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Developing digital game-based learning system for the acquisition of Chinese characters in primary education: An interest-driven creator (IDC) theory perspective

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Abstract: Due to the vast amount of and the complexity of Chinese characters, practice by handwriting is a common and effective strategy in the primary stage of literacy education. Nevertheless, students regard the practice as tedium or labor work, and this mental load leads them to lost interest in practicing to copy and write the characters in the assignments. To further promote students acquisition of Chinese characters, sustaining their interest of practicing acts an important role in the learning process. Therefore, the aim of the current study is to develop a game-based learning system to support students practice by handwriting in a joyful rather than uninterested manner. Under the perspective of interest-driven creator (IDC) theory, the proposed game, called character monster, was designed according to one of three anchored loops: interest loop. The corresponding features with respect to three elements (i.e., triggering interest, immersing interest, and extending interest) are presented in detail. In addition, to examine the effects of the learning system, the experimental design is also identified.

Keywords: Chinese character, game-based learning, interest-driven

1. Introduction

Chinese is the main subject in both primary and secondary educational system in Mandarin-speaking areas, and the acquisition of the characters is the essential foundation of mastering the other language skills of Chinese. Due to the vast amount of and the complexity of Chinese characters, there are some commonly used strategies, such as writing in air with an index finger, copying with a pen, and pronouncing their sounds, when students begin learning to write Chinese characters (Hao et al., 2010). Prior studies (e.g., Longcamp, Boucard, Gilhodes, & Velay, 2006) indicated that handwriting would be a sort of perceptual-motor skill and this motor activity could beneficially contribute to memory retention. Because every characters comprised individual shape, pronunciation, and explanation, students are requested to memorize relevant information embedded in the target characters (Shen, 2005). Therefore, sustaining practice is necessary for mastery of Chinese characters handwriting and supportive to word recognition.

However, students regarded such repeated practices as tedious and laborious works, and this situation often tackled them and resulted in counter-effect such as having no intention or interest to do (Zahradníková, 2016). In addition to cognitive aspect, the factors in affective aspect are also imperative for teaching and learning. Previous evidence-based empirical studies revealed that there exists a positive correlation between school achievement and subject-specific interest (Jansen, Lüdtke, & Schroeders, 2016). If a learner lost interest in the learning of specific subject matter, he/she would be less willing to engage in the learning tasks corresponding to such subject. In other words, the development of interest would be taken into account for school curriculum, since interest may directly involve students' concentration, engagement, and experiences (Harackiewicz, Smith, & Priniski, 2016).

It is noted that interest promotes deeper learning. Hidi and Renninger (2006) further pointed out that interest can be conceptualized into two categories involving situational and individual interest. Yet, there had been certain theoretical perspectives to interpret how to cultivate individual interest (stable

state of personal preference) from situational interest (temporary state of environmental factors). More recently, a group of Asian scholars put forth an interest-driven creator (IDC) theory (Chan et al., 2018; Wong et al., 2015) and implemented into practical domains under the affordance of technology such as the learning of mind-mapping (Chang, Shih, & Huang, 2017) and programming education (Kong & Li, 2016).

With the progressive advancement of emergent technology, game-based technology is one of energetic tools for boosting active participation and immersive engagement (Jabbar, Azita, & Felicia, 2015). That is to say, the game-based learning environment probably draws students' concentration and further facilitates learners' task engagement. Therefore, integrating game-based technology into the context potentially become a promising approach to support the learning of Chinese characters. Designed by the viewpoint of the IDC theory, this study aimed at both improving performance and sustaining interest through incorporating game-based learning system into the process of Chinese characters learning.

2. Development of game system: Character Monster

2.1 Radical-Oriented Design Approach

The Chinese characters are well-known for the logographic properties of their components and structures. The stroke is the basic unit of the Chinese character, since each character is structurally assembled by various kinds of strokes into a square-block space. Every character comprises three components: shape, pronunciation, and meaning. In terms of the functional contributions, the radical, central component of certain character, comprise semantic and phonetic part which represents the underlying meaning and the pronunciation guidance respectively. Over 80% of characters are phono-semantic compound characters, hence knowing the radical information would help understand a group of similar characters (Chen et al., 2013). While students are gradually taught how a character was combined and to develop the structural awareness of a character, they can probably memorize Chinese characters in a systematized way (Shen, 2004).

One of the effective way of introducing characters is to focus on the radical structure initially, and make connections between the radicals and characters (Taft & Chung, 1999). Different from the tradition method, the radical-oriented approach was utilized to design the character monster (a virtual role) and relevant deriving characters are the food of these monsters. Table 1 summarized three examples of character monsters with regard to corresponding radicals and their deriving characters (with the same radical) as well as the attributes in common. It is worth noting that each character monster is designed according to its radical knowledge and related attributes. This design approach affords intuitive information about the radical, and helps evoke the students' curiosity directly.

Table 1

Character monster, corresponding radical, and deriving characters

Monster	Radical	Deriving characters			Attribute in common
Gold-radical	金(gold)	釘(nail)	銀(silver)	錢(money)	mental material
Rain-radical	雨(rain)	雷(thunder)	霜(frost)	霧(fog)	weather phenomenon
Clothes-radical	衣(clothes)	衫(shirt)	袖(sleeve)	褲(pants)	made of cloth

2.2 Conceptual Framework and Game-Based Model

Prior research results have revealed that games could enhance subject learning, since games offered learners with visual-audio effects and immersive experience, but the design of educational game should take the suitable learning content into account (Jabbar, Azita, & Felicia, 2015). In the current study, we attempted to purposely develop a digital game by implanting "monster-feeding equals to characters-writing" notion as the part of game scenarios to support students in promoting language learning outcomes in both cognitive (e.g., achievement performance) and affective (e.g., attitude and interest) aspects. Specifically, the proposed game system was developed according to one specific anchored loop — interest loop — in IDC theory.

Figure 1 illustrated the interest loop (the referred conceptual framework) and game-based model. The interest loop comprises three elements, namely triggering interest, immersing interest, and extending interest (Chan et al., 2018; Wong et al., 2015). In terms of the triggering interest, the students' interest is aroused by character monster's appearance. The student can hold a monster and accompany him/herself in gaming context. Since every character monster is designed individually in accordance with their radical knowledge and relevant features, and each one is appealing with different outer shape so that these monsters could attract students' attention and evoke their curiosity initially.

In terms of the immersing interest, the learning tasks involve mainly in writing characters on behalf of feeding character monsters. In other words, these written-produced character by handwriting (belong to certain radical) would become the food of one radical-specific character monster within the game scenario. At this time, the students would become more willing to engage themselves in writing characters so as to strengthen the ability of the character monsters by feeding food (i.e., accomplishing the handwriting tasks).

In terms of extending interest, the students can continue readily to collect and further feed the other character monsters. After sufficiently attending the game levels, the students can choose to enter the arenas. The arenas offer three-stage modules, namely single, collaborative, and challenge. The reward mechanism designed in the game scenario also supportively holds the joyfulness and inspires the students keep on partaking the game-play. The activities, designed in accordance with interest loop, are cyclically implemented, and enhance students learning of Chinese characters.

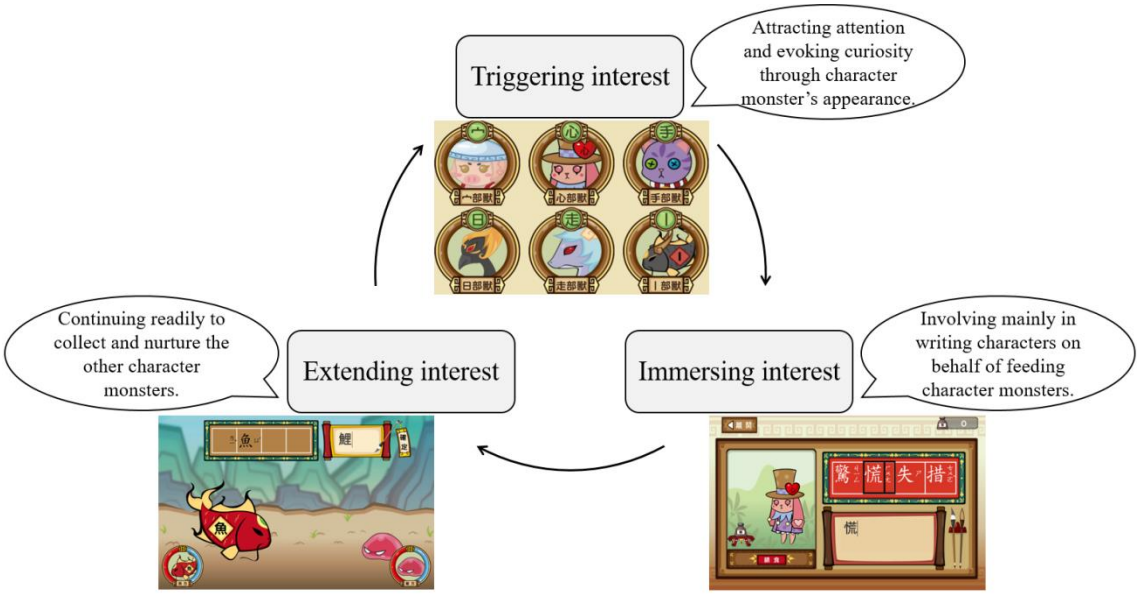

Figure 1. Interest loop and game-based model.

3. Experimental design

3.1 Participants and Settings

The participants in this study are fifty fifth graders (native speakers of Chinese) at an elementary school. Two intact classes are randomly assigned as the experimental group (n = 25) and control group (n = 25). The students in experimental group receive the digital game-based learning system (Character Monster), and every student is equipped with a mobile device (i.e., tablet PC) to afford learning engagement, while those in control group receive the conventional instructions.

The target characters are adopted from the Chinese textbook used at the chosen elementary school. To examine the effectiveness of the game-based learning system, the long-term intervention is needed. The duration of the experimental procedure will last for eight weeks, and the frequency of the intervention is two periods per week and each period is around forty minutes.

3.2 Research Instruments

The dependent variables we concerned are performance and interest, so the achievement test and interest questionnaire are developed by authors to act as research instruments.

The achievement test consisted of three section with full mark 60 points. The sections involve identification of radical, orthography of character, and semantic meaning of radical-related characters. The orthography of character is finished by handwriting with pen, while the other two sections are measured in the form of multiple choices.

The interest questionnaire is designed based on the three dimensions of interest loop in IDC theory. Nine items in total are included in the survey with a 5-point Likert's scale, and every dimension involves three items. The triggering interest refers to the evoking of curiosity, while immersing interest is similar to the state of flow experience, and extending interest means the willingness to re-partake. The item examples of the interest questionnaire are shown in Table 2.

Table 2

Item Example of Interest Questionnaire

Dimension	Description of item
Triggering interest	Using the learning system can arouse my curiosity towards the knowledge of radical and character.
Immersing interest	Compared to general case, when using the learning system to write characters, time passes faster than I think it does.
Extending interest	If given another opportunity, I am willing to spend more time in how to write characters by using the learning system.

4. Conclusions and future works

This study presented a conceptual framework and game-based model on the basis of interest-drive creator (IDC) theory, and incorporated the attributes of tablet PC technology for handwriting and the characteristics of Chinese characters. In the developed game-based learning system, it is expected that the students are able to practice handwriting and learn the Chinese characters in a joyful manner. Additionally, more practical experiments are required to examine the proposed framework and model in the future.

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