Tangible Animal Companions in Traditional Chinese Character Learning

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Abstract: With the advance of tangible technology, more and more educational systems are enhanced. This paper describes how tangible technology could enhance animal companions in terms of human computer interaction. These potential advantages are further organized as three design considerations, which further underpin the development of tangible animal companions. The tangible animal companions are also applied to the learning activity of traditional Chinese characters for young students. By doing so, tangible technology in learning can be evaluated and advanced in the future.

Keywords: Tangible technology in learning, animal companion, Chinese character

1. Introduction

With the emergence of the tangible technology— users use their hands to manipulate some physical objects, and a computer system detects this to give appropriate feedback (Ullmer & Ishii, 2001; Ishii & Ullmer, 1997), tangible technology in learning has been devoted more and more research efforts. This might be due to the fact that tangible technology might benefit learning in two ways.

First, tangible technology could enrich students' learning experience by combining multiple sensorial media. From the perspective of history, new technologies (e.g., Multimedia, Internet, Mobile devices) always drive new educational applications, in which students are more engaged or have more joyful learning experiences. Tangible technology emphasizes manipulating physical objects to learn, which can be further integrated with other multisensory approach (e.g., visual, auditory, kinesthetic, and tactile) and pedagogical strategies to benefit students' learning experience.

Second, tangible technology could advance students' thinking through learning-by-doing. From the perspective of tangible user interface, embodiment and metaphor are the two significant characteristics (Fishkin, 2004). The former means the tie relationship between input event (e.g., manipulation) and out event (e.g., feedback). For instance, the full embodiment means the entire state of the device is embodied within the system, which can focus students' attention. The latter refers to the comparison between the system effect and real-world effect performed by a user's action. For example, the full metaphor offers more affordances by physical shape, size, color, texture, or other features to invoke the metaphorical cues.

Previous studies have indicated that animal companions could enhance the human-computer interaction through developing emotional attachment with students (Chen, 2012). On the other hand, tangible technology has also been investigated to benefit students' interest and motivation. Along this line, tangible animal companions might maximize the effects of educational systems on student learning in different domain subjects. However, fewer studies investigate possible applications on different domain subjects. Thus, this study develops a tangible animal companion applied to the learning of traditional Chinese characters. Having this system, the influences of tangible animal companions system can be conducted in the future.

2. Tangible Animal Companion

2.1 Conceptual idea

The conceptual idea of tangible animal companion is underpinned by three design considerations: emotional attachment, learning companion, and tangible user interface. First of all, emotional attachment is regarded as one of the effective means to deepen the relationship between computers and students. For young students, their attachments to pets have been applied to enhance the interaction with educational agents (Chen, 2012). When students are more willing to care about their educational agents, the educational agents will have more chances to care about the system, which in turn drives the reciprocal caring and feedback between students and computers. Human-computer interaction is thus deepened and enhanced.

Next, learning companions are our design consideration from cognitive aspect. Learning companions refer to a pedagogical representation of virtual participants which learn and interact with students (Wolf, 2009). Based on the hypothesis of zone of proximal development—a distance between what a student has achieved and what the student can achieve when offered by appropriate social interactions with adults or more capable peers (Vygotsky, 1978), learning companions can offer appropriate scaffoldings to interact with students, and facilitate the zone of proximal development.

Finally, interface is the channel that determines how many power or benefits students can gain from computer systems, including educational systems. Different from virtual user interface, tangible user interface can empower the potential advantages of the former two considerations (i.e., emotional attachment and learning companions). More specifically, tangible user interface is helpful to the establishment of the emotional attachment to animal companions. When students can use their hands to touch their animal companions or take a physical ball to play with them, the students' perception on the pet ownership and psychological supporting could be enhanced. This will help students develop close relationship with their animal companions. Therefore, the tangible technology (e.g., touch-based petting or combing for their pets) can foster the establishment of the emotional attachment. In addition, tangible user interface can integrate many interaction technologies (e.g., virtual reality, augmented reality, or mixed reality) as multisensory interaction, which could enhance students' motivation and learning performance.

2.2 Implementation

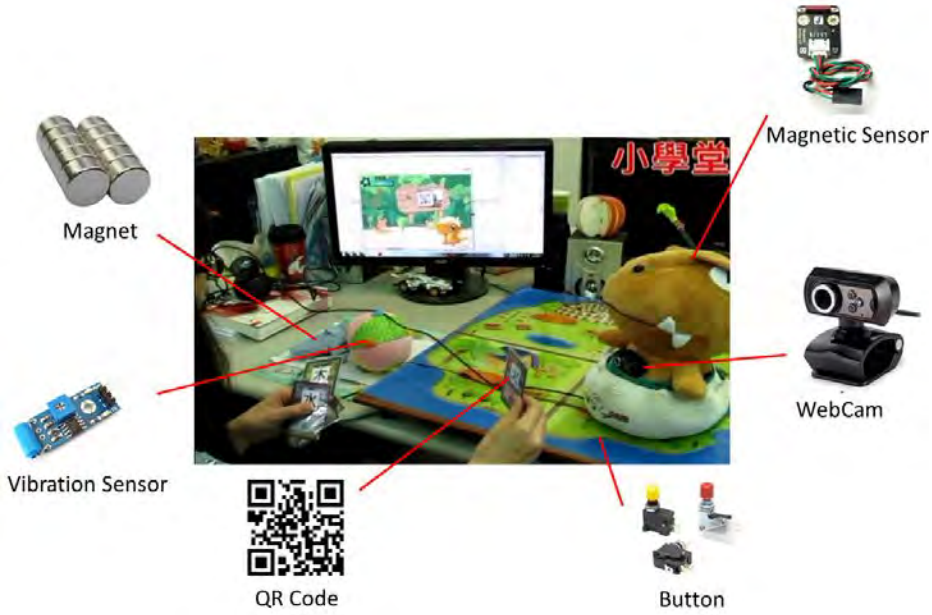

Figure 1. Different sensors and devices embedded in the pet dragon

The implementation of the pet dragon system involves different sensors and devices, including magnet/magnetic sensor, vibration sensor, QR code/WebCam, and buttons (see Figure 1). These sensor and devices are embedded in the pet dragon, a stuffed toy in the shape of dragon. In addition, the pet dragon is also connected to the computer so that some complex or detailed information (e.g., learning materials and feedbacks) can be illustrated on the computer screen.

The learning activity can be divided into three phases: nurturing, learning, and challenging (see Figure 2). In the nurturing phase, a student can see his/her pet dragon in the My Home. The goal of the

student is to establish emotional attachment by taking good care of his/her pet dragon, which is a stuffed toy and the student can touch its head or play a ball with the pet dragon. This function is realized by different sensors and Ardunio. These interactive behaviors will influence the dragon whose status is illustrated on the computer screen. In other words, the student can observe the status of the dragon and interact with it.

In the learning phase, the student can strengthen the pet dragon's power by feeding traditional Chinese characters. The goal of the student is to learn more traditional Chinese characters, and then have more opportunities to review what he/she has learned by feeding the dragon correct Chinese characters in the My School. This intention is realized by the character cards with QR codes and WebCam in the pet dragon. When the student takes the correct character card matching the given question on the computer screen, the computer will show the feedback.

In the challenging phase, the student can challenge a series of levels with the pet dragon in the My Arena. The goal of the student is to compete against different opponents in the levels. The activity model in this phase is similar with that in the learning phase. However, different from the learning phase, the challenging phase fosters students' master level of Chinese character learning. This intention is realized by a set of game levels, in which the student needs to take correct character cards in the limited time in these game levels. By doing so, students have more chances to practice what they have learned in the previous phase.

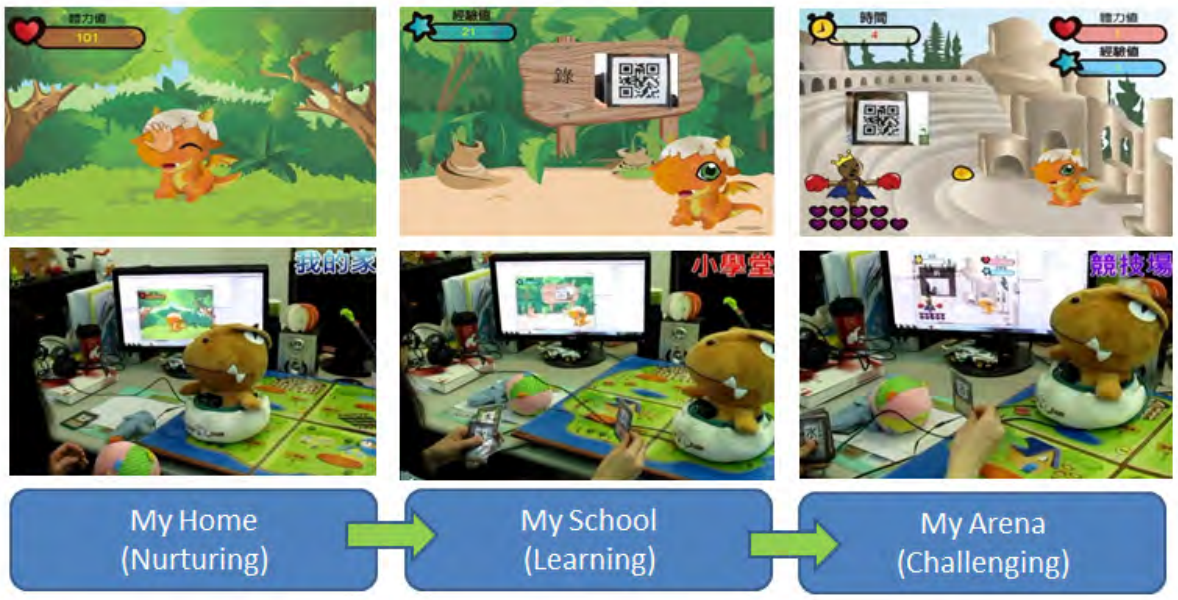

Figure 2. Three phases of the activity for the pet dragon system

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