Research Bulletin

Game-Based Learning

Developing an Institutional Strategy

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Overview

Games, play, and learning have enjoyed a symbiotic relationship throughout recorded history,¹ but when Apple Computer released the education game Lemonade Stand for the Apple II in 1979, educators and software companies like Broderbund and The Learning Company validated computer games (aka video games) as a new way to engage students.² It wasn't until 2003, however, that James Gee, in his book What Videogames Are Teaching Our Children, spotlighted the many benefits of video games for learning.³ Since then, games have enjoyed increasing attention and support as a powerful medium for teaching and learning.

There is little doubt that computer games for entertainment are influencing our culture and our lives. Although we tend to stereotype the players of these games as teenage boys, the facts tell a very different story. In 2011, 47% of game players were women and 29% were over age 50.⁴ While games for purposes such as education, training, problem solving, team building, and corporate marketing are still an emerging technology, they are nonetheless gaining prominence and media attention. A search of the Chronicle of Higher Education archives showed over 100 articles that mentioned “game-based learning” or “games in the classroom” during the past year.

But true adoption and institutional implementation of games in U.S. postsecondary education is still at an early, experimental stage. Indeed, although the market research firm Ambient Insight includes game-based learning among the “eight types of pedagogically-defined learning products,” in an August 2011 interview with IndustryGamers, Sam Adkins noted that “[game-based learning is] not in wide use in higher education.”⁵ The New Media Consortium’s NMC Horizon Report: 2012 Higher Education Edition puts the time-to-adoption horizon for game-based learning at two-to-three years.⁶ Further, our own recent attempts to catalogue games currently in use yielded a list of game titles numbering in the hundreds (versus the thousands of institutions in the United States and the hundreds of thousands of courses they offer), underscoring our belief that adoption is not yet widespread.

These six trends will drive the adoption of game-based learning:

- **Student expectations:** The majority of today’s postsecondary students are digital natives and have grown up with computer games. Those who have spent time playing games report that they have provided many and various learning opportunities, even when those games are for entertainment purposes.⁷
• **Integration of games and simulation:** Simulation is at the heart of much of game-based learning. However, simulations by themselves lack an intrinsic competitive element that is the hallmark of a game. Digital simulations provide a learning environment in which the student can practice difficult, exacting, life-threatening, or mission-critical skills. Successful simulations rely on two interdependent factors:
  a. *System modeling and representation.* This enables insight into how a system functions under different conditions (i.e., "If I do X, Y happens. If I alter A, B changes, but C doesn’t").
  b. *Sensory fidelity between the simulation and the real world.* Digital technology advances are enabling fidelity that is increasingly fine-grained, immersive, and realistic. As our ability to model highly intricate systems increases, so too does the quality of the insight students gain. However, we are reminded that it is often the quality of the insight rather than the fidelity of the representation that most often determines the appeal of a game. This explains the continued popularity of games such as Go, Chess, Bridge, Monopoly, and other board games.

High-fidelity simulations paired with gameplay dynamics and competitive game elements can increase student engagement and enhance learning.

• **Data analytics:** At their core, games are a succession of interactions. As such, games generate a tremendous amount of transactional data that can reveal insights not only about student success or failure but also about student teamwork and collaboration preferences, learning styles, and a variety of other learning issues. These data can be integrated with data from other sources and used in combination to drive insights into the effectiveness of a particular instructional design approach across educational cohorts within an institution and between cohorts at multiple institutions. Institutions with the ability to analyze these data in real time would be at the forefront of an exciting opportunity to customize their students’ learning experience to an unprecedented degree.

• **Badges for learning:** Digital badges for learning provide an online record of student accomplishment or achievement. Badges are "used to set goals, motivate behaviors, represent achievements, and communicate success in many contexts." While badges for learning are not, in and of themselves, games, the activities (usually called challenges, missions, or quests) that support the acquisition of badges can have a game-like quality. Further, the skill-building structure of games—which is both recursive and accretive—pairs naturally with badges for learning. As such, there is growing interest in badges as an alternative or extension to traditional assessment and credentialing methods.

• **Mobile devices:** Rapid growth in mobile device ownership continues. At the end of 2011, 64% of Americans subscribed to 3G mobile services—a 31% increase over the previous year. From April 2009 to January 2012 (less than three years), ownership of tablets/e-readers among American adults rose from 2% to 29%. More important, postsecondary students value technology—particularly mobile technology—in education.

Mobile devices offer many services that can enhance a game-based learning experience. Location-based services like mobile check-ins and geotagging, augmented reality, QR codes, and accelerometry open up new forms of gameplay to attract and engage students in meaningful ways.
Increasing prevalence of social media: Two-thirds of Internet users access social networking sites. \(^1\) These users form and maintain relationships, research and make purchases, conduct business, and pursue nearly every other form of human interaction. Social games are among the most popular uses of social media, with some 98 million social game players in the United States in 2011. \(^2\)

As social media tools become more thoroughly integrated throughout postsecondary education, their usage within game-based learning is inevitable.

While the above trends are driving adoption of game-based learning, we see several significant factors continuing to inhibit rapid, widespread adoption.

- Most games are one-off, “homegrown” products that don’t lend themselves to adoption at other institutions.
- Marrying engaging game design and storytelling with learning objectives is challenging.
- Equally difficult is designing a game experience that is accessible for all students, regardless of physical ability.
- Game development requires multiple competencies, not just content and teaching expertise.
- There is no established publishing and distribution channel for educational games. For instructors who aren’t interested in or able to do their own game design/development, the time needed to find games appropriate to their courses and figure out how to incorporate them into their syllabi and learning experiences can be prohibitive.
- Cultural barriers remain for some faculty. While less influential, similar concerns can be found among parents.
- The cost of developing a fully game-based course can be prohibitive for some colleges and universities.

In this bulletin we explore these topics and provide a framework for successful integration of game-based learning at postsecondary education institutions. The basis for the institutional framework is derived from the authors’ own experiences as well as a set of selected interviews conducted by ECAR Fellow Judith A. Pirani with representatives of institutions pursuing game-based learning strategies. The interviewees were selected based on responses to the EDUCAUSE Core Data Service survey.

**Highlights**

Many institutions have already adopted game-based learning strategies. However, a single game or several games applied to a course does not address broader learning needs or opportunities for scaled adoption. Moving from pockets of innovation to systemic implementation requires different planning and support structures. In developing an institution-wide strategy, leaders should begin to think long-term (three- to five-year planning horizon) and commit resources within that time frame, recognizing that they will encounter challenges and inevitable “bumps” along the way. The elements below constitute a framework for implementation within an “institutional game-based learning ecosystem,” as pictured in Figure 1.
Figure 1. Institutional Perspective of the Game-Based Learning Ecosystem

Adapted from Anne Derryberry, “Game-based Learning Ecosystem for Higher Ed,” April 2012.

Institutional Commitment and Support

Somewhere on every college campus, faculty are already teaching with games. These independent, pilot-project efforts will likely come up with increasing frequency. We found this to be the case with each of the seven institutions interviewed for this report. However, without institutional support, there will be no cohesion or ability to scale the pilot projects. Institutions can demonstrate commitment and support for game-based learning using the following strategies:

- **Articulate a clearly defined strategy.** At the University of Central Florida, the goal is to make game-based learning truly accessible and usable by the largest number of faculty possible and in as many disciplines as possible. The university has created a solution that is program- and faculty-agnostic. According to Joel Hartman, vice president and CIO at UCF,

  > We want to integrate what we can learn from our advanced simulation tools, but we have to integrate [game-based learning] in a way that is usable by faculty and students. For our online program we are starting with simple “low threshold” tools in order to allow greater participation.\(^{14}\)

The UCF strategy is to build a path that allows knowledge, tools, and game engines to “trickle down” from the simulation center, while allowing online learning to “work up the ladder” as things become accessible, usable, and adoptable—as well as to observe what is yet to come.
• **Establish a center of excellence.** A central organization that is tasked to coordinate, promote, support, and enable game-based learning can provide institutions with a means to drive and sustain their initiative. For example, Pennsylvania State University created the Educational Gaming Commons to explore the use of games for teaching and learning, facilitate game-based learning research, help faculty implement games in their classes, and support faculty in the design of game-based learning. The Gaming Commons focuses its efforts on creating game engines that serve multiple courses and disciplines, rather than customized programming for individual faculty requests. As explained by Chris Stubbs, project manager for the commons,

> Previously we solicited faculty members for [game-based learning] proposals, selecting one or two each year to design and implement. But with a small development staff, the more games you build, the more maintenance expectations, resulting in less ability to create new things.¹⁵

The strategy has moved to a more holistic approach that encourages faculty to articulate their pedagogical challenges (not necessarily in a game context), which are then synthesized to create a game engine that can work more broadly—such as a game engine for an economics class that is designed for other uses like energy policy, health policy, political science, or biology.

• **Fund grants and awards for innovation in game-based learning.** Providing seed money to faculty will certainly create interest and innovation in game-based learning, but it must be part of a larger institutional commitment if the projects are to be scaled and sustained. An example of this strategy is seen in the Immersive and Game-based Learning Faculty Challenge Grants at the Colorado Community College System (CCCS). A system-wide request for proposals was issued to faculty at the 13 CCCS community colleges to identify, improve, and scale collaborative game-based learning solutions that lead to greater student retention and completion.¹⁶

The first round of grants began July 1, 2012, where over $1 million was awarded to 15 collaborative faculty projects in subjects ranging from biology, psychology, and English to diesel mechanics. All learning materials that are created must be openly licensed and made available to faculty throughout all 13 colleges. For example, the Colorado Film School at the Community College of Aurora is creating a Virtual Studio System, which will be a modular virtual economy adaptable to a variety of creative, technical, and entrepreneurial programs throughout the community college system. The strategy behind the faculty grants at CCCS is to accelerate interest among faculty, collect data to support effectiveness, and determine the best support structures as game-based learning continues to evolve.

While not intended to be an exhaustive list of institutional strategies, the above examples demonstrate how some institutions are providing institutional commitment and sustained support for game-based learning. As expressed by Kurt Squire, senior investigator and associate professor at the University of Wisconsin–Madison, “We’ve seen institutions experiment for a year or two, develop expertise, and then abandon game-based learning right when they were starting to get a handle on it.”¹⁷ Institutional leaders should ensure there is sufficient interest and commitment to sustain a game-based learning initiative through the inevitable challenges along the way.
Maintaining Academic Quality

Without a driving pedagogical rationale, the value of games will be trivialized in the eyes of faculty. In implementing a game-based learning initiative, institutions must balance a consideration for academic excellence, program integrity, academic freedom, and student achievement. Faculty understand the educational challenges facing students in their disciplines and the stumbling blocks of current instructional methods. Campus leaders should work with faculty to establish the educational criteria and quality metrics that will guide the planning and implementation of game-based learning. The inclusion of badges as a means of student assessment in game-based learning faces questions of quality and legitimacy and will be a fertile topic for campus discussion. However, it may ultimately serve to mitigate some concerns as faculty better understand the measurement of student learning in games.  

Faculty Readiness and Support

Faculty understand the pedagogy of their disciplines but need to know how to incorporate game-based learning resources into their syllabi and into their teaching. This is not unlike where we were a decade ago with supporting faculty to begin putting some of their teaching materials online.

Institutions must provide opportunities for faculty engagement. Faculty professional development is critical to the success of any new instructional strategy. With game-based learning still at an early stage of development in higher education, opportunities for faculty to learn about the pedagogy and design of game-based learning are even more essential. An example of a faculty engagement program is the University of Wisconsin–Madison’s Engage program. Engaging to Learn: Simulations & Games is both an innovation award and faculty engagement program. The program has launched two rounds of awards for gaming and simulation development. Each round is a two-year period for the faculty member to work with Engage staff to design, develop, and implement a simulation or game. Faculty are awarded hours, not cash funding, to support their work. Professional development activities have included workshops that were hosted by a local game design company, support for a faculty “community” around the Engage activities, events to showcase faculty projects to their colleagues, and monthly faculty community lunches. The Engage program also set up a gaming lab for faculty to learn about and experience games and to help them generate ideas for their own projects.

Assessment, Tracking, and Analysis

A move from discrete learning games to a game-based learning initiative requires a shift from “game as closed system” to “game as data-rich learning artifact.” This shift presents significant challenges by requiring us to apply a finer level of granularity to our content. However, at the same time it offers an extremely compelling organizing principle if we are willing to define our content in terms of a game. If we consider the very simple and abstract model of a game being composed of a series of events, then each event would possess some form of experience that would generate an outcome. These outcomes would then be used to help determine the next set of relevant experiences. These performance data could also inform the metagame universe as predictors of real-world success. If in turn we were to consider the real world as a series of outcome-generating experiences we could translate across the game-based and real world in a dynamic and synergistic manner that would blur the distinctions between game and reality.
longer does game playing mean sitting in front of a screen. Current mobile and augmented reality gaming offers a glimpse into the future of game-based learning.

Separating the tracking and assessment functionality from the specific game—and for that matter from a specific LMS—and enabling it to be accessed via a standards-based interface would enable an ecosystem capable of supporting heterogeneous learning systems, games, and content. Further, such an environment would support the distribution of content based on the specific needs of a given gaming device.

Similarly, institutions might consider the merits of a common data set and standardized approach to evaluation using broad, multidimensional, quantitative metrics. This approach will allow outcomes to be measured across funded projects and courses that are deploying game-based learning. In addition to providing incentive to invest in game-based learning, the ability to draw upon various constituencies to evaluate the quality of the content, its organization, and presentation will provide institutions with accurate and consistent information regarding the relative effectiveness of a particular instructional design across a population of learners.

Impact on Students

It is easy to lose sight of the learner amid the various technical complexities of digital game-based learning. However, the learner must serve as the central point of focus for the deployment of game-based learning offerings. From the learner’s perspective games offer not only the opportunity for a more compelling, rich, and exciting experience but also offer the opportunity for a more individualized experience and efficient learning. Institutions that place the learner front and center are far more likely to meet with success in the deployment of game-based learning.

Originally developed by Lev Vygotsky, the concept of the zone of proximal development suggests that instead of using standardized tests as the measure of intelligence, it is more useful to compare a learner’s ability to solve a problem independently against their ability to solve problems with assistance from an individual (or group of individuals) who have mastered the concepts being learned. Game-based learning offers unique capabilities that can be used to examine this paradigm, in particular the instructional scaffolding strategies that offer individualized support for learners by means of a series of incremental improvement opportunities where a learner builds on past successes.

Content Management and Maintenance

Game-based learning assets must be kept fresh, just as textbooks and other teaching aids must be curated and refreshed. As technology trends emerge (e.g., new access devices, operating system upgrades), content assets must be updated to remain compatible. As previously mentioned, the lack of an established publishing and distribution channel for game-based learning content inhibits widespread adoption and drives the creation of customized, individual faculty-produced assets. And yet internal, faculty-produced content is the greatest point of vulnerability vis-à-vis game-based learning content currency. Institutions should consider investing development efforts in multiuse game engines, such as those developed by the Pennsylvania State University Gaming Commons. Multiuse game-based learning platforms can be scaled and used by multiple disciplines and faculty and can be more easily supported and maintained.
IT Infrastructure and Equipment

Within the context of a learner-centric environment, the presence of several technology enablers of game-based learning can promote success. Among the most critical are the following:

- **Scalable architecture.** Do you have an architecture that separates functionality into discrete layers or modules that can be accessed in a cost-effective manner? For instance, is there a tracking and assessment layer that can be accessed (ideally via a standards-based interface such as SCORM, AICC, or CMIS) separately from content storage and delivery? If so, this would help integrate game-based learning into the curriculum because the results of games can be tracked with minimal time and expense.

- **New and emerging technologies capability.** Do you have a group charged with evaluating new technologies? If so, those evaluations can be leveraged to include assessments of quickly changing game-based learning technologies, provide a place for faculty to dabble with and incubate new game ideas, and surface assumptions, making them explicit and actionable. Such an organization would provide useful demographic and trend information that would facilitate investment and policy decisions. For example, mobile, social, and location-based services will be the focus of technology advancements over the next several years. These trends will be reflected in education—especially game-based learning—just as with every other industry.

- **Game development capability.** A team devoted to game development can offer a powerful means by which to produce and commercialize new games. This could also be achieved through close partnerships with key industry partners. Of considerable interest would be a synergistic relationship between an academic program that educated future game developers and industry partners by having them develop games for use by the host institution.

- **Incremental development and customization capability.** This is quite different from game development and requires a different set of skills. This would be the team responsible for integrating new games into the existing infrastructure and maintaining those games in a cost-effective manner.

- **Security.** Are your security policies, procedures, and infrastructure deployed in a way that promotes experimentation? Security is usually a challenge in academia. On the one hand, we strive to be open and accessible; on the other, we must protect privacy and ensure that technical assets are used in the manner and for the purposes intended. Making game-based learning part of the security planning process can facilitate its adoption.

Given the seven elements of the framework presented above, we envision an institutional game-based learning ecosystem that embraces all aspects of the institution’s commitment to faculty and students for successful implementation.

**What It Means to Higher Education**

Contemporary students are sophisticated consumers of digital content. They know how to acquire, manipulate, rate, and share digital resources. They are comfortable working at great speed and with great quantities of content and thus have little patience for content that is not
compelling in terms of its appearance, its function, or its narrative. Students regularly interact with each other remotely, in real time or asynchronously. Distinctions between the real world and online digital worlds are blurry in the students’ worlds. The traditional barriers to sensory-rich simulations—expensive graphics hardware and powerful processors—are continually diminishing, while at the same time game producers are under pressure to deliver ever more compelling levels of sensory fidelity.

As Marshall McLuhan observed, “The medium is the message.” So it is with game-based learning. To be successful it must be an organic part of the student’s digital environment. It must be accessible (at the student’s convenience, anytime, anywhere), and it must be easily shared, rated, and manipulated. Otherwise it runs the risk of being perceived as a curiosity and passed over by the students. Institutional leaders who perceive the adoption cycle coming at them faster than they are ready for it can begin planning for game-based learning with some of the strategies presented here. Investments now in game-based learning either as pilot projects or supplemental learning opportunities provide a concrete operational path and a transitional way to get from today to tomorrow in terms of IT infrastructure, faculty development, content development/acquisition, assessment, and curriculum redesign.

Key Questions to Ask

- Which university communities or stakeholders on campus have investigated or piloted game-based learning, through which projects? What were their results?
- How does game-based learning align with our overall institutional strategy? Where, specifically, does it produce the greatest effect on achieving our primary goals?
- How do we ensure sufficient interest and investment? Which groups on campus are in the best position to become actively involved in implementing game-based learning at our college or university, and how can we successfully involve them in such efforts?
- Can we modify existing reporting methods to track results of game-based learning implementations, or do we need to create new analytics to measure success? What will successful implementation of game-based learning look like?

Where to Learn More

- Conferences on game-based learning:
  - Games for Change (http://www.gamesforchange.org)
  - Games, Learning & Society (http://www.gameslearningsociety.org)
  - Meaningful Play (http://www.meaningfulplay.msu.edu)
  - Serious Play (http://www.seriousplayconference.com)


• See the slideshows at http://www.slideshare.net/a_derryberry.

• I’m Serious.net blog. http://www.imserious.net.


• Sheldon, Lee. The Multiplayer Classroom: Designing Coursework as a Game (Boston: Course Technology, 2012).

• “What Is Game-Based Learning?” http://www.youtube.com/watch?v=DuFcaPAx3jQ.

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Citation for This Work


Notes

2. Students and teachers from that era still speak fondly of games like Where in the World Is Carmen Sandiego and Oregon Trail.
15. Interview with Chris Stubbs, Project Manager, Educational Technology Services, The Pennsylvania State University, by Judith Pirani, April 2012.
17. Interview with Kurt Squire, Senior Investigator/Creative Director, Educational Research Integration, Morgridge Institute for Research, University of Wisconsin, Madison, by Judy Pirani, April 2012.
20. Interview with Christine Y. Lupton, Manager, Engage program, University of Wisconsin, Madison, by Judith Pirani, April 2012.