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HCI Technology with Mastery Learning Approach for Children Learning Chinese Characters Writing in Hong Kong

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***Abstract* – The learning of Chinese is an abstract learning mode for primary school students. Correct writing stroke is an elementary but difficult task for most of students. This study tried to create a more efficient and interesting learning environment through human-computer interaction technology with mastery learning approach, and a self-pace learning mode to construct a learning system, where rich, efficient and effective interactions in learning were considered. The prototype was designed for tablets with human-computer interaction technology with the purpose to facilitate learning of a fundamental set of Chinese characters. This paper shown an interesting way to enhance self-learning Chinese character writing via human-computer interaction technology. The final outcomes of the project included the improvement of Chinese characters learning tool and feedback from parents, teachers and students.**

Keywords: Chinese Language Learning, Technology-Assisted Education, Human-Computer Interaction Technology (HCI), Technological-Based Education

I. INTRODUCTION

A. Human-Computer Interaction Technology (HCI)

Human-Computer Interaction (HCI) is a multi-disciplinary field of study, which focuses on the design and use of computer technology, regarding on the interface between humans and computers. HCI concerned with humans and computers' interaction originally, while it has expanded to cover almost all forms of information technology design [3]. In traditional Chinese teaching, teachers teach students how to write Chinese characters with correct stroke orders by using blackboard, projectors or copy-books. When students write wrong characters, teachers normally write a standard form on students' copy-book and indicate the wrong element. If teachers want to know students' writing order, they need a face-to-face observation. Generally, there are 30 students with one Chinese teacher per class. Each student has own learning ability and progress. It may be a challenge for teachers to teach and students to learn.

HCI technology might be a powerful solution to promote Chinese character learning with correct stroke order and standard form of writing. In cognitive awareness, stroke order plays an essential role to primary students [5]. The research of HCI in language learning has grown in recent years, which may benefit learners in overcoming the barriers by using grid pattern, tracing outline, colour coding, stroke labelling, play control, stroke speed, and writing exercise [4]. The study presents a system that combines HCI technology and mastery learning approach to promote Chinese character learning. We will discuss HCI's potential as a tool of support in Chinese character learning from learning achievements and observing during learning later.

B. Mastery Learning Apporach

Mastery Learning is a common teaching strategy to advance an individual's learning potential. It is a group-based, teacher-paced and instruction-oriented approach to mastery teach wherein students learn [1]. In traditional classroom, students are passive. The ideal situation is to deliver same materials at the same time to all students and they have same level of achievement. In reality, with different learning abilities, it is in contrast with traditional teaching. Carroll [2] proposed to allow students to learn with individual pace, then they would probably attain the similar level of achievement. Using standard teaching materials and teaching guideline, the quality of teaching highly depends on instructors. Even the same instructors, teaching quality may vary regarding to the psychological quality and physiological quality. With technology-based mastery leaning approach, human factors (instructors) could be eliminated. Students are able to learn under individual progress and meet individual needs.

II. METHOD

The prototype was designed by the first author, a software engineer, a multi-media designer and a Chinese instructor. Chinese (Cantonese) is the language of instruction in the Chinese language subject. Students learn traditional Chinese characters in the school. 45 primary 1 students (24 boys and 21 girls) were recruited, who were beginners in the learning Chinese. All students were evaluated on their learning achievement and feedback. Before the execution of all pilot tests, a parental consensus for the information collection of students was collected.

The pilot test underwent 60 minutes including learning exercises, that accords with the teaching principle and then the pre-test and post-test were taken before and after the pilot test respectively. A simple learning evaluation on writing was taken among all students after undergoing the same learning. Twelve

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learning cards were prepared for each student. Students picked the card they preferred to complete a Chinese character writing game.

Rabbit (兔), son (子), small (小), cat (貓), cow (牛), dog (狗), lion (獅), sheep (羊), old (老), tiger (虎), snake (蛇), big (大), elephant (象) , pig (豬), and horse (馬) were chosen, which were covered by primary 1 teaching curriculum. Students scanned a card. A 3D virtual object popped up. Students listened to Cantonese pronunciation by pressing buttons. Then, a Chinese writing page popped up. Students followed instructions to finish the writing tasks. Instructions and hints were given to children and gradually reduced to master the learning. Step 1 provided a frame and stroke guidance. Step 2 provided a frame only. Step 3 provided a grid and a hint button. If students forgot how to write the character, they could press the hint button to retrieve their memory. During the whole learning period, the system responded with the display of the stroke and its engine sound (Table 1).

III. Results

The evaluation of correctness was defined in 3 scales (Table 3). When students wrote irrelevant characters or left the grid blank, they got 0 point. When students wrote characters partially correct, they got 0.5 point. When students wrote characters totally correct, they got 1 point.

The paired t test was used to analyze the quantitative data. Means were calculated for the sample groups based on the pre- and post-tests. The paired t test was adopted to examine the learning improvement between pre- and post-test after using our system to learn Chinese writing.

Based on the result of Table 2, the mean score in post-test was 1.245 higher than pre-test, which students performed better in post-tests. The standard deviation was smaller in post-test, which students' learning gap was reduced.

IV. User Feedback

After the pilot test, we conducted face-to-face feedback collection from two teachers, three parents and students.

Question: Which function do you like the most?

Teachers replied that they liked the stroke order function. They believed stroke order was essential to enhance students' memory. With correct order, students could write Chinese character neatly.

Parents replied that writing standard was important to kids. Parents and kids were educated under different education systems. The writing standard has changed. Parents did not know how to teach kids at home. With the tool, they would not have arguments in writing standard.

Students replied that the sound effect and animation were attractive because they were interesting and cute. Some students told us that they did not memorize majority of characters they learnt in class. They kept practice through our tool in order to enhance the memory.

V. Conclusion and Future Improvement

In conclusion, the pilot tests provided a satisfactory result on Chinese character writing improvement. The result supported the fact that human-computer interaction technology with master learning could motivate students to learn Chinese characters and improved their learning performance. Yet, we will have a control group to make the result more convincing.

VI. Reference

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Step 1: provided a frame and stroke guidance	
Step 2: provided a frame only	
Step 3: provided a grid and a hint button	

Table 1: Three Step Writing

Paired t test of Students' Writing Scores

Pre-test		Post-test		Difference	
M	SD	M	SD	M	SD
3.033	1.444	4.278	1.085	1.245	-0.359
Standard Error of Mean		Standard Error of Mean		Standard Error of Difference	
0.215		0.162		0.169	
t		df		Sig.	
7.3792		44		-1.244	

p<0.0001

Table 2: Paired t test of students' writing scores

Coding on the Chinese pilot test

*3 scales

*marks are allocated according in different condition

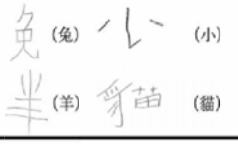
0 mark	0.5 mark	1 mark
*left blank *other irrelevant characters	*able to write one part of the character with wrong strokes e.g.  	*Totally correct

Table 3: Coding on the Chinese pilot test