Video Games as Learning Tools for Project Management

Rudy McDaniel, Steve Fiore, Adams Greenwood-Ericksen, Sandro Scielzo, and Janis Cannon-Bowers

PROSE Laboratory
University of Central Florida

Abstract

In this paper, we begin by discussing some of the statistics that reveal electronic gaming’s place as a major force in today’s economy. We next discuss two of the major problems involved with the usage of video games as a tool for teaching and learning in digital media: the issues of inconsistency and complexity. Gee’s pioneering work (2004) is used to establish some principles of gaming that transcend these problems and present a unique medium with which to examine the nature of digital media and its principles and tools. We expand upon Gee’s work to suggest specific ways that video games can be used to teach digital media students about a particular subset of digital media – in this case, that of project management, and speculate as to how this might be done in several genres of gaming. We conclude with a brief case study of our experiences in working with digital media students to build a video game that was used to teach fourth graders about African-American history and the Underground Railroad.

Why Video Games?

The Entertainment Software Association (ESA) – formerly the Interactive Digital Software Association (IDSA) – not surprisingly, takes an aggressive position on the popularity of electronic gaming in society. Within their yearly publication on gaming demographics, the organization includes this quote from USA Today writer Kevin Maney:

…if you’re over 35, chances are you view video games as, at best, an occasional distraction … If you’re under 35, games are a major entertainment and a part of life. In that sense, they are similar to what rock ‘n’ roll meant to boomers.

All one needs to do to witness the phenomenal popularity of video games is wander inside the home of a young adult and take a look at their television’s peripheral connections. Chances are, you’ll find attached one or more gaming consoles (a Playstation2 or Gamecube maybe, or perhaps even an Xbox 360) and an accompanying assortment of popular gaming titles. If not a console platform, there is likely a computer nearby with access to game titles in PC or Macintosh format. Gee notes that “the video-game industry makes as much money or more money each year than the film industry” (2003, p. 6). Seventy-five percent of heads of households play some type of electronic game, with the average gamer’s age being 30 (up one year from 2004), and the largest segment of gamers (43%) being between the ages of 18 and 49 (Entertainment Software Association, 2005). From these figures, it is evident that a large number of the students filling seats in college classrooms have at least some experience in electronic gaming, and that they are
likely to be open-minded toward teaching methods that take advantage of digital gaming or
digital gaming methodologies.

Even the gender inequity seems to be gradually decreasing, as the latest figures from the ESA
reveal that 55% of gamers are male and 43% are female, a set of statistics that suggests the
dearth of female gamers may no longer be a problem in future years. The increasing percentage
of female gamers suggests that this discourse community – what Gee might describe as an
affinity group – seems to be gradually fighting for equilibrium, and the ESA also notes that
“women over the age of 18 represent a greater portion of the game-playing population (28%)
than boys from ages 6 to 17 (21%)” (p. 5). Furthermore, female gamers are not confined to a
single gaming genre as some have speculated; Carr’s (2005) examination of gaming at an all-
girls state school in the UK found that female games enjoyed playing not only “God-games” or
simulation games like The Sims, but also other types of sports and fighting games previously
thought to be the domain of male gamers only. These games included such titles as Tony Hawk’s
Pro Skater 4 and Dead or Alive 3. Carr notes, “To attribute gaming tastes directly,
solely, or primarily to an individual subjects’ gender is to risk underestimating the
complexities of both identity and preference.” (p. 479). Both the increasing numbers of female
gamers and the wide breadth of interest for these gamers provide hope that digital games may in
fact provide a means for better engaging and teaching both male and female students in the
digital media classroom.

While the market penetration of gaming makes a convincing argument for the popularity of
games, it does nothing to suggest these games are well-suited for non-entertainment functions
such as teaching. In terms of connecting gaming with the classroom, we now have at least a
small base of materials from which to draw ideas and frameworks for pedagogy and assessment.
Much has been written about the potential of video games for teaching and learning in the 21st
century (Prensky, 2001; Gee, 2003; Dekanter, 2005; de Castell & Jenson, 2004). The journal
Simulation & Gaming recently devoted two entire issues of the journal to a special symposium
on video gaming and learning (see Myers, 2005). While these sources are a great start, much of
the discussion so far has been focused on the potential of the medium rather than concrete
examples of connecting gaming technology to pedagogy (e.g. Gee, 2003, p. 9).

Many of these researchers note that gaming solutions are successful because they better address
the learning patterns and multimodal competencies of those growing up with devices such as
Ipods, Blackberries, PDAs, and multimedia phones. These devices now infiltrate all parts of the
Information Age culture we find ourselves immersed in, from home to school and work
environments; de Castell and Jenson label this new type of atmosphere as an “attentional
economy” (2004, p. 381). Gamers are also cultivating a skillset that is becoming increasingly
compatible with this type of economy. As Dekanter (2005) notes, “The elements of interactive
game playing – adaptivity, competition, communication – are becoming the traits of successful
students and workers” (p. 28). The task for instructors is now to try and harness these interactive
skills and competencies and focus them in a more useful direction.

The Problems of Inconsistency and Complexity

When considering the problems involved with using digital game technologies as a tool for
instruction, it is possible to divide those problems into two groups: problems that take place
during the construction of games (i.e. design issues) and problems that take place during the playing of games (i.e. runtime issues). In the former, there is the potential to correct or improve educational video games by simply a) following sound design practices and researching those elements of the types of successful video games that players now demand using existing technologies, or b) developing a new gaming architecture that can support an educational game from the ground up. In the latter, during runtime, there is less opportunity to implement prescriptive measures, but it is useful to at least acknowledge the complex social, cultural, and critical environments that are present when a player is interacting in virtual space. That being said, there is plenty of literature elsewhere that focuses on the inequities of the video game playing field or on the stereotypical, cultural, or aggressive implications of digital gameplay (see for example Carnagey & Anderson, 2005; Colwell & Kato, 2005; or the United States Senate’s Hearing on the impact of interactive violence on children, 2000).

One significant problem with the notion of using gaming as a pedagogical tool during design, though, is related to the inconsistency of the medium. As Apperley (2006) notes, the general feature of interactivity is not enough to unite video games of all makes and models under one common umbrella. As opposed to a textbook, for example, where commonalities such as structural and organizational entities (e.g. tables of contents, page numbers, title pages, covers, etc.) are generally shared from one book to the next, video games have no such consistency, particularly in regard to aesthetics and visual look and feel. From one game to another, it is common to have completely redefined notions of gameplay, graphical fidelity, problem-solving strategies, scoring, collaborative play, and so forth. While genres of games may share some consistency in this regard, even within a specific domain of video games – first person shooters or real time strategy games, for example – there will undoubtedly be some variation to the ways in which a player interacts with the medium and its virtual components. Of course, this is often also precisely what makes video games so great. Variations in gameplay, story, and mechanics have led to innovations and creative applications of programming and multimedia that transform games from mediocre performers to blockbuster titles. Nonetheless, this inconsistency presents a challenge for those wishing to make use of structured lesson plans within a gaming environment.

Apperley argues for a move towards the study of what he calls the “nonrepresentational” characteristics of video games – those characteristics (primarily interactivity) that are not centered on the visual aesthetics of the medium. Specifically, he proposes the creation of “…a more nuanced, meaningful, and critical vocabulary for discussing video games; one that can perceive the underlying common characteristics of games that might otherwise be regarded as entirely dissimilar if judged solely on representation.” (2006, p. 7). While this task is undoubtedly a formidable undertaking, his idea is laudable; possessing such an understanding of the intricate differences in various types of interaction would do much to assist educators and potential designers in the construction of game-based scenarios and new media learning environments. Furthermore, such a repository of design guidelines could be used to weed out problematic or inconsistent gameplay scenarios – if ninety-nine percent of users pick up objects in a virtual world using the same type of controller interactions, then it is probably safe to say that a significant change to this procedure is likely to be frustrating or confusing to a player. To this extent, then, a lack of commonality at both the macro (gaming as a medium) and micro (similar types of games that exist within specific game genres) levels poses problems for the effective use of video games as pedagogical tools.
An equally troublesome characteristic of modern video games is that of complexity. Video games are complex and complicated by nature; the hardware generally has only very limited resources available and the software must be as efficient as possible in order to achieve the fast frame rates and the photorealistic fidelity that modern players demand and crave. In addition to that, the production of a bestselling video game is a massive undertaking. The game *Gun* (2005), designed and developed by the game studio Neversoft, lists hundreds of names in its production credits, representing professionals from producers and art directors to voiceover actors and quality assurance employees. On the backend, video games often possess a million lines of programming code or more and can cost millions of dollars to produce, market, and distribute (ESA, 2005). To create a video game that has entertainment-quality graphics, story, audio, and gameplay, then, is no small endeavor.

Fortunately, there have been several attempts at creating open source game design engines that allow developers to extend core sets of functional code in new directions based on their needs and desired outcomes. These engines generally include the core functionality necessary for the creation of a 3d navigable environment, and implement methods for dealing with physics, object collisions, and the importing of art objects and models. One online collection provides information on over 240 such 3D engines (DevMaster.net, online) each with its own set of features and custom tools. Other popular engines such as Ogre3D, Delta3D, and Panda3D have been created and tested in specialized areas such as academia or the military.

In addition to open source engines, another option for minimizing the complexity of game development is to use an engine that has been associated with a commercial video game such as *Half Life* or *Neverwinter Nights*. Rather than using this engine within the context of the original game, though, developers have created toolsets that allow players to create their own environments, characters, dialog, and art – giving way to a new breed of game players known as game modifiers or more often simply “modders.” Modding games, while still a complicated process, simplifies the task of game development enough so that even college students unfamiliar with programming or 3d modeling can learn to create a video game environment over the course of several weeks. Modders can design their environments to different types of items, gadgets, “characters, enemies, modes, textures, levels, and story lines” that may be useful for any given learning environment (Wikipedia, online). An example of this process using an Underground Railroad narrative is explained in greater detail at the end of this paper.

**Learning by Designing**

Given the problems of consistency and complexity discussed above, perhaps a step in the right direction would be to focus on those aspects of game design that are relevant to other areas of digital media curriculum. This is one of Gee’s core learning principles. Out of the 36 he mentions in his text, the Design Principle is number two, and is described as “learning about and coming to appreciate design and design principles” (2003, p. 207). For instance, in courses requiring students to learn about interactivity, it might be worthwhile for them to implement interactivity first in a CD-ROM environment, then in an Internet environment, and finally in a gaming environment, thus roughly mimicking the evolution of interactivity in industry (see DeKanter, 2005, p. 26). Given the same source of content, then, a student would be able to observe the ways in which the user experience changes as a viewer/browser/player is given increasing amounts of control over their environment and the objects that exist within that
environment. In this regard, digital media instructors have a wealth of information to choose from (digital audio, three-dimensional art and modeling techniques, narrative structures and plot devices, etc.). Furthermore, by building a product that would be used to teach others about these concepts, students are likely to retain this information for a longer period of time than they would simply sitting in a classroom listening to a lecture. In fact, the Learning Pyramid model of interactive learning retention rates associates a straightforward lecture with only a 5% retention rate, while a situation in which a learner teaches others about a concept or uses the concept immediately warrants a 90% retention rate (DeKanter, 2005, p. 27).

From a project management perspective, the design of practically any type of game is relevant to the objectives of the course. For example, in a media project planning course, an instructor might introduce students to proposal writing, scheduling, resource management, collaborative teamwork, and presentation skills. By asking small groups of students to work throughout the semester and build a single “level” or “scene” of a moddable video game, they would have the opportunity to learn about many of these topics in great detail. A final presentation on the group’s accomplishments would further connect the project to curricular goals.

An even easier way to connect students to digital media coursework through gaming, though, is simply to ask them to play their favorite games and then use this gaming experience as a device to drive in-class reflection and discussion about a lecture topic. In this type of situation, relatively little up-front planning is necessary, and there are no complicated programs to install or freeware tools to download. In the next section of this paper, we discuss ways in which playing games can be used to generate new ideas and thoughts about project management in a multimodal environment.

Learning by Playing

As the video game industry is necessarily highly secretive and competitive, the lessons learned from the industry often must come from the end user perspective, in other words: what can we learn from playing the games rather than from studying the process of video game development? Gee’s seminal text What Video Games Have to Teach Us About Learning and Literacy has done just this; it has claimed that something useful can be learned from all types of video games, whether these games are massively-multiplayer online role-playing games like World of Warcraft, Gamecube simulation games like Pikmin, or even the globally ubiquitous first-person shooter games like Halo 2. In addition, Gee’s text has helped to reignite interest in educational gaming technologies; the term “edutainment” has recently been replaced with the more politically pleasing “serious gaming” (Sawyer, 2005). Furthermore, serious gaming has led to what some have called “serious play” (de Castell & Jenson, 2004, p. 384). While the phrase is an oxymoron at first glance, a better way to think about the concept is to consider the task of play in its normal context but with an additional emergent property that leads to outcomes in a specified discipline. For Derrida (1997), “play” led to the formation of new ideas about linguistics and linguistic theories. For digital media students, play might instead lead to new ideas about optimizing project workflows or creating new juxtapositions of narrative and media. In either case, though, play can be thought of as a tool leading to new ideas and outcomes.

In this section, we expand upon Gee’s 36 learning principles of video games to add three more principles relevant to what we have called runtime project management in the field of digital
media. We call these principles the Interactive Learning Principle, the Attention-to-Detail Principle, and the Ethics Principle. For each of these three principles, we discuss actual projects that depend upon the skills cultivated by these types of learning. Next, we discuss and critique particular video games with which students can study, develop, and hone these skills.

1. The Interactive Learning Principle

Crawford (2005) defines interactivity as “a cyclic process between two or more active agents in which each agent alternately listens, thinks, and speaks” (29). Using this definition and a metaphorical interpretation of what it means to listen, think, and speak, we can assess the quality of interaction by determining how well a virtual system can continue to engage a user’s attention in order to sustain interest in the virtual environment. In a video game, this equates to keeping the player playing for as long as possible. In successful video games like the Ratchet and Clank series for the Playstation2, many innovative techniques have been developed to keep the user interested and immersed in virtual space. Many of these techniques are directly applicable to the world of media project management, and include concepts such as:

1. Forward-thinking design: How do you design products that allow the user to visualize additional interactivity once certain operations have been completed? For instance, video games like Ratchet and Clank will show additional areas of each level that the user will be unable to access until they have collected certain items or solved certain puzzles. How can such techniques encourage a longer interaction?

2. Cooperative and collaborative media design: How can you devise a world in which sound, vision, and gameplay operate as a single, cohesive unit? How can you plan projects so that each member of the team has an overall vision of the product rather than segmented and isolationist perspectives that encourage last minute work plans? Such design also calls for improvements in communication in all phases of the project cycle.

3. Distraction and misdirection through narrative: The earliest Playstation games included long load times during which a progress bar would slowly creep across a user’s screen as the next environment was loaded into memory. More modern games such as Ratchet and Clank instead use dynamic loading technologies in which the next environment is gradually loaded into memory as the player progresses. In addition, cutscenes of video can be used to advance the storyline for a video as the next environment loads. Such sleight of hand techniques can be used to sustain immersion while still performing the necessary technological steps of loading data and preparing the system for the next set of gameplay requirements.

In addition to the Interactive Learning Principle, other runtime characteristics related to project management include phenomena we might describe as the Attention to Detail Principle and the Ethics Principle. Examples of the principles are given below.

2. The Attention to Detail Principle

The game of Zork, which is an interactive video game of the earliest variety (the game is text only), encouraged players to cultivate a precise and simplistic vocabulary when communicating
with the game and directing the actions of the virtual player. The instruction “give the jewel encrusted egg to the thief,” for example, might be more successful than “give jewel to thief.” With modern games now impressively grounded in high-fidelity graphics, such attention to detail is cultivated in other ways. An analysis of these types of games might permit an instructor to communicate the importance of detail to digital media students when other methods are unsuccessful.

3. The Ethics Principle

Like simulation, gaming can also provide a safe environment in which to experiment with ethics or to discuss ethical situations. In project management especially, students will often find themselves in situations where their personal beliefs about ethics will generate action in one direction or another.

The ethical decisions made by game designers can provide one such entry point for discussions of ethics. A simple example can be found in a sports game such as Mario Golf. Mario Golf is a golf simulation for the Nintendo Gamecube. In this game, a player is permitted to taunt other players during multiplayer game with mild insults and annoying phrases that are built into the character’s repertoire. Is such a design encouraging unethical behavior, or is it simply making the game more enjoyable for other players during their periods of inactivity? The fact that a player’s ability to taunt ceases when the active player begins their backswing further complicates this issue. Massively multiplayer online games also routinely provide opportunity for unethical behaviors; economic issues such as the management of virtual capital (buying or selling money on the Internet) and the existence of virtual outsourcing (paying other people to build up the attributes of your character, often referred to as “farming”) are only two such examples.

Obviously, examples of games requiring attention to detail or games presenting ethical dilemmas are easy to find in contemporary best-selling games (ethics is something routinely discussed in the media in regards to games like those found in the Grand Theft Auto or Hitman series, for example), but challenging students to find their own examples of these learning principles from their own favorite games is perhaps an interesting exercise in and of itself.

Example: A Brief Case Study of Synthetic Learning

For a more concrete example, we can consider the creation of a “modded” video game that was designed to teach fourth graders about African-American history and the Underground Railroad. The game, dubbed the Carol Mundy Video Game, incorporates digitized artifacts from local historian Carol Mundy’s private collection. The goal in this project was to create what we describe as a Synthetic Learning Game, or SLG, in order to a) teach college-level digital media students about project management at design time, and b) teach primary school students about history and culture at runtime. Fourth grade is also a significant grade level for this type of game technology; as Gee notes, the transition from the first three years of elementary school (where students are primarily learning to read in a general sense) to the fourth year (where reading becomes focused in particular subject areas) can be particularly difficult, even leading to what has been known as the “fourth-grade slump” (2003, p. 17).
We describe SLGs as digital-media based environments that provide deliberate, well-managed synthetic experiences as a means to enhance learning and performance. We are using the term synthetic learning environments (SLEs) to describe such systems, and seek to generate knowledge that leads to their optimization in both design and implementation. This particular collection provides a unique look into the lives and histories of Central Florida life from the 1720s to the 1970s, and is one that Carol Mundy was hoping to make accessible to the general public, particularly to the schoolchildren learning about African-American history and culture. Access to her special collection of historical materials was enabled through her African American History Education and Culture (AAHEC) organization.

This SLG project was funded by UCF’s Institute for Simulation and Training as part of a collaboration between UCF’s Cognitive Sciences program and the School of Film and Digital Media. This in-house grant provided enough funding (around $6,000) to support the development of a single level that included targeted learning materials and digitized artifacts from Ms. Mundy’s collection. This effort supported the development of a demonstration version of a story-driven learning game used for research in finding new ways to teach children about African-American culture and history using video game technology. Our goal was to create a compelling introduction to the Underground Railroad using existing “off-the-shelf” technology for role-playing computer games so as to stimulate interest and understanding of events of historical significance while introducing the public to historical artifacts. The collaborative and multidisciplinary efforts involved with this development process contributed to the formation of the Partnership for Research on Synthetic Environments lab (PROSE) lab, which was formed to continue the study of synthetic learning in various environments. One of the first opportunities for learning for the digital media students involved was simply to use the Gantt chart constructed for the grant as an exercise and explain how this type of chart is useful for working on complicated projects (Table 1).

<table>
<thead>
<tr>
<th>Plan of Work Tasking</th>
<th>Weeks from Start</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2</td>
</tr>
<tr>
<td>Task 1. Review Mundy artifacts</td>
<td></td>
</tr>
<tr>
<td>Task 2a. Identify <em>History</em> Sunshine State Standards</td>
<td></td>
</tr>
<tr>
<td>Task 2b. Identify <em>African American Culture</em> Sunshine State Standards</td>
<td></td>
</tr>
<tr>
<td>Task 3. Identify modifiable COTS</td>
<td></td>
</tr>
<tr>
<td>Task 4. Develop storyline for use in prototype SLG</td>
<td></td>
</tr>
<tr>
<td>Task 5. Modify COTS via integration with artifacts and storyline</td>
<td></td>
</tr>
<tr>
<td>Task 6. Develop challenge activities to facilitate learning processes</td>
<td></td>
</tr>
<tr>
<td>Task 7. Incorporate challenge activities into prototype SLG</td>
<td></td>
</tr>
</tbody>
</table>
A screenshot of this game – the story begins on a North Florida indigo plantation – is shown in Figure 1. The initial task given to the player is to escape from this plantation and find freedom to the north. The player is given background information about their task and environment through the use of an interactive text window placed at the bottom of the screen. Connections to appropriate fourth-grade standards are then made by tying into specific benchmarks from the curriculum, in this case the Florida Sunshine State Standards for history (see Figure 2).
While the game itself is interesting, what is more pertinent to the topic of this paper is the way in which the creation of this game inspired university students to be better project managers and team leaders. While the head designer for the project was in fact a Human Factors doctoral student, digital media students were involved in many aspects of the games production, from synthesizing original digital music to developing storylines, programming dialog, and scripting gameplay interactions.

As these students worked with the mod tools available to them in this particular toolset, they began to think about things like interaction and resource management in entirely new ways. For instance, rather than thinking about interaction in the general terms of a human interacting with a machine, they began to understand interaction in more specific terms as they were tasked with creating interactive dialog and trigger-driven responses for the characters in their environment. In addition, they began to see resource management strategies as an essential part of the design process; certain models, textures, and maps were only able to be used in certain situations, and considerations like the density of characters or objects in a scene were critical to both the dramatic and interactive success of a given level or scene. Even the mapping of locations within the game provided an opportunity to teach students about the importance of goal-directed project management and the use of milestones within a project schedule (Figure 3).

![Figure 3: Level Layout for Mundy Game](image)
Conclusion: Implications for the Digital Media Classroom

In this article, we have examined only a few of the properties of computer and console games that make these technologies so compelling and interesting for teaching and learning situations. By discussing a use for gaming in a particular context, though, we hope to have shown how a focused application of gaming technologies can be useful as a means for engaging and exciting students about even seemingly bland topics like project management. Many other possibilities remain, from using games as simulators for universities, training, and hospitals (already being done) to using them as vehicles for environmental policy or for peace activism, as Crookall suggests might be a worthy pursuit (2005, p. 437). By using games as a tool for learning during both design and play phases, it is possible to produce flexible outcomes for two very different categories of learning materials. Design time is an ideal opportunity to learn about the actual practice of project management, while runtime provides a perfect time to reflect and discuss the outcomes made possible by good project management strategies and open lines of communication within a team.

The enormity of this medium is what makes it so exciting, but this breadth of material and depth of textual complexity also makes it a dangerous and volatile entity capable of producing more distraction and entropy than genuine improvements in learning and retention. By considering video games as both text (subject of critical analysis) and technology (subject of technical analysis) we can begin to uncover the potential of this digital juggernaut as a classroom aid and as a motivational tool for learning about digital media theories and techniques. Indeed, if we are to survive in what de Castell and Jenson describe as an attentional economy, then we can imagine no greater form of currency than that of the video game.
Works Cited


*The Impact of Interactive Violence on Children*, United States Senate, One Hundred Sixth Congress, Second Sess. (2000).