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Featured Article

Augmented Reality Integrated Simulation Education in Health Care

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KEYWORDS

augmented reality;
simulation;
health care;
ARIS;
game theory;
situated learning theory;
TAACCCT

Abstract

Background: Augmented Reality Integrated Simulation Education (ARISE) merges the concepts of simulation with augmented reality and game-based situated learning theory. As part of a Department of Labor grant, 150 ARISE scenarios for health care students are being constructed for open-source use.

Method: Four prototypes were trialed with representatives from the Wisconsin Technical College System.

Results: Results showed versatile use and favorable reviews.

Conclusions: Constructive feedback will be used in creating future scenarios. Further ARISE research, including student learning, student experience, and faculty evaluation, is recommended as well as expanding the concept to other disciplines.

Cite this article:

Carlson, K. J., & Gagnon, D. J. (2016, April). Augmented reality integrated simulation education in health care. *Clinical Simulation in Nursing*, 12(4), 123-127. <http://dx.doi.org/10.1016/j.ecns.2015.12.005>.

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Background

In 2014, the Advancing Careers and Training for Healthcare (ACT for Healthcare) was formed as part of a 3-year Trade Adjustment Assistance Community College and Career Training Grant from the Department of Labor (DOL). The ACT for Healthcare group is a collaboration of 16 Wisconsin technical colleges, industry partners, workforce development systems, and previous Trade Adjustment Assistance Community College and Career Training grant recipients focused on enhancing health care training programs. One portion of the grant is the development of Augmented Reality Integrated Simulation Education (ARISE) utilizing the

Augmented Reality and Interactive Storytelling (ARIS) application. The ARISE project merges the concepts of simulation with augmented reality and game-based situated learning theory within 150 scenarios for health care students. The finished scenarios will be open source through the Multimedia Educational Resource for Learning and Online Teaching database in fall 2017.

Literature Review

Simulation, augmented reality, and game-based situated learning theory are not new concepts. However, the utilization and integration of the three is new to health care education. Therefore, current research is mainly based on the individual concepts or integrating two of the three.

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Simulation

Simulation scenarios are used as a teaching strategy complementing the existing curriculum. They have been found to be an effective method to meet learning objectives.

Key Points

- Augmented Reality Integrated Simulation Education (ARISE) merges the concepts of simulation with augmented reality and game-based situated learning theory.
- Results from a preliminary trial in nursing shows ARISE may enhance health care simulation, learning, and critical thinking through providing a more authentic, engaging experience.
- Further ARISE research may include student learning, student experience, faculty evaluation, and expanding the concept to other disciplines.

In a meta-analysis of 600 simulation studies with >36,500 participants comparing the results of simulation-based training against no intervention, Cook (2013) found that the use of simulation was “consistently associated with large, statistically significant benefits in the areas of knowledge, skills, (instructor ratings, computer scores, or minor complications in a test setting), and behaviors (similar to skills, but in the context of actual patient care).” Learning can be customized to meet the needs of novice to expert learners.

The simulation experience can be more beneficial with faculty involvement as facilitators and debriefers. According to best evidence practices (Motola, Devine, Chung, Sullivan, & Issenberg, 2013), providing feedback during the scenario

helps guide students to meet the learning objectives and debriefing allows discussion of thought processes.

Augmented Reality

Augmented reality (AR) is a software technology that allows a virtual 2D or 3D computer-generated image to be overlaid onto a real environment (Lee, 2012). It differs from virtual reality because it utilizes the real world. Devices loaded with the AR software need to have a cue to trigger the virtual images and thus can be marker (e.g., quick response [QR] code) or markerless based (e.g., Global Positioning System [GPS]).

AR is being used in education to show 3D representations of structures including the internal human body and the earth (Lee, 2012). Some textbooks contain markers which, when scanned with a device, show 3D scenes. AR can also be merged with game theory. Johnson, Levine, Smith, and Stone (2010) demonstrated an AR geography

flat board game map that became a 3D rendered model with a mobile device or a webcam.

Lin, Duh, Wang, and Tsai (2013) investigated learning behavior patterns and performances with the use of augmented reality. In the study, 40 undergraduate students were divided and given a task either with the assistance of the AR Physics system or a traditional 2D simulation system. Overall knowledge was evaluated through a pre- and posttest comparison. The *t* test result of their posttest scores indicated that the learners’ knowledge significantly improved by using AR. Lin et al. concluded that although AR has been shown as an effective teaching method, it has not been widely adopted because of the lack of financial support and benefit awareness.

Games-Based Situated Learning Theory

Games-based situated learning theory is based on two key points. The first is “information must be given in authentic simulated context,” and the second is “learning must take place within social interaction and collaboration” (Ladley, 2010a,b). Its roots stem from situated cognition learning theory which holds the notion that knowledge is a process where involvement in authentic activities and interactions with experts builds on previous knowledge (Brown, Collins, & Duguid, 1989). This approach to educational design prioritizes the creation of learning contexts in which the learner is able to try, practice, fail, and iterate on their approach; performing the same actions; and participating in the same discourse that practitioners utilize (Gee, 2004). Applying this theory in education, learning is “dilemma driven rather than content driven” or what Squire (2006) refers to as “Context over Concept.”

Current Integration

Integrating simulation and augmented reality for health care education has been implemented at Sheffield Hallam University in England with positive results. Lindley, Clark, and Gissing (2013) collected data from 91 nursing and 36 medical students after completing a merged learning experience. Eighty-seven percent preferred the integrated learning experience over the traditional simulation experience.

Conceptual Framework

The ARISE model (Figure 1) depicts not only the layered relationships between the technologies but the learning expected with the level of game theory integrated. Combining low- and high-fidelity human patient simulators with the reality and engagement of augmented reality has shown authentic and immersive experiences. With more game elements, students will make critical decisions based on prompts and/or questions presented on their mobile

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