M., Tan, Q., & Yang, S. J. H. (2010). The Add-on Impact of Mobile Applications in Learning Strategies: A Review Study. *Educational Technology & Society,* 13 (3), 3–11.

[13] Joseph, S., Bisted, K., & Suthers, D. (2005). PhotoStudy: Vocabulary learning and collaboration on fixed & mobile devices. *Proceedings of IEEE Workshop on Mobile Technology in Education* (pp. 206–210).

[14] Kierman, P., & Aizawa, K.(2004).Cell phones in task based learning. Cell phones useful language learning tools? *ReCALL Journal*, 16(1), 71-84.

[15] Kukulska-Hulme A. (2005) The mobile language learner –now and in the future. Fran Vision till Praktik. Language Learning Symposium conducted at Umea University in Sweden. Available at: http://www2.humlab.umu.se/symposium2005/program.htm (last accessed 28 July 2005).

[16] Li, J. & Schmitt, N. (2009). The acquisition of lexical phrases in academic writing: A longitudinal case study. *Journal of Second Language Writing* 18, 85–102

[17] Markiewicz, J. K. (2006). Personalized and context sensitive foreign language training supported by mobile devices. Master Dissertation, Norwegian University of Science and Technology, Trondheim.

[18] Nation, I. S. P. (2001). *Learning Vocabulary in Another Language*. Cambridge, UK: Cambridge University Press.

[19] Ogata, H., & Yano, Y. (2004).Context-Aware support for computer-supported ubiquitous learning. *Proceedings of the 2nd IEEE International Workshop on Wireless and Mobile Technologies in Education.* (WMTE'04).

[20] Oxford, R. (1990). *Language Learning Strategies: What Every Teacher Should Know.* New York: Newbury House Publishers.

[21] Petersen, S., & Divitini M. (2005) Language learning: from individual learners to communities. *Proceedings of IEEE Workshop on Mobile Technology in Education.* 2005 (pp.169–173), Tokushima, Japan.

[22] Pemberton, L., Winter, M., Fallahkhair, S. (2009). A user Created Content Approach to Mobile Knowledge Sharing for Advanced Language Learners. Proceedings of the 8th World Conference on Mobile and contextual Learning (mLearn), Orlando, Florida, 26-30 October.

[23] Reynolds, R.,Walker, K. & Speight, C. (2010).Web-basedmuseum trails on PDAs for university-level design students: design and evaluation. *Computers & Education*, *55*, 3, 994–1003.

[24] Shih, J. L., Chuang, C.W. & Hwang, G. J. (2010). An inquiry-based mobile learning approach to enhancing social science learning effectiveness. *Educational Technology & Society*, *13*, 4, 50–62.

[25] Spears, R. A. (2003). *Common American Phrases in Everyday Contexts: A Detailed Guide to Real-Life Conversation and Small Talk* 2nd.ed. Publisher: McGraw-Hill. NY.

[26] Wong, L. H., Chen, W., & Zhan, Y. (2011). Analysis of Small Group Interactions in a Seamless Language Learning Environment: An Artifact-Oriented Approach. Accepted by : CSCL'11.
[27] Wong, L. H., Chin, C.K., Tan, C.L., & Liu, M. (2010). Students' Personal and Social Meaning Making in a Chinese Idiom Mobile Learning Environment. *Educational Technology & Society,* 13 (4), 15–26.
[28] Wong, L. H., & Looi, C.K. (2010). Vocabulary learning by mobile-assisted authentic content creation and social meaning-making: two case studies. *Journal of Computer assisted Learning*, 26, 421-433.

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