Video Games and Education: Designing Learning Systems for an Interactive Age

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Recently, attention has been paid to computer and video games as a medium for learning. This article provides a way of conceptualizing them as possibility spaces for learning. It provides an overview of two research programs: (1) an after-school program using commercial games to develop deep expertise in game play and game creation, and (2) an in-school program using game techniques to teach science literacy. Although there are yet to be mature examples of game-based learning programs integrating all of these elements, these programs suggest a future of schooling very different from today's current path.

Introduction

So why games? Of course, games are fun and engaging, and we might even think about using them for learning for that reason alone. But games also require deep thinking; just think of how chess is a canonical problem-solving exercise for artificial intelligence programmers (Squire, 2002; Steinkuehler, 2006a). But when most people think of computer and video games, they think of Pong, Pac Man, graphic-fighting games such as Mortal Kombat, or headline-grabbing shooters such as DOOM. Today's games are much more complex, are designed to be learned by their players over 10, 20, or even 200 hours, and recruit sophisticated forms of thinking, including the understanding of complex systems, the creative expression with digital tools, and the formation and manipulation of social networks (e.g., guilds, clans) (see Gee, 2004; Squire, 2005a for a more exhaustive list). For educators interested in learning with digital technologies, they are an excellent place to examine what interactions are possible with the medium.

But games are more than technologies, they are also indicative of broader technological and cultural shifts that have consequences for educational technologists. The framework suggested here is that they function as possibility spaces for us to explore, inhabit, master, and eventually package into trajectories of experiences that form the basis of new skills, ideas, and identities. This model of learning is at odds with most in contemporary schooling, perhaps most models of instructional design (although it shares many affinities with the kind of constructivist design espoused by Bednar, Cunningham, Duffy, & Perry, 1992).

As this form of training is already proliferating in the business and military sectors (see Li, 2004; Squire, in press-a) the question for today's educators is not if or when such environments will come into education, but how. Who will have access to these spaces and whose ideologies will be served (and whose will be left behind)? Will students have to drop out of school in order to gain access to these pedagogies? If educators do not embrace these technologies—and most importantly the principles underlying their operation—we risk creating a new equity gap that will only amplify the existing inequities in education (Games, Learning, & Society Group, 2005/2007).

This may sound far-fetched, particularly for those unfamiliar with the state of current computer/video gaming. Many academics—particularly baby boomers—find the word “video game” a troubling one. It is worth pausing to recall that play is among the oldest forms of learning; watch animals learn to hunt and you see them playing in simulated hunts (see Piaget, 1962; Vygotsky, 1976). In the military, games and simulations have been used for thousands of years. Indeed, historically speaking, it is not the notion of learning through play that is so strange; it is the notion of sitting in rows of chairs, faced forward, everyone locked on to a fixed speaker or content provider that is strange, a vestige of the industrial era and its fixation on efficiency (Apple, 1981; Reigeluth & Garfinkle, 1994).

In short, video games are the medium of the computer representing the most polished, powerful, and thoroughly digital learning experiences known. However, if the phrase “videogames” is still troubling, more cumbersome (and hence failed) labels such as “interactive digital simulations,” “immersive digital worlds,” and “entertainment software” might be substituted. For a number of reasons (see Kent, 2000, for an excellent history of the games industry), most anything we do on a computer that's fun or interesting

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has come to be called a game, and so has become the
name used to describe a wide range of digitally
mediated experiences (Games-to-Teach Team, 2003).

But before we can get to the Holodeck or Ender's
Game (canonical thought experiments for game-based
learning; see, for example, Jenkins & Squire, 2004;
Murray, 1999), we need to better understand how
games built with today's technologies work as learning
environments and how they might be harnessed for
educational purposes. What are the underlying
educational principles behind the medium? What new
forms of social organization and participation do they
create? How might a paradigm of game-based learning
look? What forms does meaningful learning take, and
what are the roles of teachers in such an environment?
This article offers one take on these questions, inviting
further research and theory into the medium.

Computer and Video Games
as a New Medium

What makes the games we're talking about here—
computer and video games—interesting? Providing a
full list of the affordances of computer and video games
is difficult, if for no other reason that the term game has
been used to describe everything from Tetris (a simple
and elegant puzzle game) to The Sims (a household
simulation game and story generation tool) to World of
Warcraft (a global massively multiplayer game) (see
Squire, in press-b). We might select a few key enduring
features in video games: They allow for real-time 3D
rendering, they can simulate physics and other physical
processes in real time, they allow for instantaneous
input, and even video communication, and they
support both user creation with digital tools and the
near instantaneous sharing of data (Squire, 2002). This
is a partial list that necessarily will change with new
technologies; take the Nintendo Wii, for example, the
recent game platform released by Nintendo that uses a
wand as a controller and, as such, allows much greater
movement and expressivity of input from the player.

What's perhaps more interesting is the underlying
logic by which the medium operates for learning. As
Gee (2003) has argued, games are perhaps the best
instantiation of contemporary cognitive science theory,
specifically situated learning theory. Games allow us to
learn through doing and creating (embodied action as
opposed to abstract representations; see Gee, 2004).
Learning is personally meaningful and reflective of
learners' goals and desires (Squire, 2004). We learn
through making choices and examining the conse-
quences of those choices (as opposed to didactic
instruction; see Salen & Zimmerman, 2003). Rather
than being static (or inert), knowledge is enacted in the
service of doing (Squire, 2005a; Whitehead, 1929).
Information is represented not just through text, but is
multi-modal and transmedia (Gee, 2003; Kress, 2003;
Tobin, 2004). Learning is fundamentally social, as
players are collaborative and competitive. Assessment
on learning is situated in action, occurring through
multiple modalities, in the context of doing, and in the
service of learning (Gee, 2004; Squire, 2003;
Steinkuehler, 2006b). Finally, game play is deeply
productive. Players solve problems and share their
solutions, develop, test, and share strategies, and even
maintain identities represented through games and
other media (Games, Learning, & Society Group,

For those who may still be skeptical, consider the
following question: 30 years from now, will students be
learning physics as their grandparents did, primarily
through listening to lectures, reading texts (perhaps
with diagrams), and performing canned experiments, or
through some experience of virtual worlds, where they
can experience the forces of electromagnetism, see
how and why field lines show forces, and test their
understandings through well developed problems, and
demonstrate their competence through multi-modal
representations (see Squire, Barnett, Higgenbotham,
& Grant, 2004)? Perhaps they may even role-play as
scientists (or other professionals who use science, such
as electricians), performing problem-solving tasks that
require them to think like professionals (see Games-to-
Teach Team, 2003). The shape these learning materials
will take remains to be seen, but it seems clear that
something like games will be a crucial part of learning.

Surely, books and lectures are not going away.
However, there is potential with games to dramatically
reconfigure the role that each plays. Similar to
problem-based learning, games offer opportunities for
organizing learning around challenges; however there
is potential with games to give more instantaneous and
responsive feedback, to use digital technologies to
customize activities to players' goals and interests, to
augment learners' thinking with digital tools, and to use
such tools to allow learners to think and act creatively
(within digital worlds). Games offer immense lessons
for us as educational technologists about the design of
these environments. Because games shape users' experience of media, they offer design solutions for
everything from interface design to the design of online
communities.

This article highlights two examples of game-based
learning environments appropriate for an interactive
age and designed to foster 21st century thinking skills.
The first is an after-school program that uses the
Civilization game series as a context for helping students
learning history while also developing their creative
problem solving, particularly within the domain of
computer modelling. This research investigates the
potentials of the medium to support learning, the
design of game-based learning environments, and the
cognitive impact of participating in such a program,
and suggests models for how an educational system for the interactive age might look.

Second, this article describes work with augmented reality games on handheld computers. The goal of this work is to investigate how role-playing games might immerse students in the roles of scientists, while encouraging them to solve problems of importance to their local communities. The goal here is to explore how gaming technologies might help students forge new identities as active thinkers and problem solvers within their communities. We want to encourage learners to take an interest in science (both as careers and as a context for participating in society) and begin to see themselves as capable of solving scientific problems. This research program has the added benefit of being significantly cheaper than commercial 3D games and soon will be playable on mobile phones.

**Centers of Expertise: Creating Learning Environments for 21st Century Skills**

The year is 1492. You’ve led your band of Aztec Indians for over 5000 years. Starting with only a unit of warriors, knowledge of pottery, and a plot of land (which fortunately was suitable for raising corn), you create your civilization. In *Civilization*, players lead a civilization from 4000BC to the present. Players use natural resources, build cities, trade, and of course wage war, giving rise to situations such as civilizations negotiating (and perhaps warring) over scarce resources such as oil. As such, the central features of the game system present an argument for the fates of civilizations as largely governed by geographical and materialist processes, an argument also made by Jared Diamond (1999) in his Pulitzer-Prize winning *Guns, Germs, and Steel*, but perhaps with a greater emphasis on political negotiation.

Pedagogically, the game offers an interesting reframing of history from one organized around “grand narratives” to one marked by themes and patterns, a method of teaching world history advocated by an increasing number of educators (Dunn, 2000). In fact, the geographical and materialist underpinnings to the model serve as healthy contrasts to those made available at most schools, where students are presented a story of the steady march of Western liberty, democracy, and rationality (see Dunn, 2000). In contrast, *Civilization III* can offer a story of advantageous geographical conditions, which provides access to global trade networks, resources, technologies, and limited opportunities for population expansion. The game also offers opportunities to think about broad domestic decisions (e.g., “guns vs. butter”) and foreign policy decisions (isolationism vs. trade).

Over the past five years, I, along with several colleagues at the University of Wisconsin-Madison, have been investigating the potential of the *Civilization* series to support learning in world history through the *Civilization* series (see also Squire, 2004). In past studies, we showed modest, if not hopeful, results suggesting that this model could be effective for engaging disenfranchised kids in learning history. However, our team also believed that creating a learning culture more thoroughly aligned with the demands of the interactive age—where students could develop deep expertise with the game and begin to use its design tools to even create their own games—might tap the true potential of the medium. Kids attend the camp voluntarily—twice per week over the summer and once per week during the school year, usually for 1–2 hours per session. After a few months, most kids also purchased the game for use at home and were playing a few nights per week there as well.

The after-school program itself features a collection of historical game scenarios, including: (1) ancient Mesopotamian civilizations (4000 BC (featuring Egypt, Phoenicia, the Hittites, and Babylonia); (2) the ancient Americas (2000 BC, featuring Aztecs, Mayans, and Mississippi tribes); (3) the iron age (100 AD, featuring ancient Rome, Greece, Germanic tribes, Persians, and Celts); and (4) the industrial age of Europe (1800 AD, including the Ottoman empire, English, French, Germans, Scandanavians, Dutch, and Spanish). As the year developed, we introduced several different versions of these basic scenarios, such as a 1300 AD Europe scenario or a global 1800 AD scenario.

Within just a few weeks, all of the participants showed dramatic improvements in their basic geography and history skills. Most could locate the major ancient civilizations on a map, and all could name key historical military units, as well as make arguments about the growth of cities in particular geographic areas. Students were skilled with collegiate-level world history terminology, using words and terms such as monotheism, cathedral, and ancient Persians regularly. We administered *Civilization* game tests to the kids, with most accurately identifying about 90% of these historical facts.

More intriguing, kids eagerly took up the practice of game play outside the camp and developed identities as gamers. In one such occasion exemplifying these shifts, the kids held a sleep-over party in order to devise a plot for taking over the adults. One of the kids explains:

We (Korea and Japan) saw how close Greece was and figured that Australia had to be closer so we got out maps. I have this big map and we built a galley with settlers and we were going to create a civilization and research to sail to Greece to make a secret attack...

This scenario illustrates the power of game-based learning approaches to meld learners identities as gamers with identities as learners, toward school-based...
ends. Games can illuminate the intrinsically interesting aspects of an area so that kids think of doing research—learning more about an area as a form of entertainment.

By the fall, each student had developed a particular interest in history, with an overlapping pet gaming strategy, as the following quote illustrates:

Interviewer: Who are you playing as today?
Jason: Scandinavia like always...Because I get berserkers...I put them on the galleys and any cities close to the shore, I can just go off and use them to attack whoever is in the city...

Interviewer: So do you think that is like the real Vikings?
Jason: Actually it is because the berserkers would take this stuff which they made called wolf-bane...like with Ivan the Boneless, which is my name in the game.

Interviewer: Where did you learn this?
Jason: It’s from a book I’m reading. It’s a fantasy, but all the land and stuff is just like real Europe. They have Iceland on the map, and the long ships.

Interviewer: So have you read about this at school at all?
Jason: No...

Each participant in our program followed a similar pattern: An interest in game play led to an interest in a particular strategy which spilled over into an interest in a particular area of history. All of them checked out books, completed school reports, and regularly engaged in voluntary learning activities stemming from their game play.

The next step for participants was to begin using the scenario design software to further their interest in gaming and history.

Interviewer: So what is the scenario you made?
Jason: Well, am Scandanavia and I have the island that I really wanted or that I had to get to if I wanted to win the game because it has every resource. Every island has horses and iron and the basic stuff....

Interviewer: So what do you think about that historically? Were the Vikings sort of isolated? Did they have an island?
Jason: Well, Vikings were up in the Netherlands, but then they also controlled Iceland and the northern tip of the United Kingdom. They were kind of isolated, and if you saw them in battle or if they came to your town you were very unlucky because—well you were kind of lucky and kind of unlucky because they don’t really attack a lot. If they are sailing, they would go to different islands, and if there are no people there, they will leave guys there to start building up cities. Then they’ll just have more people come to the city. They’ll just keep on taking over the land. If there is a village in their way, they will destroy the village.

Consider the picture of Jason we have presented, engaged in learning, voluntarily checking out books from the library, reading about history, and designing games for the purposes of amusement. He is learning geography and historical terminology far beyond what is expected in school, and even building historical understandings.

Soon, each student had undergone identifiable transformations, taking on new roles in the community and developing new identities. The following conversation, suggests these changes:

Monroe: This whole game has changed my life. Yep.
Facilitator: This Rome scenario or CIV?
Monroe: I mean like the game, ever since I played it.
Facilitator: How has it changed your life?
Monroe: Well like, most of the other videos games are boring, but this isn’t.
Facilitator: And this one isn’t?
Monroe: Yeah, and my family plays it.
Sid (brother): No they don’t.
Monroe: Mom and dad want to, my mom does.

Monroe took a particular interest in using the game editor to model world history events. As a part of a Civilization camp competition, he created a scenario depicting the 1991 Gulf War. Monroe started with a realistic map he downloaded off the Internet, and then began identifying important countries, their positions on the Iraq war, and struggling with how to model the complex global events given the constraints of the editor.

Naturally, creating a causal claim that “playing Civilization will make a child want to become a Senator” based on this or any other data is impossible. However, this kind of transformation is the sort that is possible within a comprehensive program designed to leverage students’ interest in gaming. Across all of our students, we have identified trajectories whereby students enter as novices and develop interest, knowledge, and skills related to history. They become productive members of a community with deep expertise in particular areas. Our current research focuses on where these students take this expertise, and how it may be leveraged for even more productive work in their futures.

This work does suggest, though, that such learning contexts could be very important for learners producing
21st century skills. Research on informal learning environments (e.g., Palmquist & Crowley, in press) suggests that such arrangements are crucial for learning in informal settings, where learners develop knowledge, skills, attitudes, and values toward learning in an academic domain through conversation with experts. This program seeks to build similar arrangements using the context of multi-player gaming to build and extend participants’ knowledge. As such, mentors played several crucial roles, including modeling expert behavior, participating as conversational agents scaffolding learning through conversation, and opening new trajectories of participation.

Designing Games for Schools:
Mad City Mystery

Mad City Mystery is an example of a scientific role playing game, one that seeks to leverage the ways that games establish overarching challenges for players, then place them in roles where they must collaborate to solve problems toward developing new attitudes regarding mathematics and science. This kind of structure was common in dungeons-and-dragons type games and has grown and evolved into massively multiplayer games (although they are much, much more complex in these persistent worlds). The goal of this research study is to test some basic game design structures that occur in such a game, and suggest how they might be leveraged to produce 21st century thinking skills in science.

The game follows a basic mystery premise: A friend of yours has drowned, and the case is being positioned by the insurance company as a suicide. The players’ task is to work with their teammates to collect evidence and piece together a narrative so that the police will reopen the investigation. The game itself takes place on the University of Wisconsin-Madison campus near Lake Mendota and takes roughly two hours to play. The cause of the death is open-ended and open to interpretation, but ultimately it was caused by toxins moving through the environment (TCE, PCBs) which interacted with the victim’s alcohol abuse.

A key feature of the game is that it uses handheld computers equipped with global positioning systems (GPSs) to create a fictional context which is layered upon the real world. As players move from real-world location to real-world location, they uncover data about the fictional case (e.g., levels of toxins in the environment, information about environmental chemicals). They must then construct a narrative of events based on these interactions, and as such the game contains an embedded interactive narrative of sorts.

The game is designed to leverage five specific features that are common in role playing games, specifically, (1) embedded and cascading challenges, (2) differentiated roles, (3) embedded narrative resources, (4) connections to space and place, and (5) emergent collaboration and competition. For example, as players move through the game, they uncover embedded problems and challenges (e.g., other people have gotten sick) that require them to change their hypotheses on the fly. Each role (medical doctor, government official, environmental scientist) has access to different pieces of information embedded in authentic documents (health reports, secret government documents, environmental readings, newspaper documents, interviews with locals). Critically, these represent different perspectives and positions on various local issues, requiring players to think about how their source relates to the trustworthiness of information. The roles are constructed so that only through collaboration can they gain a holistic view of the case. Finally, the game seeks to use the space of the Lake Mendota watershed to scaffold participants’ thinking, serving as a framework for thinking through the complexity of the case.

To date, we have run the game with approximately 125 participants ages 8–65. Participants have expressed enthusiasm for the game, with one typical struggling high school student reporting “I would pay for something like this outside of school.” Another commented, “We are using technology, thinking with complicated science content, what more could you want?” Another reported that he had heightened interest in the subject matter, “Before I never would have picked up a book on TCE, but now, I definitely would.” The teacher added,

The students that you worked with all have a history of poor school performance and have difficulty learning in a traditional school environment / classroom. As you probably gleaned, some of them also have issues with communication! The fact that they were engaged and excited for an extended period of time is a great sign for the power of your design and the associated technology and delivery system. You are definitely on to something! The students I talked with on Monday are very interested in trying to create a game that they can share with other students at our school.

In post-interviews, students made similar comments. An overarching comment from students was “Now I look at the lake differently.” Interestingly, this compelling game play that kids reported a willingness to pay for outside of school consisted mostly in engaging in a kind of scientific argumentation that educators have long called for, but oftentimes found difficult to produce in students (Chinn & Malhotra, 2002; Kuhn, 1999, 2005). The following exchange typifies this interaction (MD is the medical doctor, GO is the government official):

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The group begins by suggesting an initial hypothesis: Ivan died of poisoning and because he was overweight and drinking too heavily, he drowned, whereas his wife and child exhibited more mild symptoms. The government official raises one objection—that Santiago also exhibited symptoms, but did not consume any fish. Interestingly, the game to this point had not revealed that there was mercury in Lake Mendota. This is something he learned from outside the game, perhaps because he or a family member fished on the lake and was aware of the dangers of eating too many fish with mercury, and was applying these experiences to this problem. Across all of our implementations, students have drawn on previous experiences related to game content when approaching game challenge. The Games’ rootedness in place makes them a particularly fruitful context for connecting learners’ lived experiences and out of school identities with those in school.

The group continues along this line of debate and reflection. The medical doctor suggests that there is no evidence that this was a malicious poisoning, and calls the group’s attention to alcohol’s potential role in complicating Ivan’s condition:

(MD) I don’t think it would have been intentional poisoning, Andy. (Andy is the GO.)

(GO) Well, we don’t actually know any motivations yet.

(MD) I mean because...remember the wife and the child were showing signs of being overweight, and so was the dad, but the wife and child are not drinkers so, it could have been alcohol.

(GO) Yeah.

(MD) They were all eating fish so that’s the only thing we know they are consuming.

(GO) Right...

(MD) I remember Bartlely or whatever his name was...he wasn’t eating the fish. He was giving them to...Ivan and his family.

(GO) He did not fish with Ivan?

(MD) But he gives the fish to Ivan.

After sorting through the evidence (all done while standing on the shores of Lake Mendota, clicking between documents on their PDAs), they conclude that eating poisoned fish is the leading candidate. In truth, the poisoned fish is a “red herring” introduced to complicate the story. Eating fish from Lake Mendota can pose health risks from exposure to mercury and PCBs (which children are particularly susceptible to); however, the effects of this exposure tends to lead to long-term health consequences, such as increased rates of developing cancer, long-term neurological disorders, and immunological deficiencies. In short, these are series health concerns for those who eat fish from Lake Mendota (which is particularly the case for lower income families), but are not of the sort that would cause one to fall over and drown in the lake in one day. As such, the game requires students to read for deep comprehension, critically weigh evidence, think across several data sources, carefully consider the legitimacy of each piece of information (e.g., how is a newspaper story different than an EPA document than an observation by a fisherman who has fished the shores for twenty years?).

Many of the game features employed here are similar to those employed in problem-based learning. One key difference is that the games are relatively structured experiences, crafting in-game interactions and feedback to shape players’ thinking in particular ways. Many game developers (most notably those such as Blizzard) carefully sculpt players’ experiences through extensive internal and external play testing, resulting in game interactions and crafted game experiences that nurture the player from novice to expert. Consider the following exchange, which occurs late in the game. Our previous work had revealed that many students treat the game as more of a “treasure hunt” than a problem-solving exercise. As a result, we made many attempts to enliven our characters, enhance emotional engagement through fleshing out the narrative, and seeding particular interactions to create “memorable moments,” in common game parlance.* The following character, Willy, is an insurance representative who is also researching the case and appears late in the game, challenging the players’ understandings of the case by introducing an alternative explanation for the events, drawing on the same sets of evidence but developing an alternative rationale:

Willy: Let me tell you the truth. Ivan’s death was an insurance fraud. This man could not live...

*Creating and stringing together “memorable moments” is a common way of thinking about game design among many developers, first communicated to me by Henry Jenkins, working with developers at Electronic Arts. The idea here is that games, much like vaudeville or other less “classically narrative” media, operate according to a logic not of perfectly woven plot lines, but of engaging the player in experiences that have a transformative effect.
without a full-time job and he had problems finding one. His addiction to alcohol made him sick and he simply lost the will to live. He was a good husband, but he could not afford to raise his family. What would you do if you were Ivan? He set everything up to make it look like an accident so that his wife could get insurance compensation from his death. I know that it is hard to swallow, but what evidence suggests otherwise?

The text here is designed to almost taunt the players, encouraging an emotional reaction and encouraging players to quickly synthesize an alternative explanation. The medical doctor responds:

MD: He is wrong. I think obviously the runoff from...put mercury in the lake. The catfish ate...and then he ate the catfish and brought some home for his wife. That's why his wife and kid are sick. And he is sick. And the wife transferred it to the baby through breast milk but not substantially. And the kid is suffering from nervous disability so honestly Ivan had died of mercury or something else.

For the first time in the game, the medical doctor begins to build a coherent explanation of the events. He ties together several key pieces of evidence and adequately pieces together the subplot of the baby suffering from nervous conditions based on mercury and PCBs contracted from fish. His explanation does not adequately explain how and why Ivan “fell over and drowned” one day, and in fact by the end of the game, he modifies his theory to account for this anomaly. After pouring through the documents, he and the group conclude that Ivan was weakened by these health conditions, but was exposed to TCE at work, which when combined with his weakened state from alcohol caused him to be light-headed and to fall into the lake.

A number of things are striking here, but particularly the amount of emotional investment that the players show in solving the problem. Whereas these same kids were generally alienated from school, this experience spoke to them. It drew on their lived experiences and suggested productive ways of interacting (and being). One can imagine extending this problem out to include future investigations into the amounts of mercury and PCBs in the lake, or careers in environmental science. Significantly, each of these students left with more questions about chemicals in the environment, questions about what the impact of various industries on their local environment, and an increased desire to study science. As their teacher suggested, future curricula might allow them to create games around questions of interest to them.

A common question to developers of game-based learning environments is “what transfers” from the game world to the “real world.” The question, while valid in terms of transfer, more broadly raises interesting attitudes and predilections of educators toward games. How and why a fictionalized game environment is any more or less real than, say, school is an open question. Similar to Turkle (1995), it may be more productive to think of the many roles and identities that we engage in every day (educator, parent, online game player, participant in a local community) as parts of different “games,” each with its own rules and conditions. In this case, we find evidence to suggest that students are developing familiarity with scientific concepts and terminology which may or may not go far beyond the immediate learning context (after all, how many readers think that the participant is really going to find, let alone pick up, a book on TCE?). However, evidence seems more compelling that perhaps they are developing attitudes and dispositions toward science and technology, something the Games, Learning, and Society Group (2005/2007) has called productive identities, identities where they are capable participants in types of scientific discourses around problem solving. Tying this example back to the Civilization club example, game developers might think about pedagogical models that tie together such experiences into longer term trajectories where they develop significant expertise in particular areas, ideally spanning across the borders of the classroom into broader social life.

Conclusions: Toward a Future of Game-Based Learning

These examples suggest what a future of game-based learning might look like. Figure 1 shows the process that students go through in becoming expert gamers and, eventually, perhaps producers. It tries to capture that some of the learning comes from the player and the game and some comes via participation in interpretive communities. Students enter these interpretive communities with divergent knowledge, interests, and skills. As they become “players,” they develop new and further diverging knowledge, interests, and skills, moving along a continuum toward becoming designers. They might enter with an interest in ancient warfare or geography, which then, through participation in game cultures, might become an interest in hypothetical history or game design.

This model suggests that game-based pedagogies may never be “one size fits all” education. Players may begin with a relatively common starting place (similar tutorials, missions), but then begin diverging further in their interests. Unlike schools, players are encouraged to develop specific areas of expertise, separate from
one another and perhaps even the adults/facilitators. As students progress through the community, they develop new interests, which then propel them out of the community toward new areas of interest.

Regardless of whether one adopts games in their instruction, there are at least two important features of this new medium with broader implications for educators: (1) They are based on simulation, and (2) they are based on cultures of participation. Theorist Paul Starr (1994) argues that simulation—the process of setting up scenarios and exploring under what conditions they might work—is at the core of business, government, science, and entertainment, and video games are the public’s primary exposure to this important way of thinking.

Games operate according to a logic of simulation, whereby people enter and participate in virtual worlds which function as possibility spaces for their participants, opening and expanding new horizons, particularly new ways of thinking, doing, and being. Examining the social institutions that accompany games, we see that they are built on a logic of participation. As Gee (2004) points out, today’s media environment allows people to participate and even co-construct the social institutions of which they are a part.

Although digital games have largely been ignored by educators, they are a powerful new medium with potential implications for schooling. In videogames, knowing is at its essence a kind of performance, as learners learn by doing, but within powerful constraints instantiated through software and social systems. Primacy is on experience, which allows students to develop situated understandings, learn through failure, and develop identities as expert problem solvers (Gee, 2003; Squire, 2006). Here, I’ve tried to outline a process for designing experiences, experiences that take people from being media consumers to producers developing games and experiences for themselves and others.

Maybe more importantly, videogame cultures have tacit assumptions about knowledge, learning, expertise, and formal institutions which may be at odds with school. Videogames epitomize a potentially destabilizing wave of technologies where students access information and social networks any time, anywhere. As students confront more and more sophisticated
digital worlds outside of school, a challenge becomes, how will schools react? Do we present and expect students to pursue print-based literacies, ignoring the visual cultural, and computer mediated worlds they inhabit out of school? And, perhaps most importantly, what identities do we make available to students in school? Whereas our schools ask students to all learn at the same rates, in the same ways, at the same time, games make a variety of different paths to learning available. Whereas school cultures ask students to inhabit a relatively limited and very particular set of identities, particularly as recipients of ideas and agendas prescribed for them, games expect players to be active participants in co-constructing their worlds with designers. Games and their associated technologies may not render school obsolete, but it may no longer be best for the educational community to ignore the kind of learning that occurs through games and digital worlds.

As games mature as a medium, the question is becoming, not will games be used for learning, but for whom and in what contexts? If games have the dramatic potential to put players in complex systems, allowing them to learn the points of view of those systems and perhaps even develop identities within those systems, perhaps it is not surprising that the military, advergaming, and private groups have begun using games to support their agendas (Squire, 2005b). Perhaps it is also not surprising that games have been taken up most stridently in the military, an organization which is charged with training many of those who "fall through the cracks" of the education system.

As the military, private, and non-profit groups are using games to spread their ideologies, it is crucial that educators with an interest in democracy and K-12 education also examine the potential of this medium to express theirs. With the U.S. Navy and Air Force planning similar games, and middle class parents playing games such as Pokemon or Civilization with their children, the real question becomes what will happen to those families who cannot afford such technologies, or what will come of formal schools if they are the last place that this powerful medium penetrates?

References


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Helping Education Students Understand Learning Through Designing

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This article describes a course in which graduate students in education learn practical and theoretical aspects of educational design by creating technologies for learning. The course was built around three themes: Analyzing technologies, in which students study state-of-the-art technologies and interview their designers; design studio, in which students design their own technologies using an instructional model that was developed in this study; and theory, in which literature is reviewed. Outcomes illustrate tensions between students' professed beliefs about learning and their actual design practices in four dimensions that characterize the technologies they designed: Learner activity, Collaboration, Autonomy, and Content accessibility. Via peer-negotiating of these tensions in each of the course themes, students have developed their skills to design educational technologies and increased the coherence of their epistemological understanding of how people learn.

The Learning by Design Trajectory

Research in the Learning Sciences and in the CSCL field has shown that many opportunities to learn arise in the course of designing an artifact, in general, and a computer-based artifact, in particular. Papert (1991), in his description of Constructionism, claimed that a productive way to support learning is to engage