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Game-Based Learning

Time-to-Adoption Horizon: Two to Three Years

Game-based learning has gained considerable traction since 2003, when James Gee began to describe the impact of game play on cognitive development. Since then, research, and interest in, the potential of gaming on learning has exploded, as has the diversity of games themselves, with the emergence of serious games as a genre, the proliferation of gaming platforms, and the evolution of games on mobile devices. Developers and researchers are working in every area of game-based learning, including games that are goal-oriented; social game environments; non-digital games that are easy to construct and play; games developed expressly for education; and commercial games that lend themselves to refining team and group skills. Role-playing, collaborative problem solving, and other forms of simulated experiences are recognized for having broad applicability across a wide range of disciplines.

Overview

According to *Trip Wire Magazine*, 61.9 million people participated in online social games in 2011, up nearly 9 million people from 2010. Forty percent of these gamers are between the ages of 20 and 34. The average age of the American gamer is now 35-years-old, which correlates with the early 1980s timeline in which the first digital games appeared with the first home computers. Ten years later, the web was born, and games began to be delivered over the Internet. The three most recent cohorts of children — those born in the early 1980s, the early 1990s, and the early 2000s — have grown up in a world where digital games have always been an important part of their lives, and entered or graduated from higher education institutions with hundreds of hours of gaming experience.

Early studies of consumer games helped to identify the aspects of games that make them especially engaging

and appealing to players of various ages and of both genders: the feeling of working toward a goal; the possibility of attaining spectacular successes; the ability to problem solve, collaborate with others, and socialize; an interesting story line; and other characteristics. These qualities are replicable for educational content, though they can be difficult to design well. This challenge is one reason why game-based learning continues to be placed on the mid-term horizon.

In the most recent National Education Technology Plan, gaming was named as an ideal method of assessing student knowledge comprehension, citing the ability of games to provide immediate performance feedback to the players. Students are engaged because they are motivated to do better, get to the next level, and succeed. Proponents also underscore the productive role of play, which allows for experimentation, the exploration of identities, and even failure.

In recent years, the Serious Games movement has focused on uniting significant educational content with play. The games within this genre layer social issues or problems with game play, helping players gain a new perspective through active engagement. Research shows that players readily connect with learning material when doing so will help them achieve personally meaningful goals. Purdue University's Serious Games Center is just one of the many programs dedicated to conducting research and finding new means of collaboration with Serious Games in virtual environments.

Another area of gaming that is increasingly interesting for higher education institutions is simulation-based games. Militaries worldwide have adopted games and simulations across the entire range of skills training they provide, and the game-design insights from that

tremendous body of work are beginning to inform simulations designed for graduate students studying and training in specific subjects including medicine. “Emergency Room: Code Red” is one such popular game.

The 2011 edition of this report viewed massively multiplayer online (MMO) games as still a few years further out for learning, but increasingly interesting. This year, there has been more traction surrounding this genre of gaming. Online games including “Minecraft” and “World of Warcraft” have been integrated into course curriculum, with educators and educational technology writers frequently documenting their stories and outcomes. This type of game brings many players together to work on activities that require collaborative problem solving. They are complex, and include solo and group content, as well as goals that tie to a storyline or theme. Their link to education exists in the highest levels of interaction in which game-play requires teamwork, leadership, and discovery.

Relevance for Teaching, Learning, or Creative Inquiry

Game-based learning reflects a number of important skills higher education institutions strive for their students to acquire: collaboration, problem solving, communication, critical thinking, and digital literacy. What makes educational gaming appealing today is the plethora of genres and applications associated with it. From role-playing games to online social games to entire courses created around teaching better game design, aspects of game mechanics are well integrated in higher education curriculum.

Games related specifically to course content help students gain a fresh perspective on material and can potentially engage them in that content in more complex and nuanced ways. Alternate reality games (ARGs), in which players find clues and solve puzzles in experiences that blur the boundary between the game and real life, offer a clear example in which course content and game play can overlap. Recent examples of large-scale ARGs include Jane McGonigal’s “EVOKE,” a social networking game that simulates real global issues to empower people to find new and innovative

solutions. The ideas players have proposed have earned them opportunities to put their proposals into practice through internships with social innovators and business leaders around the world, and scholarships or funding for their own ventures. Stanford University created “Septris,” an HTML5 mobile simulation game that teaches practicing physicians and nurses about Sepsis (blood poisoning) identification, triage, and management. Learners play the part of a physician

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managing patients as their health deteriorates. Learners read history, order labs, and assign treatments to multiple patients at a time.

The browser-based game “Ikariam” simulates life in ancient civilizations, and players learn about economics and civic responsibility by building up the economy and caring for the residents on virtual islands. Some higher education institutions are taking the incorporation of socially aware games a step further and designing entire courses around them. St. Edward’s University recently launched a pilot section of a required Cultural Foundations course with an emphasis on the use of social media and experiential learning approaches. Their “Global Social Problems” course was designed using “heroic gaming” strategies. All course activities were rooted in a common set of heroic values and were represented as “character traits” on each student’s profile.

Open-ended, challenge-based, truly collaborative games are an emerging category of games that seems especially appropriate for higher education. Games like these, which occur in both online and non-digital forms, can draw on skills for research, writing, collaboration, problem solving, public speaking, leadership, digital literacy, and media-making. When embedded in the curriculum, they offer a path into the material that allows

the student to learn how to learn along with mastering the subject matter. These games lend themselves to curricular content, requiring students to discover and construct knowledge in order to solve problems. They are challenging to design well, but the results can be transformative.

The challenge that persists with educational games — a good indicator of why they still reside on the mid-term horizon — is embedding traditional educational

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content so that it looks and feels a natural part of playing the game. Faculty members may find it difficult to make pronounced connections between specific course content and the gaming objectives. What is known, however, is that these games spark interest in students to expand their learning outside of the game. Constance Steinkuehler, for example, founding fellow of the Games+Learning+Society Initiative, found that the average MMO gamer spends 10-15 hours per week conducting online research related to the game. Digital and communication literacy goes hand in hand with game play, which is why it continues to be of great interest to educators.

A sampling of applications of game-based learning across disciplines includes the following:

> **Music.** In McGill University's "Open Orchestra" simulation game, a workstation uses high definition panoramic video and surround sound to provide musicians with the experience of playing in an orchestra or singing in an opera. A touchscreen in the music stand displays an electronic version of the score and the system controls, as well as a visualization that

compares the student's performance to that of a professional musician. go.nmc.org/udrgw

- > **Online Learning.** Students in an Adult Education undergraduate online course at the University of British Columbia are participating in a role-playing game, in which they are reporters who are writing articles for an imaginary journal called *Adult Educator Weekly*. They also post comments as "readers" and vote for the best article. The results showed that the students posted more in the journal than they used to in LMS discussion forums. go.nmc.org/yvrzz
- > **Science.** "MicroExplorer3D," developed by North Carolina State University, provides an avenue for students who do not have access to a microscopy lab to learn the parts of a compound microscope. Students interact with the 3D model of a compound microscope by clicking (web) or touching (mobile), zoom into detailed views of the parts, and open menu items and descriptions with photograph and video examples. go.nmc.org/kwgmb

Game-Based Learning in Practice

The following links provide examples of game-based learning in use in higher education settings:

3D GameLab

go.nmc.org/vedmb

Developed by Boise State University, 3D GameLab is a unique quest-based learning platform that can turn any classroom into a living game. 3D GameLab helps teachers tie innovative learning activities to standards, providing learners choice while they game their way through a competency-based curriculum.

Cycles of Your Cognitive Learning, Expectations, and Schema

go.nmc.org/gcogy

A University at Albany research team is developing a video game that will show people negative aspects of their own decision-making processes, specifically when they are confronted with incomplete information and operating under time pressure.

GAMES Lab at Radford University

go.nmc.org/qlohz

The purpose of the Games, Animation, Modeling and Simulation (GAMES) Lab at Radford University is to design interactive mobile games and study their impact on student engagement and learning. The GAMES Lab has designed iPod Touch and iPad games for schools in rural, southwestern Virginia, and is collaborating with the participating educators to determine how best to integrate these games within the existing curricula.

Meet the Earthwork Builders

go.nmc.org/cyaow

Funded by the National Endowment for the Humanities, a team of content specialists and game developers is making a video game prototype about the Newark Earthworks, an ancient lunar observatory in Newark, Ohio. Through the game, players will learn about the lunar observatory and gain a more global understanding of different cultures.

SciEthics Interactive

go.nmc.org/khreb

This project, funded by HP and the National Science Foundation, is designed to create virtual simulations with a science and ethics focus. Upper level undergraduate and graduate students can experience real world situations in the safety of a virtual environment.

simSchool

go.nmc.org/dkbb1

A flight simulator for teachers, simSchool provides challenging teaching scenarios that develop the knowledge and skills needed for classroom success. Research has indicated that training time on the simulator makes a significant difference in a teacher's self-efficacy and sense of the focus of control.

For Further Reading

The following articles and resources are recommended for those who wish to learn more about game-based learning:

5 Teaching Tips for Professors — From Video Games

go.nmc.org/lssnv

(Jeffrey R. Young, *The Chronicle of Higher Education*, 24 January 2010.) This article shares best practices on how

to successfully incorporate gaming into university and college curriculum, underscoring that game-based learning is not a solution for all subjects and that games are no quick fix, but take research and classroom testing by the educator to ascertain their success.

Games and Learning: Teaching as Designing

go.nmc.org/cooat

(James Gee, *The Huffington Post*, 21 April 2011.) James Gee builds a case for games as catalysts for more interaction, creativity, and critical thinking in learning. He likens gamers to designers as they must understand the "rule system" to be successful.

Games in the Library

go.nmc.org/fmtam

(Anastasia Salter, *The Chronicle of Higher Education*, 13 December 2011.) This article takes a logistical perspective to game-based learning, focusing on the difficulty of disseminating a gaming experience to a large classroom of varying students, and proposing that a game library is a good option to provide access and information as well as to track inventory.

A Neurologist Makes the Case for the Video Game Model as a Learning Tool

go.nmc.org/rqvxp

(Judy Willis, *Edutopia*, 14 April 2011.) The neurologist behind this article equates the success of game-based learning with the release of dopamine, a physiological response to a prosperous choice or action, and outlines the phases of this natural learning process.

What Does Game-Based Learning Offer Higher Education?

go.nmc.org/qcuno

(Justin Marquis, *OnlineUniversities.com*, 14 October 2011.) This article explores the benefits of gaming at the university level by breaking down a hypothesis by game designer, Jane McGonigal, which recognizes specific positive attributes of gamers that can translate to productivity in the classroom and beyond.

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