

Serious Games for Students in Healthcare: Engaging a Technically Inclined Generation

by

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Abstract

Serious games for healthcare present opportunities for individuals to demonstrate and apply learning and receive immediate feedback on decisions made in realistic and experiential learning environments. Although the literature supports the use of gaming as a pedagogical tool for the current generation of students, the lack of research about the learning outcomes that can be achieved and the cost of production are major barriers to the design and development of games by educational institutions. However, the significant learning potential of serious games in the area of healthcare cannot be ignored, as this didactic medium can provide the opportunity for applying learned theory in a lifelike clinical environment, without real world consequences. It is an exciting and appealing learning medium, fitting for the emerging technically astute generation of learners.

Key words and phrases: serious games, technology, constructivism

“Students are changing. They are increasingly pragmatic. They crave interaction and personalization. They are highly visual. They are problem solvers. Often they are averse to reading. They want more material in less time. And, hardly worth mentioning anymore, they are computer savvy.” Aldrich, (2004, xxix)

Serious games are educational tools that are immersive, engaging, and practical (Prensky, 2006); qualities that are synonymous with the learning expectations of the net generation and as Oblinger & Oblinger (2005) explain, these are the characteristics of those individuals born after 1980. The primary goal of a serious game is to be educational; this is the ‘serious’ aspect (Sawyer as cited in Michael & Chen, 2006). However, the ‘game’ aspect of ‘serious games’ is the catalyst for learning, in which the aspects of fun and challenge motivate the learner to engage and transfer this learning (Oblinger & Oblinger; Michael & Chen). Serious games present opportunities for individuals to demonstrate and apply learning and receive immediate feedback on decisions made in realistic and experiential learning environments. This learning medium is of particular value to those in or entering health professions as it allows them to practice their skills without any risks or ‘real-world’ consequences (Aldrich, 2004 & 2005; Breslin, McGowan, Pecheux, & Sudol, 2007). Furthermore, serious games are “ideal for developing an understanding of *big ideas and concepts*—those things for which experience alone can deepen understanding” (Boston, as quoted in Aldrich, 2005, xxx). Serious games are a breakthrough in learning technologies and align with expectations of today’s learners. Though the production of such a tool comes with

challenges and considerations, serious games are a potentially unparalleled learning tool for students and professionals in the area of healthcare.

Utilizing a serious game as a learning medium is advantageous for a number of reasons. Immersion and engagement of the learner in the simulated environment play vital roles in the retention of information and, ultimately, the transfer of this learning to a 'real world' practice environment (Breslin et al., 2007; deFreitas, 2007). Moreover, processes in the games provide the learner with opportunities to assess situations, make decisions, learn from those judgments, and receive immediate feedback to correct an incorrect response or reinforce the correct one (deFreitas; Susi, Johannesson, & Backlund, 2007). Serious games are effective, not only because they allow students to practice in a realistic clinical environment, students can do this repeatedly until they meet the required level of competence (Alexander, 2008; Purdy, 2007; Susi et al., 2007). In repeating the game or level the learner can deepen existing knowledge and potentially acquire new learning every time the game or level is played, depending on the capacity of the game (Gee, 2003). When competence at one level is achieved, the learner will be faced with a new level, more difficult than the last (Alexander). These aspects of assessment, repetition, reinforcement, and increasing difficulty over time are just a few of the pedagogical functions of serious games (Alexander; deFreitas).

Beyond what is learned from the content of the serious game, serious games develop other skills such as visual, tactile, psychomotor, and spatial skills. In addition, games have the potential to enhance critical thinking, and social skills, such as

negotiation, decision-making, and collaboration (Purdy, 2007; Reiner & Siegel, 2008; Susi, Johannesson, & Backlund, 2007). Individual and peer competition encourages innovation and creativity (Gee, 2003; Reiner & Seigel). The skills gained from the content, the process, and the play of a serious game enables learners to enhance their learning outcomes for healthcare practice, personal competence, and, therefore, patient safety (Breslin et al., 2007; Deker, Sportsman, Puetz, & Billings, 2008).

Another advantage of serious games is that this learning medium can eliminate some of the challenges faced by other types of clinical simulations. For example, actors in a standardized simulation may not effectively exhibit important symptoms or changes in status, such as edema, adventitious lung sounds, or wound dehiscence; similarly, a high-fidelity human patient simulator (mannequin) can offer little in terms of nurse-client and team interaction, expression, and emotion (Deker, Sportsman, Puetz, & Billings, 2008; Laseter, 2007). As well, serious games have the capacity to immerse students into an environment where they face the challenges of real life, such as the emergency room, operating room, or community setting. The portability of a serious game is unlike any other simulation; it can be utilized almost anywhere (with wireless access) and requires little more than the game and a computer (Aldrich, 2004; Texas A&M University, Corpus Christi, 2008).

There are many advantages to this approach to learning; however, a number of factors must be considered when developing serious games, or incorporating a serious game into a curriculum or learning environment. One challenge is the lack of research regarding the pedagogical implications, learning outcomes, and the best ways in

which games can be used as an educational tool or instructional strategy in a classroom (Chen & Michael, 2005; deFreitas, 2007; Dekker et al., 2008; Lasater, 2007). Game developers are exploring the best ways to incorporate the instructional content into a game, support student learning, and evaluate the efficacy of this new learning medium (Chen & Michael). In addition to the technical complexity, designers must incorporate feedback loops that will guide and educate the learner, but which remain unobtrusive and do not compromise the 'play' aspect of the game (Gee, 2003; Chen & Michael). From a realistic point of view, game developers and educators must accept that it is almost impossible to simulate every possible phenomenon that students and faculty would find in a clinical environment (Chen & Michael; Susi et al., 2007).

One of the greatest obstacles in serious game development is most often the cost and human resources required to develop a usable, educational, and entertaining software. The budget for serious games can range from tens of thousands of dollars up to tens of millions. Sawyer (2002) suggests that most games designed for personal computers (PCs) cost between \$500,000 and \$2.5 million and take 12-24 months to complete. Some disciplines are developing training games with large federal budgets of approximately \$2.5 million (Sawyer; Texas A&M University Corpus Christi [TA&M], 2008). An important example in the area of healthcare is the serious game *Pulse!!* This medical training game, developed by Texas A&M, was initiated in 2005 and cost \$9.85 million (TA&M). *Pulse!!* is a virtual clinical learning environment for teaching high-level critical thinking, diagnostic reasoning and skills to health care professionals (TA&M).

Most serious games require a development team that can have as few as 15 people and as many as hundreds (Bates, 2004). A team brings together designers, a variety of programmers, such as graphics, networking, artificial intelligence, and quality assurance programmers, and producers, artists, and sound technicians (Bates, Sawyer, 2002). Serious games require the subject matter experts from the specific professions in order to provide the content and credibility (Chen & Michael, 2005; Sawyer).

Despite cost and resource considerations, this is a time of great opportunity for serious games, many individuals and groups are interested in expanding this industry, with the goal of having an impact on health care programs (Alexander, 2008; Irish, 2005; Jackson, 2004; Purdy, 2007). Groups and companies often collaborate or consult with a variety of stakeholders in order to move forward on the design, development, and implementation of a serious game (Jackson). It is an exciting time for healthcare professionals and educators to consider the merits and potentials of embarking on initiatives involving the creation of games for health care because serious games present innovative opportunities for the application of theory in a lifelike clinical environment. As well, groups need to consider healthcare corporations and organizations that may be interested in financing such a project, such as pharmaceutical and technology companies, universities, non-government organizations, and non-profit organizations (Chen & Michael, 2005).

A number of serious games have already successfully entered the healthcare environment. These games have specific target audiences and function as treatment interventions, patient educational tools, or practical training tools for health professionals (Micheal & Chen, 2006). Examples of recently created games include : a physical therapy and exercise tool (i.e., stroke rehabilitation and physical fitness), a distraction technique during painful procedures (i.e., during chemotherapy), an educational medium for children and adults diagnosed with a particular health challenge (i.e., HIV/AIDS, asthma, and cancer), a confrontational treatment for mental health disorders (i.e., phobias or post-traumatic stress disorder), and, most relevantly, a training tool for health care professionals (i.e., surgical laparoscopic procedures; virtual emergency room triage). The narrow target audience may make serious games less profitable and therefore less appealing to publishers (Chen & Micheal, 2005). Yet, there is no limit for the potential of serious games for healthcare in the future—this is the opportunity for innovation. Perhaps a serious game that targets interprofessional health education and practice needs to be considered.

In summary, although the literature supports the use of gaming as a pedagogical tool for the current generation of students, the lack of research about the learning outcomes that can be achieved and the cost of production are major barriers to the design and development of games by educational institutions. However, the significant learning potential of serious games in the area of healthcare cannot be ignored, as this didactic medium can provide the opportunity for applying learned theory in a lifelike clinical environment, without real world consequences. Serious games are an exciting and

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