So, H. J. et al. (Eds.) (2020). Proceedings of the 28th International Conference on Computers in Education. Asia-Pacific Society for Computers in Education

Applying Component-based Strategy to Design an Educational Board Game for Children to Learn Chinese Characters

Hui-Ling HSU[a*] & Zhi-Hong CHEN[a]
[a]*Graduate Institute of Information and Computer Education, National Taiwan Normal University, Taiwan*
*huilin@jcps.tp.edu.tw

Abstract: This paper proposes an educational board game, "Chinese-character-monsters" (CCM), to facilitate primary students in Chinese character learning. Each monster game card represents a specific component of Chinese characters, which can be further combined as various Chinese characters. In the board game, students are offered a number of opportunities to apply this component-based strategy, they thus can be more aware of how Chinese characters consist of different components. A preliminary evaluation was also conducted to investigate its impacts, including satisfaction, self-efficacy, and flow experience. The results showed that the CCM educational board game had a positive effect on students. These findings will guide our design to further modify and tune the CCM board game.

Keywords: Chinese character, radical, component, educational board game

1. Introduction

Chinese is considered as one of the hard-to-learn language systems. This is because Chinese characters are non-alphabetic in form, and students need to learn various characters. In addition, since Chinese characters consists of whole characters, components and strokes, such structure complexity often confuses students, especially when they learn the characters with the same pronunciation but different meanings. In spite of understanding the meaning of the words, students are not always write Chinese characters correctly. The familiarity of the radicals and the components are important in the process of Chinese character learning. However, the lower graders may treat characters as unanalyzed wholes so that they cannot systematically make use of the components of characters as skilled Chinese learners (Shu & Anderson, 1997).

Chinese morpheme usually consists of characters based on a word, a radical, or a character. Component (bù jiàns, 部件) are the minimal orthographic unit in Chinese writing. They can be as small as a stroke, or as large as a semantic radical. Multiple orthographic structure in Chinese characters often causes learners' intrinsic cognitive load. Previous studies have shown that understanding radicals is crucial for learning Chinese characters (Chen, Hsu, Chang, Lin, Chang, Sung, 2013; Huang, 2006). A radical is the core of the components from which a character is identified. Some researchers indicated that this orthographic knowledge can be delivered explicitly by teachers who use the radical-based character teaching method (Chen et al., 2013).

The traditional form of Chinese characters, which is used in Taiwan and can have several strokes and components, were overly complex for learners. There are about 5000 high-frequency Chinese characters, with a total of 440 components, half of which are radicals. In other words, to learn Chinese characters well, you must not only know the knowledge of radicals and familiarize with the components to expand literacy and strengthen the learning effect (Huang, 2003). Learners need to gradually learn Chinese characters by recognizing and compounding radicals and components correctly.

The concept of game-based on Chinese language learning is not new. Game-based learning design is not only presenting teaching content in games, the learning objectives are also critical. However, the advantages of board games are convenient and easy to get started, it is suitable for using in teaching especially in elementary school classes that contain young children. Earlier studies mostly

emphasized radical-based Chinese characters learning strategies. In this study, the researchers aim to develop the learning aids with an increased focus on component-based design to help learn Chinese characters. Therefore, it is necessary to further examine the strategy's feasibility and applicability.

2. Chinese Characters Board Game Design

2.1 Chinese character learning

Learning to recognize Chinese characters is one of the most difficult learning items for learners. Past studies have pointed out that students could maintain stronger motivation for Chinese characters learning with gaming approaches. In addition, radicals become even more critical in literacy because of the semantic clues they provide for characters. For orthographic processing, both children and adults make use of radicals when reading compound characters, positional information is critical for activating radical information during character recognition (Lin, Wang & Singh, 2018). Previous research has developed a game-based model for Chinese character learning, named Character-Monster (Chen, Chi & Ciou, 2017). Compared with digital game systems, board games are more portable and versatile, easier to use in the class. Therefore, this study developed a component-based Chinese character board game for elementary school children in Chinese course.

2.2 Chinese Character-Monster(CCM) board game

"Character-Monster" is an educational board game using component-based strategy to learn Chinese characters for learners from 6 to 9 years old. Learning vocabulary by visualization is a method using images to present and introduce the formation of characters and the development of the form of characters. It also explains and analyzes the characters having similar structures, sounds or meanings. This method is based on the theory of etymology and cognitive psychology, and could help learners recognize words faster and have a deeper impression (Chou, 2009). Familiar with the rules of radical position is helpful in the process of learning Chinese characters (Chen, Chang, Chiou, Sung & Chang, 2011, Hong, Wu, Chen, Chang, and Chang, 2016; Zhan & Cheng, 2014). Accordingly, in this study, the basic level game includes 51 high-frequency components and 86 high-frequency characters to assist learners in developing radical awareness and character processing.

The gameplay of the system includes three phases, "Combining Components", "Making Words" and "Count Attack Points". Each of Character-Monsters cards represents a corresponding component and points. Apart from this, 6 magic cards are also designed to increase the fun and excitement in this game. Figure 1 shows an example of a monster card and a magic card design.

Figure 1. The Hand Cards Surface Design

Learners are randomly assigned as a group of four members. Figure 2 shows three phases of the CCM board game. The players are firstly given by five cards. In the Combining Components phase, players combine the cards with different components to form a character. Players take turns attacking. In the Making Words phase, the attacker gives the words based on the character to enhance their attacking power. After the attacker completes the two phases, the defender can decide whether to use the magic card to resist attacks. At last, both players add up the total points on the card used. If the sum is greater than the opponent's points, then the player wins. After a round, each player are given three more cards. The game is over until all the cards are used, the one who got the most points is the winner.

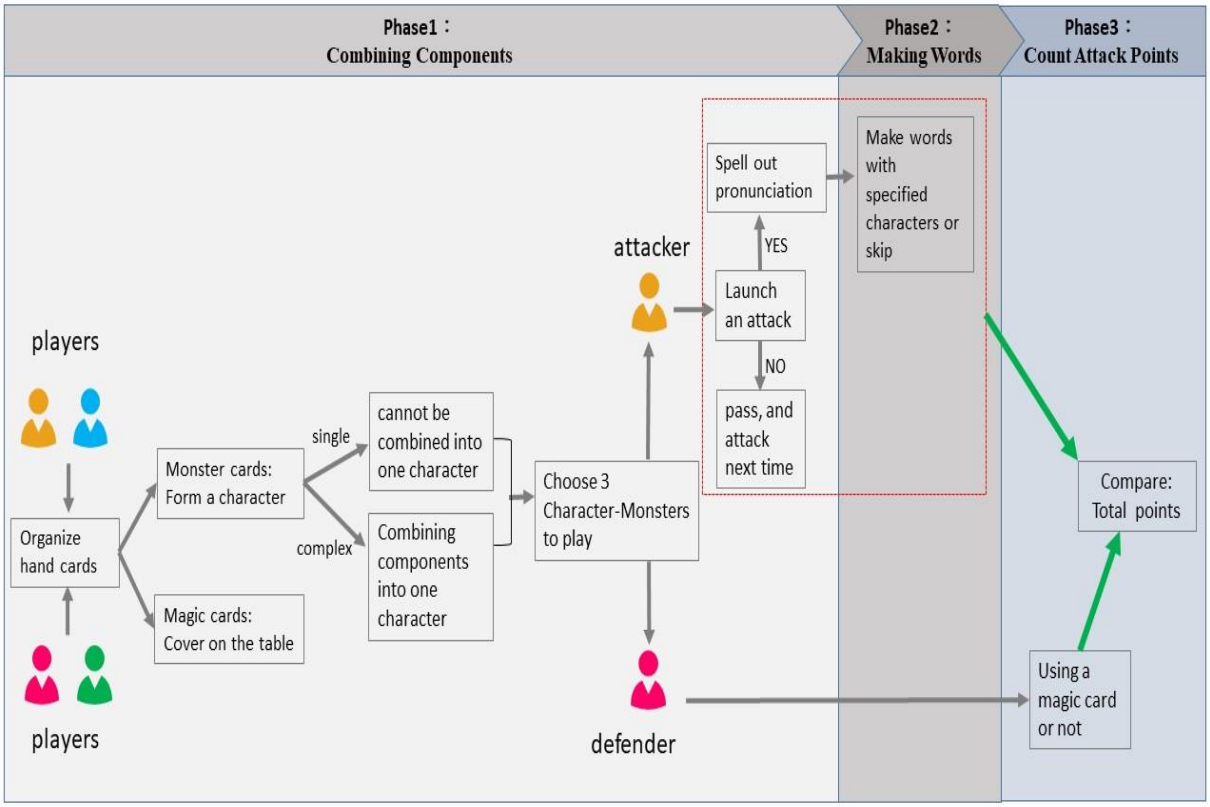

Figure2. The phases of the CCM board game

3. Analysis

3.1 Participants

A total of 20 second graders from an elementary school in northern Taiwan, participated in this study, with a mean age of 7.6. Of these participants, 9(45%) were males, 11(55%) were females. They are all voluntary participants and also include 2 attention-deficit children. After the participants completed the game, they were asked to fill in a questionnaire to collect their experience. Participants all have experiences in playing card board games, but none have used the CCM board game before, and statement that they usually learn characters by writing repeatedly.

3.2 Questionnaire

As the participants are in young ages, the teacher had explained the questions one by one and confirmed that everyone understood the meaning of the questions clearly before answering while they were filling out the questionnaire. Do these steps sequentially until the entire questionnaire was completed.

The questionnaire contains 12 items, which are composed of three dimensions to present a level of perception (satisfaction, self-efficacy, flow-experience) while playing the CCM scaled by 5-points Likert format (1=Strongly Disagree to 5=Strongly Agree). The items is developed based on the definition of Quesenbery (2004), engaging is how pleasant, satisfying, or interesting an interface is to use. To evaluate the consistency of the variables, a reliability analysis of the questionnaire is identified using Cronbach' α. According to George & Mallery (2003), a Cronbach' α value above .7 indicates acceptable reliability. As shown in Table 1, this study used SPSS as an analytical tool to carry out descriptive statistical analysis. The means of the satisfaction were between 4.5 and 4.8; the means of the self-efficacy were between 4.65 and 4.75; the means of the flow-experience were between 4.55 and 5.

Table 1. *Perception Analyses*

Construct	Min	Max	Mean	SD
Satisfaction				
1. I think the cards of this board game is well designed.	3	5	4.8	.523
2. I think the appearances of character monsters deepen my impression of radicals.	4	5	4.8	.410
3. I think it is easy to operate by combining.	3	5	4.5	.688
4. Character monster cards help me acquaint words.	3	5	4.7	.657
Self-efficacy				
1. I think the cards of this board game is helpful when acquainting components (radicals).	4	5	4.75	.444
2. I think it will deepen my impression of character component structures through combining.	4	5	4.75	.444
3. I combine characters faster after using this board game.	3	5	4.75	.550
4. I would be able to recognize and pronounce the words that appeared on the cards correctly when I see them on my quiz.	3	5	4.65	.671
Flow-experience				
1. I don't feel like taking breaks every time I play this board game.	4	5	4.95	.224
2. I think this board game is fun and I want to keep on challenge.	5	5	5	0
3. I hope to often use this board game to practice acquainting characters.	4	5	4.8	.410
4. I was immersed in learning Chinese characters while using the CCM board game.	3	5	4.55	.686

3.3 Interview

In addition to the questionnaire, the researcher also interviewed the participants and asked them several questions such as *"Do you have any suggestion for the CCM board game designer? ", "Which part of the CCM do you like the most? ", " What do you think CCM board game can help with your learning? "* and *"How do you think about your performance in the CCM game ? "*, and ask for further details based on their responses promptly to collect qualitative data about users' perception. In reporting the results of the study 'P1' stands for 'Participant 1', 'P3' stands for 'Participant 3'. Some participants expressed the hope that researchers can provide characters and words lists so that they can learn by themselves before the game. The opinion was echoed by P1, P4, P6, P12, P13 and P20. Two of them even hope to take a set of CCM board game card home for practice. In summary, the participants expressed high level of engagement and positive feedback on the CCM board games, but they also reflected the need to practice CCM content at home individually. The participants' comments were as follows:

- *"Where can I buy this board game, I want to practice at home?"* (P8)

- *"If there is a Game Manual, we can get familiar with the characters and words on the CCM cards, and it could be more fluent when playing." (P9)*

In addition, participants self-reported positive feelings and attitudes toward the CCM board game. They said the game was easy to learn and they are satisfied with the design of the cards. They thought the game was helpful for recognizing components or radicals to learn Chinese characters. They enjoyed playing the game. Thus, the game mechanism of CCM is satisfactory to participants and can also arise their interest. Some of the interview results are as follows:

- *"The monsters on the card are so beautifully painted, so I would like to play it [CCM board game] more."*(P3 and P12)
- *"I am very eager to play it [CCM board game] again soon."* (P2, P9,P13,P15&P18)
- *"When playing, I always need to see if the characters can form a word. I watch it carefully and keep it in my head because I want to win."*(P1)

4. Conclusion and Further Work

Prior research (e.g. Chen et al., 2013; Rawendy, Ying, Arifin, & Rosalin, 2017; Wen, 2018) has reported that each interactive digital Chinese character learning strategy has certain features which facilitate particular educational approaches. In the case of component-based learning strategies for Chinese characters, this study explored the design of CCM character board game. The survey results showed that the participants enjoyed it and looked forward to the next challenge. This study concluded that creating interesting learning experience for children must create an attractive learning tools to motivate children first. Using learning tools like CCM board game give a different choice from traditional learning strategy like writing repeatedly. The greatest value of this research lies in its demonstration effect on the design mechanism and application value of component-based Chinese character board game. It is better that the researcher can conduct experiments in a larger range and further conduct achievement tests to evaluate learning effectiveness.

Despite positive feedback on gameplay, how to improve the impact of this game on expanding words is one of the key items for future study. For example, providing a player's word list or supplementary teaching materials, which can not only provide a game scaffold, but also help players expand their words. In the future, the researcher will further revise and optimize the game content and design based on the experimental results.

Some limitations of the study should be noted. The participants were chosen from active volunteers, but it lacks the inference of random samples. Besides, the generalizability of the outcomes may be limited because only 20 volunteers were tested.

Acknowledgements

We would like to thank all the people who prepared and revised previous versions of this document; the principal, teacher and volunteers of our partner public school for their participation.

References

Chen, H.C., Chang, L.Y., Chiou, Y.S., Sung, Y.T., & Chang, K.E. (2011). Chinese orthography database and its application in teaching Chinese characters. *Bulletin of Educational Psychology, 43,* 269–290.

Chen, Z. H., Chi, P. Y., & Ciou, H. J. (2017, January). Applying interest loop to develop game-based model for Chinese character learning. In 25th International Conference on Computers in Education: Technology and Innovation: Computer-Based Educational Systems for the 21st Century, *ICCE 2017* (pp. 372-375). Asia-Pacific Society for Computers in Education.

Chen, H.C., Hsu C.C., Chang L.Y., Lin Y.C., Chang K.E., and Sung Y.T. (2013). Using a radical-derived character E-learning platform to increase learner knowledge of Chinese characters, *Language Learning and Technology, 17*, 89-106.

Chou, B. H., (2009). The Introduction of Principles of Learning Vocabulary by Visualization. *Journal of National Taichung University. Humanities & Arts, 23*(1), 55-68.

George, D., & Mallery, P. (2003). *SPSS for Windows step by step: A simple guide and reference.* 11.0 update (4theds.). Boston: Allyn & Bacon.

Hong, J. C., Wu, C. L., Chen, H. C., Chang, Y. L., & Chang, K. E. (2016). Effect of radical position regularity for Chinese orthographic skills of Chinese-as- a-second-language learners. *Computers in Human Behavior*, *59*, 402–410.

Huang, P. J. (2006). *Theory and practice of Chinese character instruction.* Taipei, TW: Lexis Book Co

Lin, C. Y., Wang, M. & Singh, A. (2018). Introduction to script processing in Chinese and cognitive consequences for bilingual reading. Pae, Hye K. (Eds), *Writing Systems, Reading Processes, and Cross-Linguistic Influences: Reflections from the Chinese, Japanese and Korean Languages*. 25-48. doi: 10.1075/bpa.7

Quesenbery, W. (2004). Balancing the 5Es: Usability. *Cutter IT Journal, 17* (2), 4-11

Rawendy, D., Ying, Y., Arifin, Y., & Rosalin, K. (2017). Design and development game Chinese language learning with gamification and using mnemonic method. Procedia Computer Science, 116(2017), 61–67. doi: 10.1016/j.procs.2017.10.009.

Shu, H., & Anderson, R. C. (1997). Role of radical awareness in the character and word acquisition of Chinese children. *Reading Research Quarterly*, *32*, 78–89.

Wen, Y. (2018). Chinese Character Composition Game with the Augment Paper. *Educational Technology & Society*, *21* (3), 132–145.

Zhan, H., & Cheng, H.-J. (2014).The Role of Technology in Teaching and Learning Chinese Characters. International Journal of Technology in Teaching and Learning, 10(2), 147–162.