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Networked Learning in Augmented Reality Environment

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Abstract

Nowadays, CAI (Computer Assisted Instruction) has been applied widely in many disciplines by using 2D multimedia text/animation or 3D virtual reality presentation and indeed it has elevated learners' learning motivation and performance. Nevertheless, the interactivity offered by CAI is intangible and quite constrained because of its limited inputs, mostly by using mouse and keyboard, which greatly reduces the learning performance of learners on abstract topics such as mathematical geometry, molecular structure, or technological English (English in engineering or science). In terms of technological English, many terminologies such as "CSMA/CD" in network technology, "forensic animation" in virtual reality simulation technology, and "chemical-bonding" in molecular structure are difficult to memorize literally because these words are not context-aware. Even with the help of multi-media (text, graphics, or video), the authors argue that the learning improvement of learners are still quite limited due to the lack of direct interaction between the users and the objects (text/image/video) representing a specific terminology (e.g. CSMA/CD). Fortunately, Augmented Reality (AR) technology has begun to surge as a new and improved CAI tool because of its ability to create tangible and highly interactive user interface which allows a user to interact with the learning object using hand gestures (Kaufmann & Schmalstieg, 2003; Pan, et al., 2006; Su, 2004). However, current AR learning systems are mostly stand-alone systems. Networked AR learning systems are still few in current literature. Thus, this study designs and implements a synchronous networked AR learning environment where teacher, student and objects can interact with each other synchronously over the network.

A usability questionnaire consists of motivation, ease-of-use, usefulness, interactivity, and fun-to-use constructs are given to a group of thirty students enrolling in the technological English course to evaluate the usability of the developed networked AR learning system. Thirty technological English terminologies are selected as the testing material and their AR marked cards and 3D animation are built. A teacher explains and demonstrates the concept of each terminology while students learn the concepts remotely. Afterwards, the usability questionnaires are filled by all participating students. The resulting scores of the five constructs are 4.1, 3.7, 4.1, 4.3, and 3.8 respectively, demonstrating the students' attitudes are positive. In qualitative evaluation, observation during experiments and post-experiment interviews reveal that the students think the system is not very easy to use because they never have the experience of using an AR system before. However, they think the interaction offered by the system is excellent since they not only can watch the vivid 3D animation of a terminology (e.g. CSMA/CD) but also can move the 3D objects (e.g. computers/network bus/data packets, represented by marked cards) around to see the interaction effects among all objects (e.g. data packets coming out of computers and flowing around in the network bus). Finally, pedagogical implication is provided, and conclusion and future work suggestions are given.