Game-based teaching: what educators can learn from videogames

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Most teachers only dream of their students spending the amount of motivation, attention, passion, and critical thinking on their classes that some students do playing videogames. This investigation examines the success, pitfalls, and lessons learned from incorporating videogame-like components into an educational technology class. For example, just as videogames are composed of levels, students in this class chose various levels at which to complete assignments but had to earn a certain number of points before being able to move on to the next assignment. Students’ think-aloud data as they completed assignments show parallels between their cognitive, motivational, and affective processes and those of gamers. Comparing course evaluations, student comments, and focus group data across several iterations of the class, including a traditional version that primarily consisted of direct-teaching, suggests that integrating principles of videogames into the structure of a class can help motivate learners, differentiate instruction, and increase student learning. The term “game-based teaching” is derived from Prensky’s notion of “game-based learning” in order to focus more on how teachers can incorporate lessons from videogames into their classroom teaching with or without technology.

Keywords: videogames; technology; pedagogy; teacher education

Introduction

When I first began research in this area, my initial focus was on what videogames, or rather videogame programmers, can learn from educators. The more I thought about it, though, I discovered that there is much educators can learn from videogames. After all, I doubt my students spend hours on end on my assignments or thinking about my class but I know some of them are this obsessed with videogames – on average, teenagers spend as much or more time playing videogames than doing homework (Mayo, 2009, p. 80). Most educators only dream of their students spending the amount of motivation, attention, passion, and critical thinking on their classes that some students do playing videogames. Gee (2007b) argues “How good game designers think about game design… has much to teach us about how educators ought to think about the design of learning in and out of classrooms” (p. 168). I take the term “game-based teaching” from Prensky’s (2001a) notion of “game-based learning” in order to focus on how teachers can use general principles of videogames in their teaching with or without technology.
Findings from Project Tomorrow’s online survey suggest that K-12 students are hungry for their school learning to incorporate gaming (over 50%) yet parents (19%) and administrators (15%) are reticent to add videogames to the educational menu (Stansbury, 2008, p. 14). Regardless, students are gaming on their own time. A Pew Research Center survey reported that 97% of 12- to 17-year-olds play videogames, with 50% stating they played yesterday (Lenhart et al., 2008, p. 8). Game-based teaching – using pedagogical principles that videogames capitalize on – is one way to satisfy all customers. This study examines the success, pitfalls, and lessons I learned from my attempts at game-based teaching in the hopes that others will improve upon my efforts.

**Perspectives**

Many of the pedagogical techniques that videogames employ are not new to the educational scene, but teachers and teacher educators can learn from the new and innovative ways videogames use these techniques. Although in some cases videogames are uniquely suited to leverage certain pedagogical techniques, teachers can still take advantage of lessons learned from videogames. For example, just as videogames can readily adjust to the levels of individual users to provide the optimal amount of challenge, what Prensky (2006) calls “adaptivity” and Gee (2003) terms the edge of “regime competence,” teachers can provide students with options for different levels of achievement to emulate this in the classroom by targeting students’ “zones of proximal development” (ZPD) (Vygotsky, 1978), i.e., when learning is challenging but attainable. On the other hand, it would be rather labor-intensive for educators to provide a curriculum as individualized as videogames have the potential to be.

There are other ways videogames succeed where educators struggle. Successful students learn to set and manage short-term and long-term goals; videogame players do this, what Johnson (2005) calls “telescoping”, without having to be told to do their homework. Similar to Dewey’s (1938) experiential education, i.e., learning by doing, and Papert’s (1980) constructionism, i.e., learning by making, Gee (2007a) argues for “performance before competence.” By embedding the “learning” into the “doing,” learners employ discovery learning (Bruner, 1961) where learners use problem-solving and critical thinking to construct their own understandings of the material. As Prensky (2001a) points out, “discovery learning is what many games, and certainly all adventure games, are all about” (p. 160). In other words, videogames rely on constructivism, the idea that learners build their own knowledge structures.

Hypothesis testing and discovery learning have long been used in the classroom (Mayo, 2009), but videogame players, who also use “inductive discovery” (Prensky, 2006) or “probing” (Johnson, 2005), can take risks and learn from their mistakes because they can make multiple attempts instead of a one-shot paper that is due Tuesday. When that paper is turned in, the student does not receive feedback instantaneously, and often not immediately, unlike videogames, because it requires time for the teacher to grade all the papers and write individual comments. When playing a videogame, though, feedback is on the spot and often “just-in-time”, i.e., “when the learner can use it” (Gee, 2007b, p. 24) and/or “on demand”, i.e., “when the learner is ready” (Gee, 2007b, p. 25), thus providing the assistance, or “scaffolding”, necessary to help learners learn within their ZPD. When feedback is received in the classroom, students often interpret it as a “judgment” from the teacher (Gee, 2007a, p. 63) whereas videogames sometimes have humorous or engaging feedback, which can
encourage players to make “mistakes” on purpose to find out how the game responds (Prensky, 2001a, p. 159). In the classroom, mistakes result in punishment – a lower grade. When playing videogames, risk-taking is encouraged due to decreased real-world consequences, or “psychosocial moratorium” (Erikson, 1980), so mistakes are seen as learning opportunities (Gee, 2003; Prensky, 2001a; Shaffer, 2006). This allows videogame players to remain engaged in the game while still invested instead of receiving feedback after losing interest or becoming discouraged after receiving negative feedback, unfortunately what happens all too often in school.

In addition, the potential for immersion that videogames offer due to their 3-D graphics capability is difficult to rival in a traditional classroom setting. This immersion contributes to what Csikszentmihalyi (1990) calls “flow”, or total engagement, and what Turkle (1984) describes as an “altered state” (p. 83) that people experience while playing a videogame, which she compares to transcendental meditation. Csikszentmihalyi (1990) asserts that “The more a job resembles a game – with variety, appropriate and flexible challenges, clear goals, and immediate feedback – the more enjoyable it will be regardless of the worker’s level of development” (p. 152). To keep players in their ZPD, videogames often require a certain level of mastery before players are allowed to move to the next level, similar to what educators call mastery learning (Bloom, 1980). When these elements, and others, are combined, videogames can capitalize on humans’ natural desire to learn, or “achievement motivation” (McClelland, cited in Driscoll, 2005, p. 311). A great potential lies in this intersection of best teaching practices and the capacities of videogames.

Although some may argue that imitating videogame players is the last thing a teacher should want his or her students to do, according to Squire (2008), playing videogames fosters positive qualities:

Surveys of gamers show that they have an increased appetite for risk, a greater comfort with failure, a stronger desire for social affiliations, a preference for challenges, a capacity for independent problem solving, and a desire to be involved in meaningful work when compared with nongamers (Beck & Wade, 2004). Underlying Beck and Wade’s argument is a notion of changing literacies; gamers have grown up with a medium built on assumptions unlike those in print cultures (e.g., a game engine can be tinkered with, a text is not necessarily print based or defined by book covers); game players are coauthors along with game designers, co-constructing the game-as-text through their own action (cf., Robison, 2005). Gamers have grown up in simulated worlds, worlds where anything is possible, and where learning through trial and error is expected, information is a resource for action, and expertise is enacted through both independent and collaborative problem solving in self-directed tasks. (Simpson, 2005, p. 658)

Gee (2003) describes videogame players as being able to take on new identities and perspectives, see themselves as active problem-solvers, view mistakes as “opportunities for reflection and learning” (p. 44), undo a previous way of solving a problem in order to learn new ways, and take risks. Because of these changes in thinking and behavior that technology has encouraged, Prensky (2001b) points out that “Today’s students are no longer the people our educational system was designed to teach” (p. 1). To accommodate this, educators need to learn to adjust their teaching to new generations of students. Turkle (1984) describes videogames as opportunities for people to “learn… how to learn” (p. 67). In our rapidly changing world, that should be the goal of school.

Other educators have also incorporated principles of games into their classes, mostly by playing games to teach specific concepts, but rarely is the class structured
as a game. In cases where this has been done, such as Barnard University’s “Reacting to the past” courses which are semester-long role-playing games, student motivation has increased. Even Denby (2000), a self-described traditionalist, describes students in a “Reacting to the past” course as “engaged all the time” (p. 1). Perhaps this is because of Gee’s (2003) “identity principle” where learners learn by taking on different roles. Similar to role-playing scenarios, problem-based learning also employs some of the same principles of videogames. In describing the “clinical simulation training” used in University of Edinburgh’s medical school which combines problem-based learning and role-playing, Begg, Dewherst, and Macleod (2005) conclude that “Rather than perceiving games solely as a platform in which learning content can be delivered, educators might offer more effective learning opportunities by integrating the learning principles within games into teaching practice” (Conclusion, p. 1), what they term “game-informed learning”. Vygotsky (1978), in arguing for the importance of play in learning, defines play as a world in which “unrealizable desires can be realized” (p. 93). Certainly emulating videogames is one way to create this world by providing learners opportunities to explore “epistemic frames” (Shaffer, 2006), or multiple ways of knowing.

Methods

I incorporated elements from videogames into my teaching to help answer the question: What happens when some general principles behind videogames are incorporated into instruction? To answer this question, I compare a traditional version (N=10) of an elective course designed to teach pre-service teachers how to integrate technology into their teaching to multiple versions of the course (N=69) when different game-based principles were used to structure the course. In other words, videogames were not used in the course, rather the course itself was a game. The students were a mix of career-changers, new teachers, undergraduates (25%), and recent graduates who were primarily Caucasian (90%), ranged from working class to middle class, were mostly female (66%), and had a range of technological expertise – describing their relationship with technology from “fear of the unknown” to having a “digital childhood”.

Just as videogames give constant feedback allowing for informed adjustments, I used feedback from pre- and post-assessments, focus groups, teaching artifacts, and final course evaluations to prompt changes in instruction. To capture the effects of these changes, I used qualitative content analysis (Morgan, 1993) to quantify patterns that emerged from qualitative data by counting the number of times a concept appeared on course evaluations, descriptive statistics to compare course evaluations from a traditional class with different versions of game-based teaching classes, and qualitative analysis of think-alouds to explore this experience from students’ perspectives. From this, I was able to examine what worked and what did not in my game-based teaching.

There are limitations to these data. Comparing data from the traditional mode of teaching to the game-based teaching mode is not a clean comparison because, like any comparison of teaching situations, there are multiple variables that cannot be controlled. Each class takes on its own personality and that unique combination of people, time, and place cannot be replicated. Also, my own teaching may have improved between fall 2004, when I taught the traditional class, and fall 2006, when I began teaching the game-based teaching classes. Most importantly, the traditional
class was taught at a different university than the game-based teaching classes, which introduces another host of complicating factors including different questions asked on the course evaluations and students from a different demographic pool with different sets of expectations. The traditional version was taught at a private religious university whereas the game-based classes were taught at a public commuter school. However, the stark differences between the data gathered from the traditional class and from the game-based teaching classes do suggest incorporating videogame-like elements into the structure of a class can provide a powerful means of learning.

**Background**

The first time I taught this educational technology class, I taught in a much more traditional manner of direct instruction. I told students what to do and then expected them to be able to do it. My course evaluations from this first semester were not stellar. My overall score was 2.6 out of 4, although the students did at least say they learned something (3.28 out of 4). Teaching in this manner resulted in some scathing comments being posted on a ratemyprofessor.com type website such as “I found the class to be very long and boring and left with very little knowledge other than the fact that if you use AIM Chat on a different computer, it changes your buddy icon”. Needless to say, this was discouraging and I vowed never to teach the class again.

By attending a series of workshops on designing websites, I had the chance to view that teaching style from a student’s perspective. The instructors largely told us what to do and then the students imitated them. During these workshops I was amazed at what I could produce, but I had difficulty replicating this success on my own. I liken it to driving with a navigator who tells you exactly where to go versus using a map to figure it out yourself. If someone guides you every step of the way when you are in unfamiliar territory, you will not remember your path. The information enters short-term memory but then leaves before being transferred to long-term memory. On the other hand, when you have to figure it out yourself, similar to videogames, you engage in the deeper processing that commits the information to long-term, or at least longer-term, memory. With this in mind and another opportunity to teach educational technology, I set out to reconfigure this class.

**Implementation of game-based teaching**

The crux of this new mode of teaching involved designing assignments that resulted in students creating meaningful products they could use in their own classroom teaching, employing Papert’s (1980) idea of constructionism, or learning by making. Similar to videogames that allow multiple attempts, in this new iteration students could submit these assignments multiple times for more points, a hit among students because it changed mistakes to “learning opportunities” (Shaffer, 2006), gave students more opportunities to practice based on feedback, and allowed students to take more risks because real-world consequences were decreased, employing Gee’s (2003) “psychosocial moratorium principle”. Students also had to earn a certain number of points before moving on to the next assignment, replicating a common feature in videogames where the player has to earn a certain number of points before moving on to the next level, or “leveling up” (Prensky, 2006). Using an algorithm in the selective release feature of the learning management system gave me an automatic way to make available the next assignment when the student had accumulated
the requisite number of points. Each assignment could be completed at one of three levels: Proficient, Expert, or Guru, with each level garnering an increasing number of points, again similar to videogames that allow the user to select the level of challenge. For example, the website could be designed freehand (proficient), using tables (expert), or using layers (guru). This added the element of “adaptivity” (Prensky, 2006) so students could learn at the edge of their “regime competence” (Gee, 2003) and allowed students to use their own “self-knowledge” (Gee, 2003), or metacognition. This permitted a class consisting of students with a wide range of technology expertise to complete assignments in their ZPD, but also allowed me as the professor to set a minimum threshold of competence.

Each assignment built skills necessary for later assignments – thus providing “well-ordered problems” (Gee, 2007a, p. 35) that prompted transfer. For example, for the first assignment students: defined styles in a word processing program – introducing them to styles such as those used in web design; inserted hyperlinks to websites – introducing them to inserting hyperlinks in other programs; and created comprehension questions that used bookmarks to link to the section of the text containing the answer – introducing them to named anchors used in websites. For the presentation software assignment, students storyboarded and created hyperlinks within the presentation to introduce the non-linear thinking necessary for web design. In addition, each assignment had a very concrete rubric, allowing students to get immediate feedback based on whether or not they were able to complete certain tasks. Leveling, “well-ordered problems”, immediate feedback, resubmission, and discovery learning form the core of game-based teaching.

Difficulties encountered

Although I received positive responses to game-based teaching, there were some elements that either did not work or that students did not like. Feedback from the first group of students made me realize students were already acculturated to school norms so reactions to these changes were informed by students’ notions of what counts as school learning, students’ expectations for teacher and student behavior, and students’ patterns developed from a lifetime of schooling. For example, having no deadlines except for the end of the semester meant that many students put off doing assignments until the last minute, dashing their opportunities for multiple submissions and making it difficult to build on their learning. Taking into account this feedback for the next group of students, each assignment had a deadline for their first submission, but they could resubmit assignments multiple times afterwards.

This teaching style also posed difficulties for managing curriculum because students needed different learning opportunities at different times so I developed more tutorials that students could do on their own and manuals students could use as reference. This provided scaffolding for these assignments that relied on discovery learning (Bruner, 1961; Gee, 2003; Prensky, 2006; Shaffer, 2006). Each tutorial employed the software that it was teaching. For example, I used Excel for the Excel tutorial where each step was a different worksheet and I used the pastelink feature to carry students’ work on the previous worksheet forward. Similar to hints in some videogames, I used comments to provide clues for each step so they could be accessed “just in time” and “on demand” (Gee, 2007b). Each hint gave increasing levels of detail and more direct instruction. The last hint for each step explicitly told the student what to do, operating more like a videogame walkthrough than a hint. I found that
some students would use the hint system as soon as they ran into a problem, whereas other students explicitly challenged themselves to complete the assignment without looking at a single hint – thus students could determine when to take down their own scaffolding allowing them to “telescope” (Johnson, 2005), or set their own short-term and long-term goals.

Most students responded that they loved the point system, but some said it did not motivate them because they were already motivated to do well. Unfortunately, for many students “doing well” simply meant getting an A. I wanted to motivate students beyond getting an A – thus the Expert and Guru levels. I tried other “videogame” ways to motivate students to push themselves beyond the A. For example, I posted the name of the person with the highest number of total points weekly as an incentive for higher achievers to push themselves to excel further, hoping that this simulated the way posting the high scorer of videogames serves achievement needs (Turkle, 1984). Unfortunately, the same people dominated the “high score” and I worried that their high scores might discourage other students, which was confirmed by comments on evaluation forms and during focus groups. I have since stopped using this practice.

A videogame element that I added that needs reworking is narrative. When I play videogames, I find the storyline to be mere background noise, but I understand it may be more compelling for others:

Most adults describe the ‘stories’ of videogames as cute or funny but basically irrelevant to their play, saying that they like to play a particular game to work on a specific “skill”. Children identify more directly with the games’ characters as they are chased, besieged, or… saving the last family on earth. (Turkle, 1984, p. 71)

Because “the backstory gives an emotional ‘in’ for context and character role” (Begg, Dewherst, & Macleod, 2005, “Conclusion”, p. 1), narrative can lead to Papert’s (1980) syntonic learning, learning that takes place because the learner identifies with the task, object, context, and/or character. Taking on the characters of videogames allows videogame players to explore their own identities (Turkle, 1984) and experience new perspectives (Gee, 2003). Prensky (2001a) ties the power of stories to the evocation of emotion and also notes that one of the advantages videogames have over books and movies is that the “reader” interacts with the “author” to co-construct the story (pp. 126–127). Mayo (2009) cites this sense of agency as one of the most important features of videogames that can enhance learning:

Learner control over navigation through tasks and activities is a surprisingly important feature of effective learning games. The metastudy by J.J. Vogel et al. (15) found learner control/autonomy to be one of the few easily identified predictors of enhanced learning outcomes. (Mayo, 2009, p. 80)

According to Murray (1997), these elements of immersion and agency mark the new narrative. Gee argues: “one of the primary ways – probably the primary way – human beings make sense of their experience is by casting it in narrative form” (quoted by Kutz, Groden, & Zamel, 1993, p. 40). My own personal experiences outside of videogames support the power of stories. For example, when my father was in the hospital after having a stroke I read him the second Harry Potter book. About 10 months later I suggested we watch the second Harry Potter movie. As the movie played, my father kept insisting he had seen the movie before. I kept insisting we had seen the first one but not the second. Finally, he said, “I must have seen this before
because I know the plot”. I responded, “Of course you know the plot, I read it to you”. He then stated that he had no recollection of me reading him the story, but he vividly remembered the storyline.

With all of this in mind, I included a storyline in the directions of each of the assignments so it was parcelled out only as students reached the next assignment. Each storyline segment had the assignment built into the plot and an accompanying link to a video that went along with the story. For example, the story that introduces the first assignment was about a first year teacher who is frustrated because his students are having difficulty with reading comprehension. One night he is watching the Word segment on *The Colbert Report*, which involves a split screen with commentary on Colbert’s verbal “text”. This inspires the first year teacher to gloss the text for his students, which then becomes the first assignment. The next assignment then carries on the storyline of the first year teacher. One of the first videogames I ever played, *Jumpman*, had a rudimentary animation of a robot after completing each level. This motivated me to complete the next level so I could see the next segment of the alien story, what Johnson (2005) calls “seeking” (p. 37). Thus, the storyline provided “intrinsic rewards” (Gee, 2003). Unfortunately, students’ reactions to my storyline appeared neutral as none mentioned it on their course evaluations with some students stating during the focus group that they did not even notice the storyline. Unlike *Jumpman*, the storyline introduced the next assignment instead of immediately following completion of an assignment, thus not serving as an immediate reward. Also, I wrote the story and, admittedly, it is not very suspenseful. In addition, it failed to achieve the “projective stance of an ‘authentic professional’” (p. 68) that Gee (2007b) describes. In other words, although I used “you” in the storyline, because the story was more incidental to the projects and I did not point it out or really use it to frame the projects, students did not “inhabit the goals [and norms] of a virtual character in a virtual world” (Gee, 2007b, p. 68) and therefore the storyline did not become a compelling element of the class.

Some of the feedback from students and analysis of the think-alouds has led me to believe that perhaps I took the gaming metaphor too far by giving students too little guidance in completing their projects. For example, more than one student indicated on course feedback sheets that novice students needed more knowledge before being set loose. Although I would argue that feeling lost and “pleasant frustration” (Gee, 2007b, p. 36) are part of the fun of gaming, student comments such as “I don’t ever want to do this again” indicate that the lack of guidance moved beyond “pleasant” to the point of “frustration” and “anger” – some of the feelings expressed in the think-alouds. Kirschner, Sweller, and Clark warn educators about this danger:

> While unguided or minimally-guided instructional approaches are very popular and intuitively appealing, the point is made that these approaches ignore both the structures that constitute human cognitive architecture and evidence from empirical studies over the past half century that consistently indicate that minimally-guided instruction is less effective and less efficient than instructional approaches that place a strong emphasis on guidance of the student learning process. The advantage of guidance begins to recede only when learners have sufficiently high prior knowledge to provide ‘internal’ guidance. (Kirschner, Sweller, & Clark, quoted by Gee, 2007b, p. 156)

Certainly Gee (2007a) does not advocate a “no guidance” approach, instead he emphasizes the importance of teachers acting as guides to provide scaffolding (p. 108), but with the wide range of abilities in these classes, it was difficult to find the
right balance of guidance. Some students expressed that they “need direct instruction when learning skills” with one student stating “I loved when we had classroom instruction” – quite antithetical to the premise of this article. Other students “loved” the lack of guidance: “self discovery is best!” and “It was helpful [that you taught] in a self-discovery way. I learned and internalized everything!” Some students expressed that tutorials and peer support were key to their learning. In general, students expressed that direct instruction was needed to learn the basics, guided discovery (support by the teacher, peers, and tutorials) to advance further, and self-discovery once they had the tools to learn on their own. Although game-based teaching is structured on videogames, not all elements of videogames translate easily into classroom contexts.

Findings

Overall, data suggest game-based teaching emulated aspects of videogame playing and was a distinct improvement over direct instruction. From audiotapes of students thinking aloud while they worked on some of the assignments in class I found that student comments were similar to the thoughts and behaviors of videogame players documented by other researchers. For example, students in my class broke tasks down into steps similar to the way videogame players defined “activities, actions, and operations” (p. 33) in Pelletier and Oliver’s (2006) study of videogame players in situ, paying particular attention to the order of steps (“Do all bookmarks first, then hyperlink”; “Make sure you sort the data first”). Students explored by searching through the menus (“horizontal learning”; Gee, 2007a, p. 49), used trial and error (“We can always try. What’s the worst that could happen?”; “I wonder what that does?”), tested hypotheses (“If we click these two things at the same time I think it will work”), and used the subsequent feedback to discover the rules (“We can see that it changed”), similar to videogame players in Pelletier and Oliver’s study (2006). When students had difficulties, they sought help from their “affinity spaces” (Gee, 2007a, p. 96), or groups and other resources that supply a “distributed intelligence” (Gee, 2007a, p. 26), and took advantage of “cross-functional affiliation” (Gee, 2007a, p. 27), or the fact that different members of their group had different skills by asking each other questions and giving each other direct instruction, just as videogame players do. Students also used transfer, similar to videogame players in Pelletier and Oliver’s (2006) study, to figure out challenges, often referring to other tasks, other software, and other experiences (“Do it the same way you did hypertext”). Sometimes this transfer involved a “principle of expertise” (Gee, 2007a, p. 61) where a videogame player is challenged to use an automatic skill in a different way (“I know what a hyperlink is supposed to do but I wouldn’t have thought of using it this way”). Although students sometimes felt lost (“We don’t know what the hell we’re doing”) and expressed frustration (“Why can’t you click on it? That makes me angry!”), it was often followed by euphoria (“You did it!”; “Yay!”; “It worked!”; and, most telling for this study, “Score!”), replicating Gee’s (2007a) description of the “cycle of storm and calm” (p. 62) of playing videogames. Students even expressed “flow” (“You are getting into a rhythm”). These data suggest structuring a class based on principles derived from videogames fosters similar cognitive, motivational, and emotional processes experienced by videogame players.

In addition to simulating the experiences of videogame players, data suggest students also increased their understandings of uses of technology in education.
Although these comparisons are limited, course evaluation data suggest the game-based teaching approach was more successful than the traditional approach.

Because of the low sample size for the traditional version, as the traditional version was taught at a different university, and because the criteria for the assignments became increasingly more challenging in the different versions as I became more confident about student success, it would not be valid to make statistical comparisons between the traditional version and the game-based versions of the class. However, the stark differences in course evaluation scores and grades suggest that game-based teaching can positively impact student learning.

Qualitative data from course evaluations, focus groups, and unsolicited student comments also buttress the conclusion that game-based teaching outscored direct instruction. Several themes emerged from a content analysis of voluntary student comments (N=36) on anonymous course evaluations with “learned a lot” constituting by far the highest number of responses (18). Students credited the resubmission aspect of this structure as encouraging further learning (9) by focusing on the learning process instead of the end-product. Other themes included that this structure targeted students’ ZPDs by meeting students where they are (4), allowed students to work at their own pace (4), challenged students (4), and differentiated instruction while maintaining a baseline standard of competency (3). In addition, this course encouraged students to take risks (4) while lessening their fears and stress (5), despite this class being a lot of work (2) and time-consuming (2). Most importantly for this class, the data suggest that students saw their learning as applicable to their teaching (8). Data from focus groups reiterate these themes.

A sampling of comments from course evaluations support the conclusion that the game-based structure helped increase student learning:

I came into this course with little knowledge of technology and how it could be useful in the classroom. The course helped me to find ways to integrate technology into my classroom, even though it is an urban school with little funding. Excellent class!

This course was unbelievably helpful to me. Before taking the class I would say that I was afraid of technology. [The professor] helped me realize my own potential with computers and technology, and I have since begun to incorporate technology into my teaching practices. I have already been able to share a lot of the skills that I have learned with my students who are now getting really excited about using the computers in my classroom. Though I spent a lot of time doing the work for this class, I think that I have learned more than in any other course I have taken in [this] program.
Even though I have a strong background in technology this course helped me put it to a more practical use.

And, perhaps most telling about the purpose of the game-based structure:

[The professor] truly meets her students where they are and allows them to grow from there. This is so important in this class because everyone seemed to have different backgrounds with technology.

In addition, unsolicited student comments from emails corroborate these themes:

Thanks so much… I learned a ton in your class! I’m clearly not a computer guru, but I feel much more comfortable than I ever have, and that’s what it’s all about, right? You really forced me to get out of my comfort zone. Thanks again!

Thank you for helping me face my technological fears.

As hard as I have struggled through certain parts of your class, I feel that I have learned more from you than I have in many other classes and appreciate why [another professor] recommended you to me both for my own lack of technological experience and for the quality of techniques that you incorporate in your own classes. I have learned as much about teaching as I have about technology in your class, and I plan to incorporate and utilize as many aspects of your teaching as I can in the upcoming year. I guess that is what teaching is all about.

On the other hand, comments from course evaluations from the traditional mode indicate that I was “nice” and “tried hard” but that I needed to “make class more interactive” and that students wanted “more time to explore” and to “experiment with technology.” In addition, with direct instruction: “she would demonstrate useful things on the computer but by the time I had written notes on one operation, I was unable to catch up”. The game-based teaching comments show a marked difference in tone and attitude from the course evaluation comments associated with the traditional teaching mode.

Conclusions
In 1922, Edison stated: “I believe that the motion picture is destined to revolutionize our educational system and that in a few years it will supplant largely, if not entirely, the use of textbooks” (cited in Cuban, 1986, p. 9). Similar predictions about radio and television replacing educators followed (Cuban, 1986). In 1992, Perelman proposed that schools be replaced by learning modules on the internet so students could work at their own pace, an extension of Papert’s prediction in 1984 that “There won’t be schools in the future… I think the computer will blow up the school” (quoted in Cuban, 1986, p. 72). Experiences thus far, though, largely support Cuban’s (1986) assertion that “Those who have tried to convince teachers to adopt technological innovations over the last century have discovered the durability of classroom pedagogy” (p. 109). I do not believe videogames will replace teachers – or that teachers will replace videogames. Rather, just as some videogames have used technology to leverage established pedagogical techniques, pedagogues can creatively employ motivational and pedagogical aspects of videogames in their teaching – with or without technology.
There are indications that educators are recognizing this potential:

But lately, researchers and educators say sentiment toward gaming is changing. Advocates argue that games teach vital skills overlooked in the age of high-stakes tests, such as teamwork, decision-making and digital literacy. And they admire the way good games challenge players just enough to keep them engaged and pushing to reach the next level. (Chandler, 2009, C01)

Gee (2005a), however, points out one of the major impediments of translating videogame principles into classroom practices in the abstract of his article “Learning by design”:

This article asks how good video and computer game designers manage to get new players to learn long, complex and difficult games. The short answer is that designers of good games have hit on excellent methods for getting people to learn and to enjoy learning. The longer answer is more complex. Integral to this answer are the good principles of learning built into successful games. The author discusses 13 such principles under the headings of “Empowered Learners”, “Problem Solving” and “Understanding” and concludes that the main impediment to implementing these principles in formal education is cost. This, however, is not only (or even so much) monetary cost. It is, importantly, the cost of changing minds about how and where learning is done and of changing one of our most profoundly change-resistant institutions: the school.

These principles may outline some ideal ways for individuals to learn, but can be difficult to institute in a factory-model school setting where the goal is to educate the masses. One way to make inroads is to model these principles in teacher education programs and teach pre-service teachers how to teach using these principles. Instead of complaining about how much time students spend playing videogames or feeling like one has to compete against them, educators should continue to glean from videogames what they can apply to classroom practice.

Ironically, in some ways, schools already resemble videogames. For example, Gee (2005b) points out that videogames involve “figuring out a rule system” by “discovering what is possible and impossible” (p. 2), just as playing the “game of school” (Fried, 2005) involves figuring out the rules, sometimes by testing them. In addition, like videogames, schools have a reward system – grades – but instead of motivating, grades can take the fun out of learning (Fried, 2005, p. 24). Perhaps, as the proponents of the “unschooling” movement (Gatto, 1992) contend, it is the compulsory nature of schooling that “alienate[s] men from their own decision-making… chang[ing] them into objects” (Freire, 1993). As Gee (2005b) points out, the “marriage of personal goals and ‘in-game’ goals is a highly motivating state” (p. 19). Possibly the element of choice, of playing the game and choices within the game, distinguishes videogames from school.

In other ways, videogames counter school norms. For example, what Gee (2003) describes as “distributed knowledge across members of a team” (p. 185), some would term “cheating”, although models of cooperative learning do aim for this. Despite the push for differentiated instruction, grading students does pose ethical problems for teachers when a grade represents different sets of skills for different students. Considering the amount of time and passion some students devote to videogames (Prensky, 2006), to reach future generations of digital natives, perhaps countering school norms is what is called for. If we as educators do not do what is necessary to adjust to the cognitive structures of digital natives, computers may replace us.
References

