Using Electronic Gaming to Support Problem-Based Learning

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Problem-based learning (PBL) is a constructivist-learning model of instruction, whereby the teacher acts as a facilitator to students engaged in self-directed learning based on a specific problem (Curtis, 2002; Savery & Duffy, 2001). First developed in the early 1970s, PBL was used almost exclusively in medical education (Savery & Duffy, 2001), as it results in the development of problem-solving skills (Fardanesh, 2006). PBL is meant to engage the learner in behavior that is expected within a field of study through cognitive stimulus, which is often an authentic problem (Savery & Duffy). Because the problem is authentic, learning is also authentic (Murphy, 2003). Authentic learning does not necessarily require that the learner be immersed in an actual problem. Rather, as Karagiorgi and Symeou (2005) found, the simulation of real-life situations allows for knowledge-implementation in genuine ways.

Annetta, Cook and Shultz (2007) argued that the power of video games (electronic games) can be harnessed and used as PBL scenarios, as there are natural ties existing between video game creation and PBL. Walker and Shelton (2008) found that much of the work that exists in educational games bears a strong similarity to the field of PBL, making the two a natural fit. Due to advancements in technology, electronic games are rich digital worlds that go beyond traditional action games (Annetta, Cook & Schultz, 2007; Squire, 2003) and have grown to include simulations, action games, strategy, role-playing sports, puzzles and adventure (Squire, 2003).

Simulations are of particular interest in the educational environment, as they model physical or social systems (Annetta, Cook & Shultz; Squire). McLaughlan and Kirkpatrick (1999) defined simulations as PBL experiences that are set in motion by an authentic problem; they familiarize participants with the complex nature of decision-making and negotiation, thereby better preparing them to deal with these processes in the real world. Therefore, simulations can be used as a tool within the educational environment to enhance curriculum delivery and to allow students to become closely acquainted with the curriculum through active engagement as they play games and solve puzzles (Huffaker, 2003).

Annetta, Cook and Shultz (2007) argued that, in order to obtain the benefits of video games in the classroom, a well-designed technology program needs to be grounded in sound pedagogy. Moreover, the authors argued that natural ties exist between video games and PBL, linking video games and pedagogy, and because video games are rich in storyline, games can be created for teaching purposes while adhering to the principles of the PBL model. Because PBL theory considers learning a social process (Annetta, Cook & Shultz), electronic games,

such as simulations, encourage learners to communicate, cooperate and build consensus, thereby developing shared knowledge (McLaughlan & Kirkpatrick, 1999). Squire (2003) found that video games further supported PBL in that they allow users to manipulate variables that are routinely unalterable, view information from new perspectives, and observe behaviors over time. Therefore, electronic gaming allows students to approach a problem from numerous perspectives in order to build knowledge.

Edutainment video games, with both educational and entertainment qualities, can be powerful learning tools, as they allow learners to manipulate variables not possible in reality, view problems from new perspectives, observe system behavior over the long term, and compare simulations with current understandings of a system (Squire, 2003). Annetta, Cook and Shultz (2007), in their study of PBL and online game creation, observed that student engagement was continually elevated throughout the study. Additionally, Walker and Shelton (2008) found that students who played educational games assumed more responsibility for learning, as they "are designed to be an engaging way to improve educational outcomes using multimedia virtual environments for teaching and learning science" (Teachers as Facilitators Section, ¶2). Kanet and Stößlein (2007) confirmed these findings, arguing that electronic game play significantly facilitates learning.

Barrows and Tamblyn (1980) identified four intended outcomes for PBL, which include self-directed learning skills, content-knowledge that is structured around problems, problem-solving skills and increased motivation for learning. Walker and Shelton (2008) noted that examples of each outcome can be found within electronic simulation games. Self-directed learning skills and content knowledge that is structured around problems are both evident in games where players make decisions that impact the simulated communities and environments (Walker & Shelton). Furthermore, they argued that, in simulated games, players are faced with issues that have multiple solution paths, which forces them to focus strategy while paying attention to the environment, thereby developing problem-solving skills. The authors argued that "Learners are self-directed, have freedom of actions and live with their decisions, which impacts the environment around them" (Problem Solving Skills Connected to Content Knowledge Section, ¶4).

Finally, Walker and Shelton noted that electronic simulation games result in increased motivation for learning. They observed that the games challenge students, resulting in intrinsic motivation to achieve problem resolution, and have an element of relevance, as students are able to connect why a reasoning process is necessary in learning.

In conclusion, electronic gaming supports PBL by providing authentic tasks that encourage ownership of the problem, interactivity, collaboration, decision-making skills, and engagement while retaining, or even improving, student learning

(Annetta, Cook & Schultz, 2007; McLaughlan & Kirkpatrick, 1999; Virvou, Katsionis & Manos, 2005). Virtual reality games, including simulations, can be very motivating for students while retaining, and even improving, student learning (Virvou, Katsionis & Manos). Walker and Shelton (2008) argued that game-like activity that is aligned with learning objectives is educationally meaningful and motivating. Electronic games have the potential to meet the expanding needs of the diverse student population (Annetta, Cook & Schultz, 2007).

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