^VIDEO GAMES ^anp LEARNING ^

Te aching and Participatory Cu It ur- e in the Digital fige

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Foreword by James Paul Gee
Featuring contributions by Henry Jenkins

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CHAPTER 1

Possible Worlds: Why Study Video GamesP Aren't They a Waste of lime?

"Come on, class. Please tell me that *someone* read the chapter."

I looked nervously around the room. "Please don't call on me," I thought. Of course we hadn't read it. Why Jim Douglas, my high school history teacher, even entertained the idea that we might have read it was beyond me. Douglas taught with the Socratic method and expected us to read the *entire* chapter before we started each new unit. Later, I thrived under this teaching style—because he assumed *we* were responsible for our own learning.

"So none of you can explain the causal factors behind Spanish colonization?" (Long pause). "Does anyone at least know what ships they had?"

We were getting nervous. Douglass' policy was that if "there was nothing left to discuss" then we would take the test, which would mean that we would all fail.

I tried to picture what a Spanish ship looked like. An image of a galleon popped into my head. I raised my hand.

"Ihey had galleons."

"Very good, Mr. Squire. They had galleons. Now why would they have galleons?"

"For carrying gold."

"Yes, for carrying gold." Not Alistair Cooke, but we were getting somewhere.

"Yes, that's right... for gold. And they had war galleons to protect the galleons carrying the gold. These had a lot of guns." I was warming up. "The French mostly had *barques.* The Dutch, *fluyts.* The English, merchantmen. If you saw a *pinnace,* that was French, Dutch, maybe even a pirate."

Douglas was surprised, if not impressed. I wasn't known for "reading ahead."

But I was rolling. "The Dutch—they were mostly traders. They didn't have much territory, although Curacao was a great trading base." As I rambled on about the Caribbean, my friend Jason shot me an incredulous look as if to say, "Where in the hell are you getting this ... is it a joke?"

It was, in fact, the result of my spending way too much time playing *Sid Meier's Pirates!* on my Commodore 64. *Pirates!* is an action-role-playing game, in which you are . .. well ... a pirate (see Figure 1.1). I first played it in 1987, but *Pirates!* has been updated and re-released several times (including for the Nintendo Wii in 2010).

Here's the gist of it: You are a pirate in one of five time periods (between 1520 and 1700). The Han Solo of the high seas, you swashbuckle through the Spanish Main representing the French, Dutch, Spanish, or English. In addition to engaging in sword fights and ship battles, you trade and smuggle to create a privateering empire. *Pirates!* is open ended; the "story" is the one you create. There are few instructions, few quests, and no set narrative. No two games are exactly alike.

As a (potentially) educational game, *Pirates!* works because it is incredibly specific. Each city fluctuates in size, power, or nationality according to the time period, so players get to see how the Caribbean evolved. In the late 1500s, the Spanish dominate, meaning that if you're playing as the Dutch (my favorite) you're vastly outnumbered. But there is untold opportunity if you become friendly with the French and English, learn where their ports are, and plunder the Spanish (see Figure 1.1).

How the game unfolds is up to you. When I played as the Dutch, a favorite ploy at the end of my career was to capture a town and make it Dutch. I'd earn a title from the governor, then sail out and re-attack the *same* city, only this time making it French. This earned a huge land gift from the French, but ticked off the Dutch. I'd do this a few more times until the Dutch caught on and no longer welcomed me on

Figure 1.1.
Sid Meier's Pirates!

Dutch soil. But I kept my land—and infamous reputation—created by my piratey behavior. The underlying rules *encouraged* you to think like a pirate.

Players learn as much about Caribbean geography and history as they learn about swordplay. You're immersed in this world during the game, so you *have* to learn how the various types of sailors, nations, and geography affect your plans. For example, early on in the game, most players want to sack Panama because it's incredibly wealthy. But, if you try this, you'll quickly learn that it's also well defended and removed from the Spanish Main, which means you're going to need hundreds of sailors to even have a chance. You can't build a crew like that overnight. First, you need to build notoriety by attacking smaller ports and building a crew, and then you have to get them all to Panama before they mutiny. 1 vividly remember taking a wrong turn into the Gulf of Mexico and almost losing my ship because I didn't know my basic geography.

Learning geography through playing a game such as *Pirates!* is a commonplace experience for my generation. In fact, Levi Giovanetto and I recently surveyed University of Wisconsin-Madison undergraduates and found that most of the students had played *SimCity* and almost *everyone* had played *Oregon Trail.* The majority of the students felt these games helped them in school. The gaming generation is growing up, and they show no signs of giving up their gaming. When parents play Nintendo Wii with their kids and video game conferences include panels such as "I'm Getting Old: When Life Cuts into Gaming," you know it's not just teenage fantasy anymore. (See Not Your Big Brothers Games sidebar.)

Not Your Big Brother's Games

Many educators believe that the most popular video games have violent themes, and it just isn't true. WiiFit has sold as much or more than every version of every *Halo* game ever made. Every year, the list of the most popular games includes titles such as *The Sims* as well as music games, sports games, and racing games. But even that doesn't capture the diversity of games.

Take, for example, *Harvest Moon:* a farming-simulatjon game in which the player runs a family farm, The player has to tend the crops, raise livestock, befriend townspeople, and get married (if you want). Hundreds of thousands of people love this game.

Harvest Moon isn't alone. Other wildly successful non-violent, non-sexual games include *Rock Band* (in which you are a musician), *Nintendogs* (in which you raise a pet), and *Brain Age* (in which you try to increase mental agility by doing quizzes and puzzles).

Yet probably because of the size and cultural influence of the baby boom generation, video games are regarded by many as a fringe medium, and some still argue that games are trivial. This position is baffling, given the social, economic, and cultural impact of games. Games *already* operate as a medium for learning, whether or not we design educational games. Millions of people have learned some history from *Pirates!* and have explored the basic concepts of urban planning from *SimCity*. As Stephen Johnson (2005) popularly argued, even when games aren't "educational," the intellectual play of video games is productive in its own right. Video games are all about problem solving. Just as we recognize chess as a complex game and use it for studying the mind (think of how we program computers to play chess against chess masters), video games enable us to study how people who are spread across thousands of miles collaborate in real time to solve problems in games such as *World of Warcraft* (see *World of War craft* sidebar).

Video games now include a diverse range of experiences, from music simulation to multiplayer role-playing games with new models of distributed leadership (see Steinkuehler, 2006).

For educators, the questions are practical as well as philosophical. How does playing a historical game shape our thoughts about history? Can games be used for learning? If games do become widespread, what does this mean for the future of schools?

World of Warcraft

World of Warcraft or ***WoW,*** is one of the most influential video games ever produced (with around 12 million sales). In this well-designed, massively multiplayer game, players create characters and interact in a virtual world that is populated by participants from all parts of the world. Players explore this world as they complete quests, form groups to take down bosses, join guilds (more permanent social groups) to meet friends, and compete in skill-based tournaments.

As an example of its cultural impact, consider the following scenario. One player, Ben Schultz, created a character named Leeroy Jenkins and filmed a video of Leeroy eschewing all social norms and running straight into a battle while his teammates were busy strategizing and calculating the odds of success. The video went viral (i.e., was widely viewed and distributed among people on the Internet) and became so widely known that it was referenced in ***South Park*** and Leeroy became the answer to a ***Jeopardy*** question.

Will Wright, designer of *SimCity, The Sims*, and *Spore* and one of the most important creative geniuses of our time, explained the educational potential of the medium: "Start with systems," Will said. "Games teach about systems in ways that no other medium can."

Will was right. *Pirates!* isn't about teaching declarative facts such as "the Spanish conquistadors colonized the Americas for gold." *Pirates!* puts the player in a *micro-world* of the ancient Caribbean in which they experience it as a system. Through cycles of action and feedback, players learn some facts (e.g., galleons are for carrying plunder), but, more importantly, they learn the *rules* underlying that world, the relationships of these rules, and the emergent properties of the system (e.g., to start a raid on Panama you must have a string of friendly ports, a fleet of galleons, and a lot of luck). James Paul Gee (2005) argues that what gamers learn is *embodied empathy for a complex system.* Video game players develop a feel or intuition of how systems work.

This *systemic* thinking is valuable because it helps people solve problems holistically, rather than focusing on single-cause solutions. Video game players learn that if you change one variable, for instance, the type of ships available, it affects the entire system (e.g., the placement of cities). Systemic thinking isn't valued much inside schools today (particularly because it isn't captured well by standardized tests), but this type of thinking is important everywhere outside school, from ecology to engineering to politics. If video games can support systemic thinking in these areas, they could be powerful educational tools indeed.

So far we've focused on the intellectual aspects of gaming, but isn't that missing the point? The allure of video games for education is that students learn while being thoroughly engaged in play. Might we design similar learning environments for schools?

DESIGNING EXPERIENCE, OR THAT EVASIVE "FUN FACTOR"

One response might be, "Of course *Pirates!* is fun. You get to be a pirate." It's true that learning history is more fun when you approach it as a pirate. But is that a bad thing? Why not learn academic content by playing interesting roles, such as learning history by becoming a privateer or studying science as a forensic investigator?

Studying video games in depth teaches us that a game isn't automatically fun just because it's about pirates. Every year many games are released in which players are pirates, soldiers, or other interesting characters, but the games aren't very good and don't sell well. The difference between good and bad games is more in the polished game experience than in the content. The textbook example of this is *Diner Dash,* the game about being a waitress (see *Diner Dash* sidebar and Figure 1.2).

Diner Dash

Diner Dash illustrates how good games can arise from boring content. *Diner Dash* is a real-time strategy game that "found" the game in balancing a section of tables (seating patrons, taking orders, delivering food in a timely fashion, and getting the check out fast). The designers added the story of a waitress thumbing her nose at her corporate job and struggling to start her own business. *Diner Dash* was one of the most compelling games that year.

How is it that a game like *Diner Dash* is fun (despite the lack of sex and violence), whereas others with sexier, more interesting premises are not? There are many answers. Good games are cleverly designed. They involve hours of play-testing. The player's experience is sculpted so that it feels like a warm hug. Let's return to *Pirates!* to see how it works.

An Orchestration of Time

When *Pirates!* is compared with other pirate games, the prevalence of overlapping short-, medium-, and long-range goals stands out. From the moment you pick up the box, the long-term goals (plunder cities, win fame and fortune) are enticingly communicated. Short-term goals are presented by the game system. Vulnerable merchantmen ships sail past. Unguarded cities lay ahead. Tírese potential goals "pull" players toward their long-term destiny of reaching infamy.

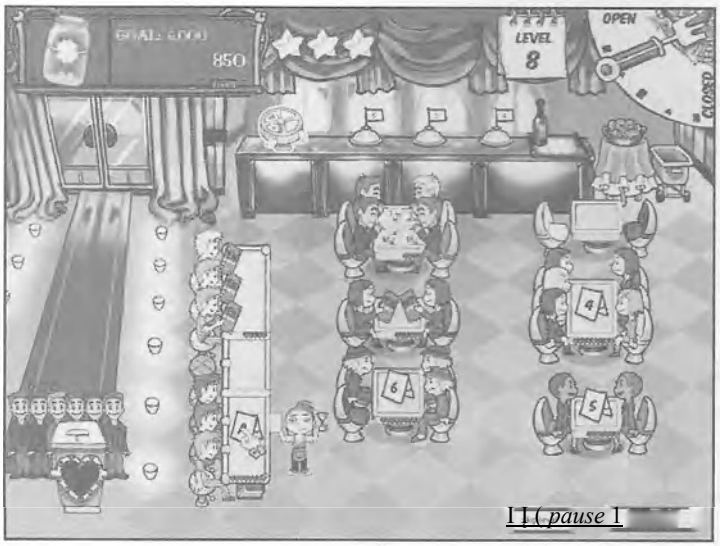

Figure 1.2. ***Diner Dash***

To see how well *Pirates!* is designed, try playing it with a stopwatch. Short-term goals (restock supplies, sail to the next harbor, battle) take between 45 seconds and 2 minutes. Completing a short-term goal (such as restocking a ship) should not take an hour.[1] In contrast, *Sea Dogs* has fully 3-D cities. What could be wrong with that? It's a feature players clamored for. While it's visually interesting, the 3-D design means that it takes 5 to 10 minutes to do simple housekeeping tasks in port, such as restocking supplies. Many critics panned it for being a pirate game in which you "spend your time walking around town." We can infer a design rule from this comparison: "Make short-term goals doable in a short amount of time." Interestingly, *Pirates!* and *World of Warcraft* can both be divvied up into short-term goals of 60 to 90 seconds, medium-range goals of 45 to 60 minutes), and long-term goals of 3 to 4 hours. *World of Warcraft* battles take 45 to 60 seconds, hunts (3 or 4 overlapping quests) take just under an hour, and raids go on for 3 to 4 hours, including preparation and debriefing.[2]

Overlapping Goals

A second design rule is to provide *overlapping goals.* When a *Pirates!* player sails into town for the first time, the governor instructs him or her to visit a neighboring city and receive a reward. So now the player has a long-term goal (earn fame and riches) and two short-term goals (attack a ship and visit a neighboring port). The short-term goals compete with one another, which gives the player an interesting choice: Do I attack that ship on the horizon, or do I sail to the next port?

But it gets better. As the player sets sail, he or she might also see an enemy town that is ripe for the picking, Attacking this port becomes a new medium-range goal. *Pirates!* constantly presents players with these overlapping goals. The importance of *clearly* communicating such goals can't be understated. Video games do a lot of work to make these goals compelling to players. These goals *seduce* players into pursuing them. As video game designers, it's always shocking just how much you have to lead players by the nose.

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1. Interestingly, ship battles in the original *Pirates!* often went on longer, but in subsequent versions, designers used tricks to shorten them.

2. In fact, instances (typical five-person group activities) were designed to take 2 to 3 hours in earlier versions of the game, but when you had a bad group of players, your whole evening could be ruined. So Blizzard trimmed down group hunts to about an hour. Now, an instance is just one part of a gaming evening. A potential downside is that this design decreases players' commitment to the group. If you have a bad group, you don't have to learn how to fix it; you just move on. Raids (the longer activities, with a constant set of members) still recruit such group commitment.

As we design learning environments, video games teach us to ask: What goals do I offer players (or learners)? Will relatively trivial goals be attained quickly? Are they clear and overlapping so that my players feel compelled to continue? Does my environment constantly advertise new, seductive things to do? Is the game designed to produce emotionally satisfying experiences?

Anyone can theorize about design for learning, but good games *execute* these goals. We often think that this is because entertainment games have huge budgets, yet this isn't always the case. Many wonderful, small-budget entertainment games like *Flower* or *World of Goo* put their educational brethren to shame. Good game developers tweak games for months or years after many educational developers would have already shipped their educational game. Famously, Blizzard won't ship a game "until it's done," even if that means extra years of development and testing.

Throughout this book, I analyze both entertainment and educational games. This method is similar to what Doug Church calls *formal abstract design tools.* Church, a veteran game designer (now at Electronic Arts [EA]), uses concepts such as overlapping goals or power-up curves (the rate at which players gain new skills) to understand game design. Church invented these terms to help game designers learn from games across genres and to teach them to look beneath the surface of game features and toward interacting systems.

This spirit of studying one another's games—and then "stealing" features that work—is one reason that the games industry has grown and improved so rapidly. Commercial game designers play one another's games *all the time.* If there's a feature that works in one game, it will be adopted by others in the next product cycle. Ideas jump across games at a dizzying pace that puts academic "knowledge dissemination" to shame. Educational technologists rarely make their work available for others to critique, let alone build on.

Possibility Spaces

But video games aren't just about polished experiences; they can be more deeply transformative experiences in which we can do new things and become new kinds of people. Game designer Raph Koster (2004) talks about this in cognitive terms in his *Hieory of Fun for Game Design·,* games are fun because they provide new problems to solve. We stop playing when we get bored—when all the learning is done. We might contrast these open possibilities with closed ones. Games (or careers) with developmental paths that lead nowhere are like dead-end jobs. In *Civilization*, it's knowing how your game will end before you even start. In *World of Warcraft,* it's that moment when players say, "So I get better gear to do bigger battles to get bigger gear. What's the point of this again?" It's being

able to predict every move in a game before it happens. Good games (think of classic nonvideo games, such as chess or basketball) refresh themselves, offering new lessons the more that we play.

Games like *Pirates!* or *Civilization* advertise these possibilities well, but there is nothing like a multiplayer game to amplify these possibilities. Multiplayer games continuously refresh themselves as we learn to be different kinds of people in social groups. Consider the first time a newcomer walks into a city in *WoW*. The experience is one giant exposure after another to interesting "possibilities." New players see a variety of characters riding outlandish-looking mounts. They see curious flying contraptions, rogues bouncing up and down, or goblins selling their wares. This is to say nothing of the chat channels, which now brim with esoteric conversations. Each element points to potential futures for the player.

This struck me die first time I saw a tauren druid decked out in the Cenarion Rainment, the "tier 1 dungeon set" (see Figure 1.3). Simply the existence of a gear set made out of tree branches inexplicably delighted me. What were those things? How do you get them? Do they have special powers? And what shoes do you wear with those?

Opening Social Horizons

These moments open horizons or players. Curiosities are piqued, desires are stoked, and feelings of wonder are stimulated. For a brief moment, anything is possible. When I saw that druid, I wanted to become a powerful, nature-channeling, bad-ass cow too. I imagined slaying monsters, saving friends, and emerging with cool-looking tree-branch shoulders that symbolized my exploits.

Figure 1.3.
Tauren Druid with Leafy Shoulders (Cenarion Spaulders) in *World of Warcraft*

In essence, people's characters *themselves* are walking billboards for the game's possibilities. Each glowing sword, flame-hooved horse, or YouTube video of a hilarious prank advertises new possibilities. A key *WoW* design decision may be *not* starting newbies in large, populated cities but instead waiting until they had experienced core game systems, such as combat, quests, and grouping, before lifting the veil and showing the games depth. This moment happens around the 4- to 6-hour mark, which is about the time that a nonhardcore player would be just about ready to put the game down after a night or weekend of playing. Only then do the designers go for the kill and get you hooked.

I can still recall my inaugural voyage into Ironforge. My first character was a night elf, so it was a hike. Trekking through swamplands and snowy mountains, I saw crocodiles, gnomes, dwarves—outlandish creatures nothing like the denizens of my forest home. I struggled to navigate the crowded thoroughfares until a friend logged in and offered to show me around. He pointed out the giant cauldrons of Ironforge, with its blacksmiths and their clients in their crazy helmets, fancy pants, and glowing swords. He showed me trainers, vendors, and the Auction House where players buy and sell stuff, much like an "in-game eBay." He told me to make friends with a crafter to help with my gear.[3] He believed that a shrewd trader could make more money buying and selling goods than hunting, but it required dedication and an in-depth knowledge of IVbW's markets.

SOCIAL GAMING: POSSIBLE IDENTITIES

Games' possibility spaces are deeply social, even in single player games. I first learned to play *Civilization* by having a college roommate show me the basics. On consoles, kids show off games such as *Madden* (see *Madden* sidebar) or *Ico* (see Stevens, Satwicz, & McCarthy, 2008) to peers crowded behind them on the couch.

As studies of game players in their natural habitats (inasmuch as they exist) reveal, gaming is a deeply social activity for most players. Research shows that it is often players, not designers, who publicize possibilities through sharing stories, formal and informal apprenticing, and group activities (Steinkuehler, 2006).

Massively multiplayer games enable people to play together and collaborate in activities to achieve mutually desirable goals, and this intensifies learning. Massively multiplayer games researcher Constance Steinkuehler (my wife, who will be cited

3. WoIVhas changed over the years to require less social interdependence. Now, you can get goods through the Auction House or by making random requests in town, making it less personal and social. Stop me before I long for the days of crafting in *Star Wars Galaxies.*

throughout this book, as I've learned a lot from her) shows how even mundane activities such as a group hunt have instruction embedded within them. That Ironforge tour I described earlier may seem pedestrian, but my friend was showing me how to read the environment. He showed me what was worth noticing and what wasn't, what practices made up the world, and what kind of a character I could become.

Madden

Many games—not just strategy games—recruit systemic thinking. Sports games such as *Madden* are classic examples. Play a lot of *Madden,* and you will see patterns in how games unfold. I learned to "see" soccer games by playing *FIFA* with my brother (who was good enough at soccer to explain what parts were realistic and which parts weren't).

I was surprised to learn that pro players play video games to learn, too. When asked what helped him make the transition between basketball and football, Antonio Gates, an All-Pro NFL tight end, told *Sports Illustrated* (Silver, 2004):

> You know what helped? Playing *Madden.* I was always the Chargers. After I got here, I'd play the game and notice things about the defenses. I started recognizing formations in the [video] game, then I'd get to practice and see them there [in actual practice],

Lauren Silberman (2009) studied athletes and video games and found that players ranging from the University of Wisconsin baseball team to the Boston Red Sox use them as visualization tools. It helps them see the playbook, identify patterns, or generally just keep their heads in the game on off days.

This mentoring is routine in collaborative gaming. Anyone who has run an endgame group in a *WoW* instance (a dungeon that takes 2 to 4 hours to complete) should understand this. Let's say I'm a newbie "tank," which means my job is to absorb damage so that the healers and damage dealers in my group can do *their* jobs without dying. As we prepare for the battle, someone will ask, "OK, who has been here before?" Players fess up about who knows what battles. Because some monsters are "chained" together (pull one and they all come after you), there are strategies for me, as the tank, to keep the monsters focused on me and for damage dealers to "control" monsters by putting them to sleep or freezing them and so on. The approach is contingent on group makeup, meaning different constellations of players use different strategies.

As the group members negotiate, they're debating not just procedures, but also the goals of the activity itself. Will the group play as efficiently as possible? Or is there room for experimentation and error? Whereas some people value quick achievement, others (like me) enjoy the unexpected. I'm not happy unless everyone is operating right at the edge of his or her competence, and I like to court danger with taunts on occasion. (I'm not sure whether it's always appreciated).

We see these values negotiated most often when the group confronts failure. Is it OK to occasionally make a mistake, especially if it means a better experience, or should every battle be methodically planned? Games let us play with different value systems (which is more difficult to do in our real lives at home or at work). In the simplest of situations, players' activities are coordinated in ways that shape knowledge, skills, values, and even identities.

This form of learning—having people (including novices and experts) engaged in joint problem solving—is considered by learning theorists such as Annemarie Palincsar and Ann Brown (1984) to be perhaps the "best" form of learning. Yet it is rarely utilized in schools, which focus on individual work and are segregated by skill level. Typically in each class, there is one "expert" (the teacher), whose job it is to impart knowledge to the students, who are supposed to diligently work on their own learning. Educators have tried a variety of peer-to-peer approaches with good success, particularly when they leverage the diversity of abilities that exist in class (no matter how much we may try to track students). My own teaching experiences have been in multiage classrooms, so this idea of segregating people by ability has always seemed a little odd to me (see Chapter 3). Games excel at promoting different levels of expertise, and educators might embrace, rather than apologize for, this capacity.

POSSIBLE CULTURES

Thus, to understand how games operate, we need to look beyond the game itself and toward the broader cultural contexts in which it is situated. In many game communities, players themselves become the content, making them emblematic of *participatory* media culture. When my friend showed me around Ironforge, he was a central part of my game experience. This is also true of game communities around single-player games (see Chapter 7), particularly within the resource sites created for the games.

Online communities are also an integral part of massively multiplayer games such as *WoW*. The *WoW* community has actively cataloged every monster, item, and so on, to the point that the game is basically mapped out. Plunk the name of any item into Google (or better yet, thottbot.com or wowiki.com, the *WoW*-specific information databases) and you will find everything you need to know

about the item's origin, attributes, and value.[4] The current site du jour is Elitist Jerks, a guild site visited by people from around the world for its quality resources and discussion. As designers respond to this increasingly savvy player base, they ramp up the game's complexity so that the game and players literally co-evolve. In fact, game designer Soren Johnson (in press) has argued that *WoW* is one big evolutionary struggle between players and designers toward creating a complex, fair, and balanced game system.

Lets compare this open, participatory culture to the environment of most schools. Gamers are surrounded by walk-throughs, guides, even videos explaining and demonstrating almost every nuance of the game. If, for example, a player wants to become a good tank, he or she can find forum threads, spreadsheets, and guides explaining gear, strategy, or how to deal with annoying damage dealers who don't do their jobs. In educational terms, there are examples, nonexamples, and worked problems for players to analyze to improve their performance. It's as if students had access, not only to the teacher's notes, but also to the guidebook, the Cliff notes, and experts in the field in question. Schools, in contrast, segregate learners by ability level and erect strong barriers between classrooms and authentic communities of practice.

But games aren't just open environments; they are carefully crafted learning experiences. Take the trajectory of how players learn about gear in *WoW*. The player's first task is to choose the "right" type of equipment after completing a quest. For example, do I choose cloth or leather? This is really a faux choice; there is one correct answer (whichever type your class wears). But seeing the items "previews" statistics that will soon matter. Next, players find new items in the world and must compare them to learn more about item attributes. Is the new item I found better than what I have? Again, this decision is straightforward, as there is only one variable initially (armor points). Soon enough, players must compare items in detail. I recently decided which of the two items in Figure 1.4 I should get for tanking. Even seasoned *WoW* players might have a hard time discerning the difference between them.[5]

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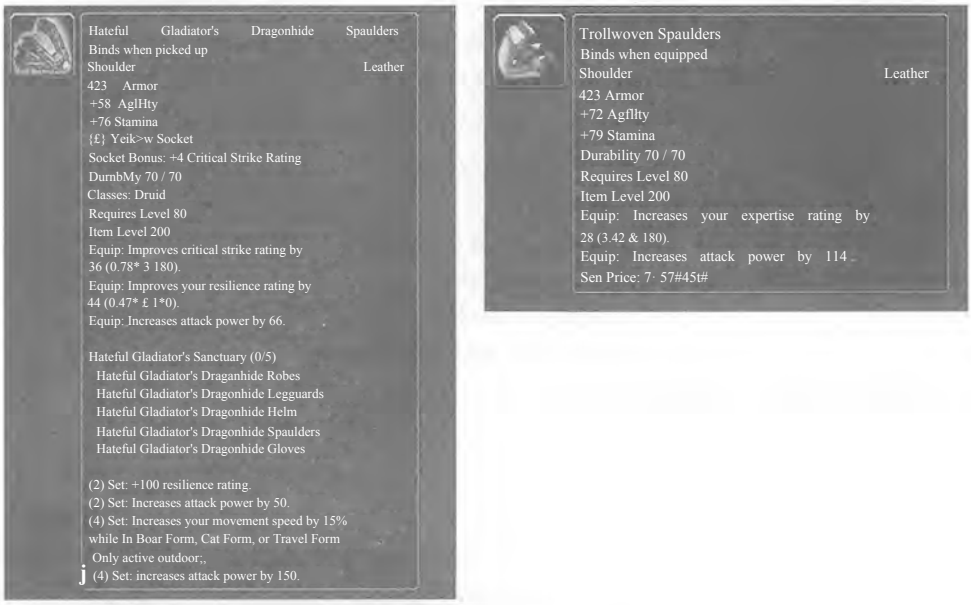
4. If a *Wo W* player asks a question in general chat, such as "Where do I get the Cenarion Shoulders?" the response is usually "thottbot" or "wowiki," meaning, go look up the information yourself rather than clog the chat channel with simple requests for information that anyone could find on the web. The logic of this system valuing self-directed learning is contrary to the values reflected in the design of our schools.

5. The answer is: "It depends." The general consensus is that the trollwoven spaulders are better tanking gear than hateful spaulders because the trollwoven spaulders enable better damage-dealing, which is good for "holding aggro" (keeping the monsters aggressive toward you and not your party), Critical strikes are useful in generating threat, and the trollwoven include almost twice the attack power, even if you add a gem for agility

Figure 1.4. Comparing Two Types of Leather Shoulder Pads in *World of Warcraft*.



DIGITAL MEDIA AND LEARNING

Although games are a vivid example of participatory culturej (especially when compared with broadcast media,), a profound shift is occurring across media and institutions. Digital development and production tools such as GarageBand, iMovie, and YouTube are reshaping music and video. Blogs like *Daily Kos* are reshaping public discourse. The list goes on. These media present opportunities for ordinary people to follow a passion, develop expertise in a particular domain, and then reach a global audience through online publishing (for a thorough description, see Jenkins, 2006, or Black, 2008). What games do is guide and scaffold this trajectory.

Ironically, we can point to examples across almost every aspect of life where this takes place *except* for formal schooling. While schools remain static, *learning* is changing; every day, millions of people log on to *Daily Kos* to learn about politics or join a Flickr group to hone their photography skills. Researchers such as Doug

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on the hateful spaulders. Plus, the extra expertise (with a weapon) provided by the trollwoven spaulders is important because it helps negate your opponents' chance to parry or dodge your attacks. As you can see, both items are viable, but when you get into optimizing gear, the trollwoven spaulders will make a bigger difference when multiplied across 16 items.

Levin and Sousan Arafeh (2002) have found that kids' Internet use shows that when they want to learn something personally meaningful, they look online. Online learning is personally meaningful, tailored to their interests and ability level, and provides immediate feedback.

In many respects, the promise of video games is about realizing age-old visions of education proposed by Maria Montessori or John Dewey. However, digital media make new things possible—such as leading a *Civilization* game or collaborating in real time with people around the world. We need to rethink what we want out of education in the digital age.

THEORY AND PRACTICE

Returning to our question, "Why study video games?" we have four responses:

1. People are developing academic interests and learning academic content through games, regardless of whether or not we design them for education. Players learn the basic facts of their games (the names of pieces, the maps, the - terms), but, more important, they learn the emergent properties of the game as a system. How learners interpret game experiences and relate them to other aspects of life is explored further in chap ter 7.
2. Games are deeply engaging for those who play them, and we can study £ games' educational design principles, such as orchestrating time, providing overlapping goals, constructing open-ended problems, and maintaining open social horizons. Even if we don't bring a game into every classroom, we can incorporate these principles in our instruction.
3. Third, games are emblematic of a broader shift toward participatory culture and suggest ways of structuring participatory educational experiences. Gaming communities push players from consumption to production. This is a useful model for educators (see chapters 4 and 7).
4. Finally, and most important for me, games, when they work, are aesthetically enlivening experiences, worthy of study in and of themselves as part of human experience. In my mind, this property should make them intriguing to anyone responsible for designing experiences for others. However, the moral imperative to study enlivening experiences is especially true for educators, who are responsible for shaping the daily lives of children attending school out of compulsion. Any time that we turn a child off to learning rather than awakening their intellectual curiosity, we've failed. In

> fact, in a digital, participatory age, awakening students' interests and curiosity and empowering them to pursue them may be what constitutes a "basic" education.

This first chapter tried to make the case for studying games as an important site of learning. The next chapter digs deeper and asks, "What should a good educational game look like?"

THE MOST FUN YOU CAN HAVE WITH MODEL RAILROADS WITHOUT SNIFFING GLUE

"Mostly sunny with a 25% chance of. . ." the morning D] cut off as my roommate hit snooze. It was 6:00 a.m., which meant that I'd played *Railroad Tycoon II* (1998) for nearly 7 hours. "I'll quit just as soon as I connect Chicago and New York.. l'

A Digital Model Railroad

Railroad Tycoon II (*RT2*), die sequel to Sid Meier's 1990 *Railroad Tycoon,* is a linked series of scenarios such as connecting New York to Chicago, building the first transcontinental railroad, creating the Orient Express, and so on. Scenarios become campaigns, which, like military campaigns, allow you to build a company through time, so that *RT2* feels somewhat like a role-playing game (RPG), Trains get faster. Production and technology become more complex. As in *SimCity,* you need money to build in *RT2, so* much of the game is strategic expansion, linking up profitable routes, managing your company's stocks and bonds, and, of course, running the trains on time. You can also build new maps, create scenarios, or play online.

RT2 is not only a powerful railroad simulation but a formidable financial one as well. You can participate in all the financial wheeling and dealing of the Guilded Age and progressive era: Create shell companies and float yourself a loan from the main company; drive the stock of your primary company into the dirt and then buy it back, build it up, and flip your stock for profit. Some players forsake the railroad building altogether and make it a financial game of buying and selling companies. In short, you can do everything except create the savings and loan crisis (or more recently WorldCom). In fact, you could probably do that too in the right scenario.

Powerful Simulation Editor + Railroad Enthusiasts = Geek Heaven

"Railroad buffs have definitely loved *RT2.* Some folks complained about the speed of the game when they had 1,400 trains running simultaneously," noted Phil Steinmeyer, head designer of *RT2.* Wait, 1,400 trains? At one time? My all-

night scenario topped out at about 15 trains. Who is building 1,400 trains?

To find out, I investigated fan sites such as the Indianapolis Depot, which has historical trains, custom maps, and new scenarios ranging from Santa Claus's railroad to historical routes in India. I talked to the head conductor Wabash Banks, who described *RT2* as an extension of his long-standing interest in railroads. Many railroad buffs are enthusiastic supporters of the game for its factual accuracy and underlying models.

RT2 works because it is *more* than a digital train set; it simulates railroad baroning, which extends the concept of model railroads by enabling players to do the following:

- Adopt a unique perspective (a baron), control financial variables, and interact with geography in a way that is inaccessible with a model railroad.
- See how a system behaves over time. Digital simulations are good at compressing or stretching time. *RT2* squeezes a decade of railroading into 90 minutes.
- Explore "what if" scenarios. There is no one way to beat the game. Players solve problems instead of guessing the designers' intentions.
- Learn the properties of the simulation through increasingly complex scenarios. No newbie player could play *RT2*'s financial game right away, but the mission structure walks players through different game systems.
- Design their own interactive content for other players. It's like players creating tools for other players to create their own railroads.

In fact, watching your trains rim *is* a little like building a model railroad. Set it up, sit back, and watch your trains take folks from San Francisco to Atlanta. Without the sticky glue.

CHAPTER 2

ideological worlds: What Makes a "Good" Educational Game?

Chapter 1 argued for studying games as a new site for learning. This chapter asks. *What makes a good educational game?* And it builds on Chapter 1 by using game series such as *Civilization, SimCity,* and *The Sims* to discuss important educational issues such as oversimplification or bias. We often see games' educational value as being in their realism or complexity, but good games find "the game in the content." They inspire interest, creativity, and social interaction. Later on in this book, we'll explore how to design such games.

INTEREST-DRIVEN LEARNING

"I'm tired. I'm heading home," David said. It was still early, maybe midnight. I asked what was up. "Oh, nothing... We were out late last night. Maybe I'll just pack it in."

"That's cool. . . See you back at the place," I said. What I was really thinking was: If I waited a few minutes, 1 could sneak out of the party and squeeze in a few turns of *Civilization* on the house computer while he slept and my housemates "Smurf" and "J-Man" remained at the party. You see, there was only one computer for the four of us, and Smurf owned it. Ever since he'd installed *Civilization,* negotiating *"Civ* time" was an issue. Multiple Civ-addicted college students sharing one computer is a bad, bad scenario.

I don't know why I didn't see it coming. When I escaped home, I wasn't greeted by an unoccupied computer but instead by David, who was knee deep in fighting the Aztecs.

"What are you doing!?" I asked.

"What *are you* doing!?" he challenged back.

"I guess we're geeks," I conceded. Rather than fight, we agreed to take turns before Smurf got home.

Soon enough, an angry Smurf charged through the door. "You guys just left me there. Get off my computer. Go to bed!"

We sloughed off to the living room and fired up Tecmo Bowl. It *was* kind of mean—and awfully dorky—for us to abandon friends at a party for a computer game. After a few minutes, though, we realized he was a little *too* angry. We peeked back into Smurf's room, only to see him playing *Civilization.*

It's hard to capture how groundbreaking the first *Civilization* game was when it was released in 1991. In *Civilization,* players choose a civilization (Egyptian, Russian, Iroquois, American, German, etc.) to lead for 6,000 years (if successful). Through military might, cultural domination, diplomatic victory, or, my favorite way, a "space race victory" the goal is to be the first civilization to colonize a planet in the Alpha Centauri System.

The game is enormous. Starting in 4000 BC, players begin with just a settler, which is used to start a city (and hence a civilization). From there, players choose which technologies (such as the wheel or pottery) to research, add more settlers to improve the land (once the appropriate technologies are discovered), and build city improvements (such as temples or granaries). Part of why *Civilization* works is that you start small: a settler and a small plot of land. Each game evolves through your choices regarding which technologies to pursue, how to balance military strength versus infrastructure (a classic "guns vs. butter" problem), how to expand, and whether to go to war to protect your interests. My favorite part is building wonders of the world (such as the Colossus or the Great Wall of China). All the while, players compete with computer-controlled civilizations for these scarce resources. For a kid who cut his teeth on *Pac-Man, Bard's Tale,* and *Pirates!, Civilization* was a revelation.

Civtied together themes from geography, economics, politics, andhistory, enabling me to identify holes in my understanding, such as, "What was happening in sub-Saharan Africa during the Roman Empire?" These connective questions come naturally to a *Civ* player but are rarely interrogated when topics are presented separately Ln school. At the time, I was an undergraduate studying social studies education in the Western College Program at Miami University. Between my teacher James Douglass' class and Sid Meiers' games, I developed an interest in history and education.[1]

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1. My *Pirates!* episode got me off to a good start with Mr. Douglas. I was such a dork that in my senior year I became a teaching assistant for his AP history class so that I could observe his teaching methods. For example, when someone asked, "Can 1 go to the bathroom?" he would say, "You're 17 years old. Don't you feel demeaned asking permission to do what any 4-year-old can do on her own?" This bathroom example illustrates how our system fails to give freedom and demand responsibility from students. Many other educators make similar observations; one of my favorites is Ted Sizers (2004) *Horace's Compromise.*

SimCity

I could have opened this chapter by discussing late-night *SimCity* sessions. Some evil colleague installed *SimCity* in our Mac lab at college, and it sucked away hours of our lives.

Civilization built on these compelling facets of simulation games but added a competitive dimension. In *SimCity*, you compete with the game model itself, trying to build your city according to whatever goals you choose. One common goal is to build an ecofriendly city. As players attempt to build public transportation or parks, they might run low on cash. To raise cash via property taxes, they might create a new subdivision. This new subdivision might create a mini-increase in crime if it is not properly policed, so more money is needed .. . and so the game continues. In many respects, the joy of *SimCity* is monitoring the "artificial life" of your creation as it grows and evolves over time.

My first academic exploration of games came in Computers and Cognition, a course taught by Christopher Wolfe (who became my advisor). We played *Smithville, Hidden Agenda, SimAnt, SimEarth, SimCity,* and *Net Trek* (awesome), read theories of hypertext, and discussed constructionist learning theory (Wolfe, 1995). Constructionism, associated with Seymour Papért (1981), is the idea that we learn best through constructing understandings through personally meaningful projects. I still recall my first assignment for Dr. Wolfe, which was to build a class hypercard stack on constructivism. Each of us took a subtopic (a nice, parsimonious assignment, I'd say) and then built our own group project. My friend David Simutis and I made an enormous hypercard stack called "The Hitchhiker's Guide to Western," which lived on the groups' computers for years after we graduated. We read newsgroups such as alt.barney.dinosaur.die.die.die. We got email accounts and signed up for the grunge-L list. As). C. Herz (1995) documented in *Surfing on the Internet,* we contemplated life in a world in which people might access—and contribute to!—whatever information they wanted from their desktop.

The field of digital media and learning formed because my generation played games and experienced participatory culture as *students.* We remember discovering the Internet and realizing that it changed everything (even if we didn't quite know how). Not everyone gamed 12 hours a day or even owned their own computer, but almost everyone played educational games, tried programming games in BASIC, and authored content on the web. There's a saying that we study the technologies we grew up with because they shape our basic experiences and expectations. Today's graduate students are gaming and Internet kids, and tomorrow's may be the mobile generation.

This story is an example of interest-driven learning. Playing *Pirates!* led to my interest in history and my identity as someone who was interested in education. Next, I found a mentor who nurtured that interest and suggested ways I might extend it. From there, I discovered *Civilization* and further delved into this interest. I was lucky enough to pursue these interests in both courses and graduate seminars and through my apprenticeship at the McGuffey Foimdation School (discussed in Chapter 5).

So for many from my generation, the question "Can you learn with games?" is moot. The real questions are "How do we make *good* learning games?" and "Can games help transform education?"

WORLDS WITH BIAS

Video games are unique in that they are participatory. Games are complex systems that invite us to *play* with them. They are dynamic in that they unfold over time; most games evolve in response to our choices. Many games that are of interest to educators are *simulations.* They aren't *perfect* simulations, and it's not always clear what they are a simulation of, but very often they try to create some *experience* for the player. The real learning occurs through the transformations we have through playing and then engaging in related practices (viewing gaming forums, playing with friends, and so on). Let's return to *Civilization* as an example.

Educators often raise two issues with *Civilization:* "Who designs it (and do they know anything about history) ?" and "The game is overly simplified and distorts reality"

Who Designs It?

This answer is straightforward: game designers. They are entertainers above all else. Firaxis, the makers of *Civilization,* are not professional historians, scholars, or educators. Game developers such as Sid Meier and Will Wright are classic Renaissance (mostly) men; they direct the programming, graphic design, and sound effects on many games, working with teams of developers. Sid Meier, the creative genius behind *Civilization,* builds historical games *(Civ, Pirates!,* and *Railroad Tycoon),* military strategy games (*F-15 Strike Eagle, Silent Service),* and whimsical games *(Sid Meier's SimGolf).* He also plays the piano—and particularly enjoys Bach—and sings in his church choir. Subsequent *Civ* designers share this breadth of interests. Brian Reynolds, lead designer of *Civ2,* studied philosophy at Berkeley. Jeff Briggs, lead designer of *Civ3,* has a PhD in music composition and is a history buff. Soren Johnson, lead designer of *Civ4,* has a BA in history and a master's in computer science from Stanford.

Civilization's designers iterate on its flaws over time. For example, *Civ3* didn't handle slavery, religion, or disease especially well. No one wanted to touch slavery for the obvious reasons, and it seemed similarly impossible to do religion without offending somebody.[2] Its also not fun to have 95% of your civilization die from diseases that are out of your control. In *Civ4,* designers included slavery as a labor system and religion as a tool for generating happiness and making money. The slave trade, which was so important to colonialism, still isn't realistically represented, nor are diseases.

Civilizations' designers readily acknowledge its simplifications. Some ideas (such as the importance of raising sheep for wool) are excluded to keep the number of resources manageable. Others are simplified so that players can see the effects of their actions. If the model gets too complex, you can't observe the consequences, and then it is not entertaining or educational. Many educators malce this mistake (let's include everything so that it's realistic), which makes a model less useful for learning. We don't want a 1:1 map of the world; we want a model to illustrate ideas. This is why many science researchers use simplified models.

One way that designers address these imperfections is by shipping the game with robust editing tools. If you don't like the stock game rules, change them yourself! People add resources like wool, create their own civilizations, or build "total conversion" mods, turning the game into a *Lord of the Rings* map, for example. Some even use Civ's tools for historical modeling.

Inaccuracies and Simplifications

This main lesson—*models have to be simplified if they are to be understood*—is important for both game design and for educators. Many scientists distinguish between two kinds of models: *idea* models, which illustrate key concepts (such as predator-prey relationships) and *predictive* models, which predict events.[3] No one would argue that *Civilization* is a good predictive model; global leaders shouldn't make policy decisions based on playing *Civ.*

However, Civ does enable players to see history and geopolitics from different perspectives. For example, try to wage a military-cultural war against a far-off civilization with ancient traditions and see how far you get. Or play a closed, theocratic government and watch as your economy stagnates. In fact, theocratic civilizations almost

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2. A notable exception is *Sid Meier's Alpha Centauri,* designed by Brian Reynolds. Brian's interest in philosophy comes through as players choose among different cultural values in deciding how to colonize outer space. Here, science fiction provided a convenient cover for exploring cultural and philosophical issues.

3. Although there are technical differences between models and simulations (models are static; simulations, dynamic), I use the terms interchangeably here.

always have little scientific advancement and often end up going to war to defend their interests. One big idea in *Civ* is that new technologies enable you to use *new* resources, creating economic benefits for advanced nations. Civilizations that invest in technologies reap the benefits; iron isn't valuable until you discover ironworldng. Today, new resources may become valuable as we discover nanotech or turbine technologies.

These relationships aren't scripted into the game; they are patterns that can be observed after repeated game play. You may learn them not from programming the game but instead by studying the emergent properties of the model. The learning is addictive. Of course, we want students to test these inferences on other representations of history. We want conversations between historical observations and game play, something that games invite and sustain and which can be scaffolded in classroom discussion.

Bias in Games

As you read that last section, hopefully you thought, "But isn't that model biased?" The answer is, "Of course!" In fact, this bias is its biggest strength. First, remember that all representations of history are imperfect. Simplification is at the heart of historical interpretation; books include some facts and leave out others, while films tell stories from particular perspectives. Games happen to frame history according to certain variables (and not others).

History is simplified in even more subtle ways. Historians always choose a starting date and an ending date to their stories; if you were to move those dates forward or back a few years, the story would change. Same goes for geographic boundaries. As my history professor Alan Karras taught, U.S. history looks different when it's not divided by the familiar periods (colonial history, Civil War, and so on) because the time period you choose to study leads historical accounts toward "inevitable" events (see also Karras & McNeill, 1992). Similarly, the history of European colonization looks different when the Caribbean is included. Many historians cross such traditional boundaries to find fresh insights.

During my brief graduate career in history, I was shocked by how many books there are on any topic. I had to read over 50 books on the history of the American South for just two courses, and even then, professors said I was only just getting a flavor for the topic. Any serious historian would read hundreds more. The same is true of political figures; think of how many Lincoln biographies there are. You can only "grok" a topic after looking at many accounts of a phenomenon.

So all representations have their slant, but games uniquely *force* players to confront many of these assumptions directly. The most obvious example in *Civ* is how it models foreign relations. In *Civ* (as in life) more advanced civilizations

strong-arm less-developed civilizations into sharing precious resources, giving access to military space, or joining in foreign conflicts. They might give away technologies or food in return for a friendly United Nations vote. Every player knows this (and often curses it). It's impossible to play *Civ* without picking up on this bias, although to what extent the player relates this to U.S. policy depends on the context (including their preexisting beliefs and purpose for playing).

Seeing a game unfold also reveals what is missing from a game. In realistic maps. Native American civilizations will develop large, advanced settlements. With no diseases such as smallpox to wipe them out, they stay populated, which changes history dramatically. How players interpret these causes (and decide to pursue the questions that arise) depends on players' goals, knowledge, and the gaming context. When I teach with *Civilization,* I use this missing feature as a teachable moment to discuss the size of Native American civilizations (which most people underestimate) and the importance of diseases. When *Civ* play is framed as a colonial simulation, students often make interesting observations:

1. "Old world" civilizations can become part of a vast trading network spanning from China to Egypt to England. This network trades technology, resources, and economic goods, not to mention diseases, so that they advance more quickly than the Americas or sub-Saharan Africa.
2. The "new world" doesn't have elephants, camels, or horses. This means that there is no natural "cavalry unit" and spells big trouble should armed conflict arise.
3. Native American civilizations are much larger than students ever realized.

How *Civilizations* model is biased is the subject of academic debate. I'd say that there are at least four groups of bias:

1. *Bias toward management.* This one is kind of obvious (and was first raised by Friedman, 1999). Because *Civilization* is *agame* in which players affect the world, a well-managed civilization does "better" than a poorly managed one. There are good arguments on either side of this issue, but suffice it to say that the bias is there.[1] What meanings players actually make of the bias is a different

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4. For an analysis of values in the fate of civilizations, see Jared Diamond's (2004) *Collapse,* a book that argues that many civilizations have failed because they destroyed their local ecolog)'. Other world histories (including Diamond's *Guns, Germs, and Steel*, 1999) frame history largely as the result of conditions that civilizations are placed in. Within Diamond's work, this apparent contradiction is largely a matter of time and geographical scale; in the short term, relatively isolated societies make decisions that lead them to flourish or decline. Over millennia and across broad regions (e.g., an entire continent) these differences tend to wash out.

question altogether. The drive to see the world in terms of management may be an inherent bias resulting from playing games, just as the narrative structure of books may invite us to see the world in terms of simple, linear causality and watching films may lead us to emphasize the importance of personal narratives.

2. *Progress and science.* The standard rules of games are biased toward scientific progress being good. New discoveries make things *better.* The story of most *Civilization* games is that new technological discoveries provide advantages over other civilizations. There is little opportunity to ask if this really is progress. It's an interesting question because in "real history" less-advanced civilizations that adopt new technologies tend to get attacked or assimilated. After all, there aren't many hunter-gatherers running around.
3. *Critical-Marxist orientation to power and conflict.* Despite the many "critical" reads of *Civilization* as being biased toward Western notions of progress (see Schut, 2007), there is an undercurrent of power coming from material goods and the use of such power by governments to obtain and secure resources. If a civilization controls resources but has inadequate military, economic, religious, or diplomatic power, it will be attacked, which is not exactly how manifest destiny was taught in my textbook.
4. *Geographical materialist theory of history.* From an educational perspective, the most interesting bias of *Civilization* is that everything emanates from geographical positioning. For example, start a civilization in the Nile Valley, and it will grow fast and then suffer from diseases. If they survive, the Egyptians must confront the Babylonians to the east and the Greeks to the north, which requires military spending. Expanding south on the Nile toward Kenya means assimilating or conquering African tribes and obtaining horses and bronze. If the Egyptians *don't* obtain horses and bronze, they stand little chance against Greek hoplites and Roman legionnaires. Almost every game played on this scenario unfolds similarly, and players start to infer rules for how history plays out on broad time scales.

Because these biases reveal themselves to the player (who is often yelling, "This is unfair! I hate the Greeks!"), most players learn them.

CIVILIZATION AS A GEOGRAPHICAL MODEL

Once you accept that bias is inherent in the game, *Civilization* is good for thinking about how geography and broad policy decisions (such as guns vs. butter) have an impact on history. To explain, examine figures 2.2 and 2.3 from *Civ3.* Figure 2.2

Figure 2.2.
C/V3 World Map

Figure 2.3.
***Civ3* City Management Screen**

shows the map players see most of the time. The map shows physical geography, natural resources, political geography, and human modifications to the environment, such as cities, roads, farms, and railroads. (Incidentally, teachers love that playing *Civ* involves staring at maps all day. As one student put it, *"Civ* is a boring 'natural resource' diagram from your textbook come to life.") Figure 2.2 shows how these resources are gathered and manipulated via cities.

Geography undergirds game play as players study the map to infer the *strategic* implications of these elements. It matters, for example, that the Nile is long and

snaking and that there are horses, bronze, and gold to the south, because it affects how cities form. The Sahara Desert also serves as a natural border constraining westward expansion. These lessons correspond to middle school world geography standards.

So the game comes down to one's ability to gather resources, to amplify them by building structures, and then to make strategic decisions on how to maximize them. For example, if one is on an island, then your number-one goal should be to pursue fishing and sailing technologies (much like the Phoenicians). Conversely, the Persians sit at the crossroads of Asia and Europe and thus are well positioned to control trade routes, so your first job is to build your military to counteract threats from neighboring civilizations.

Remarkably, many historical phenomena are simulated "well enough" through these variables. To be sure, *Civ* contains some 10,000 concepts that make even the most advanced educational software look embarrassingly simple. Yet the foundations of *Civ* are straightforward, which Chris Crawford (2003) has argued is at the core of its appeal. A simplified, elegant model is easier for people to understand and much more useful than a "perfect" model that is too complex.

Getting an ideal model "right" so that it is both fun to play and generates insights is the key for both research and education. Idea simulations such as the Lotka-Volterra equations (the basis for many predator-prey models) do not model entire ecosystems. Lotka-Volterra doesn't *predict* what happens to a deer population if a particular policy toward wolves is adopted in Yellowstone National Park, for example. Rather, it shows patterns over time and highlights nonintuitive relationships. Lotka-Volterra shows how an imbalanced system eventually results in the predators themselves dying. First, the predators kill off the prey. With no prey left, the predators eventually starve. After the predators die from a lack of food, the prey rebounds. Now, there's an overabundance of prey, which enables the predator to rebound, and the whole thing repeats itself. (Google it, play with some of the models, and you'll see.)

So, asking whether or not *Civilization* is "accurate" misses the point. My argument is that *Civ* (1) provides a framework tying together world geopolitical history; (2) gives fluency with a model that is useful for analyzing world history on broad time scales; and (3) inspires revisiting, tinkering, and socializing. These same factors make good success criteria for games more generally.

IDEOLOGICAL WORLDS AS FRAMEWORKS FOR THINKING

Games are "ideological worlds" in that they instantiate ideas through implicit rule sets and systems (rather than by telling stories). The word *ideological* tries to capture that

they are built according to theories of how the world operates (implicitly or explicitly). Every game makes value judgments about what is and is not important. I prefer the word *world* to *system* because games are not (usually) abstracted rule systems but worlds rich with representations. These representations might be of cities, resources, and armies, such as in *Civilization*, or automobiles, city streets, and their denizens, such as in *Grand Theft Auto.* Although it's useful to look at games as systems, the term *system* shortchanges the role of graphics and sound in how players infer meaning from games. Visual representations are a critical part of meaning-making.

Games and Simulations

Games differ from simulations in that they give roles, goals, and agency; elicit fantasies (including transgressive play); and design experiences to manage complexity and learning. Dan Norton (2008) sums it up well with the phrase "roles and goals." In the case of *Civ,* your role is a leader, somewhere between a dictator, a president, and God. This trade off between realism (what role do you play in *Civ?)* and engagement (it's fun to test out your ideas without annual elections) is part of the allure of games. The Senate in C/V2, for example, intervenes on military decisions. Players can avoid this by overthrowing their government and installing a fascist state before going to war. Current versions still penalize players for unpopular wars, but more coherently.

Game designers often say, "It's OK to sacrifice realistic *roles* if they support players in pursuing meaningful goals." Critics may argue that these simplifications are dangerous, but none of the hundreds of *Civ* players I've interviewed (some even as young as 8 years old) have ever confused their role with that of the president or emperor (see Chapters 6 and 8). This fictional conceit loses realism, but buys the ability to affect multiple levels of a system. As an educator, I tend to start with authentic experiences (such as being a scientist), which is fine, but also precludes many interesting roles (such as a time traveller).

The latter part of the equation is *goals.* Games entice players into developing goals. Players' goals are a property of neither the player nor the game, but are a coupling of the possibilities of the game space and the player's desires. *Civilization* has the capacity for players to do many things, ranging from leading a peaceful global society to waging religious wars to wiping civilizations off the map. Yet players do things all the time that the designers didn't anticipate. Thus, even though *Civilization* isn't a perfect simulation, its value is in its gameness.

This distinction between games as rule-based systems versus worlds mirrors the "narratology versus ludology" debate that once defined game studies as a field. The debate, in essence, is whether to study games as *media* or *play.* Study them as media, and we are inclined to see them in the context of the history of media, which includes books, film, TV, radio, and so on. Study them as play, and they are situated in the tradition of toys, hobbies, board games, and sport.

Games are both media *and* play. They allow us to play with representations, such as when we play being a gang member who wears a Hawaiian shirt and drives a pink Cadillac in *Grand Theft Auto: San Andreas,* and to test the rule systems of those representations, such as taking that getup into rival-gang territory.

No one game captures everything perfectly, so ideally we want multiple frameworks for thinking about any topic. Students should experience a variety of theories of history. For example, *Civilization* deals with history at such broad time scales that "great people" are unimportant. Students might imagine how *Civ* would be different with a "great man" theory of history (see Chapter 6).

MEANING-MAKING IN IDEOLOGICAL WORLDS

How do we make meaning within ideological worlds? Within game contexts, at least two qualities are important: (1) the learning cycle of a player developing goals, reading the game space for information, taking action in the game world, and then reading games for feedback; and (2) the social experience of participating in particular game communities, which is where much of the reflection, interpretation, and media production occurs as interpretations are debated and legitimized.

Meaning-making within games is a deeply *productive* act. Players formulate goals, develop plans and strategies to reach those goals, and read the game space to understand what happens—all within a broader social context. Learning has been thought of as an active process for a long time, and if there is one message coming out of the learning sciences over the past 30 years, it is that learners are active meaning malters who *create* knowledge from experiences. However, learning through game play is about creating knowledge in a way that challenges even our most "student-centered" notions of learning.

Meaning-making is related to particular goals. When first playing *Civ,* you start with a vague goal, which for me was "play Smurf's cool game." What made it cool, from a distance, was its complexity and ability to grip my friend for hours at a time. Next, I was taken by the ability to "replay" history. Could I play as a Native American tribe and fend off Europeans? From there, I developed more specific goals (if I "discovered" Europe, maybe I could strike peaceful diplomatic agreements and

protect myself). Moving forward, I developed more sophisticated strategies (grow quickly and research naval technologies). Every student I have studied has his or her own trajectory (explored further in Chapter 8). For some, an interest in ancient Rome translates to a focus on achieving great wonders, which leads to understanding cultural and economic variables. Others take to naval warfare, which might lead to learning about Vikings.

This process is deeply *productive* in that players constantly construct goals, strategies, and theories about the game system. You can see the products of these strategies on screen, in how cities grow, how trade routes are constructed, and how military defense systems are built. But there is also the theory production in the player's mind. As designers of educational games, we want to align this theorizing with socially valued forms of thinking, whether it is thinking like a citizen scientist or like an engineer.

Michael Nitsche (2008) provides a useful way to navigate these planes of gaming. The first plane is the game as it is encoded in the box. The second plane is the game that unfolds on screen. There is no "game" without the player. The third plane is the game being played in the player's mind. Will Wright (quoted in Pearce, 2001) argues that from the moment the player looks at the box, he or she is constructing a model of the game. Game play for Wright is simply the process of developing deeper understandings of that model. Understanding this mental plane is critical for understanding *The Sims* (see *The Sims* sidebar). I might, for example, play a game based on my family. The people on screen aren't "my family," but in my mind, I am playing my family. The fourth plane is the action occurring in real space (the mouse clicks and so on). This is the "button mashing" plane; those who claim that games are just button mashing are focusing on this interaction (but not really understanding it). The fifth plane is the social plane. This plane is gaming in its social context, which might involve performative dimensions (as in *Rock Band)* or competitive play.

PARTICIPATION IN IDEOLOGICAL WORLDS

So far, we've focused on games as interactions between humans and computers (largely planes 1-4), but this fifth social plane may be most important for learning, and we need to unpack how it drives advanced game play. Consider how *The Sims* encourages people to be not just *consumers* but *producers* of content (something studied in more depth by James Paul Gee and Elizabeth Hayes, 2010). When I first reviewed *The Sims* back in 2000, I was amazed at how Wright and his team did not include every person, family, or piece of furniture imaginable in the game, but instead gave *players* the ability to produce and distribute content. Essentially, the team put players to work for them in *creating* game content. *Spore*, the design game

in which players design cells, organisms, tribes, civilizations, and planets, takes this strategy even further, as the creatures, vehicles, buildings, and cities that players create through play become the content of others' games. A key to *Vie Sims* wild success, I think, is that it didn't try to be all games to all people; rather, it gave players the tools by which they could make unique game experiences that they wanted to play (like having the band the Damned move into their neighborhood and pee on their floor, which happened to me).

The Sims

The Sims, the household simulation game designed by Will Wright and his Maxis team, is a touchstone example for educators. Proving that popular games don't need to be violent, *The Sims* is the top-selling PC game of all time. It's now a multibillion-dollar franchise and has sold over 125 million titles.

Few things are more fascinating than watching and experimenting with people. Many *Sims* players start by modeling their real-life household to see what happens. I was shocked to learn that, according to *The Sims*, my life would be better if (1) I ate breakfast with my family (meeting my social, nutritional, and comfort needs as well as improving my relationships), and (2) I bought a good couch (meeting my needs for more social interaction, comfort, and fun, as well as providing space for relationship building, even while reading books). All kinds of people came to visit when I had a good couch.

Wright (quoted in Pearson, 2001) reports that most players use *The Sims* as an interactive storytelling machine. Maxis provides tools so that players can easily take pictures and post their stories online. Still, playing *The Sims* can be quite transgressive. Sending a housewife in need of social interaction next door to talk to an attractive neighbor feels infinitely more transgressive to me than shooting aliens in *Doom.*

So what is *The Sims*, really? A quick answer is an interactive digital dollhouse with built-in shopping, storybook making, and scrapbooking. Critics note a strong materialist bias underlying *The Sims*, in that better couches, for example, tend to make people happier. The game pokes fun at this bias. For example, the advertising copy for a table available for purchase in the game reads, "This end table will improve your life!" This can lead to some confusion about when *The Sims* is serious and when it is satire. It also raises the possibility that there is a strong materialist bias in the world. Wright (quoted in Pearce, 2001) claims that the game is about several things, including the tension between pursuing material goods in order to make our lives better and the tendency for those material possessions to own us, rather than the other way around.

The Sims isn't the only game that supports player creativity. For years, games have shipped with modification, or "modding," tools that players use to generate content. What Maxis did was make the line between consumers and producers *fluid,* so that players could *very easily* create and upload their own characters, houses, and furniture to *Hie Sims* website. For Wright, creating a "smooth ramp between consumer and producer" is paramount. In an interview with Celia Pearce (2001), he says,

> I think there are going to be certain types of new media where this is the natural form of interaction. With something like *The Sims,* it's meant to be a very smooth ramp. I buy this game and it might be a while before I tune into the web button, but it's real easy and so I don't really have to go out of my way to share my experience. As opposed to somebody who's doing a home page, where they have to actually figure out how to deal with their ISP. Or the film thing, where in fact, I have to actually pull out my camera and start doing work to make the film.

To put this quote in perspective, think of how, in 2000, few people (especially nongamers) would have signed up for a game and gone online to download content made by strangers. One might also ask, in turn, how many would have felt comfortable creating content. That's what *The Sims* did.

T*he Sims* excelled in making this ramp from consumer to producer "smooth," to use Will Wrights' term. There are simple and obvious ways that one can begin producing content, starting with uploading one's *Sims* characters. Next, one might use the game as a story-creating engine by using the "scrapbook" feature. Wright reports that for many people, advanced game play consists largely of using the game as a storytelling engine, and there are wide reports of this feature being used for family therapy.[5] At the highest levels, players might actually create custom characters and furniture for *The Sims* and earn real world cash from other players.

This fluidity of production found in *The Sims* can also be found in entirely different games, such as *World of Warcraft.* In *WoW,* players begin participation in amateur production by downloading user-generated add-ons that are required to participate in high-end gaming practices. As Steinkuehler and Johnson (2009) argue, they begin customizing the user interface and, in some cases, even developing their own mods and add-ons. In both games, there is a trajectory of experience that starts with *using* user-generated content and grows into *contributing* user-generated content.

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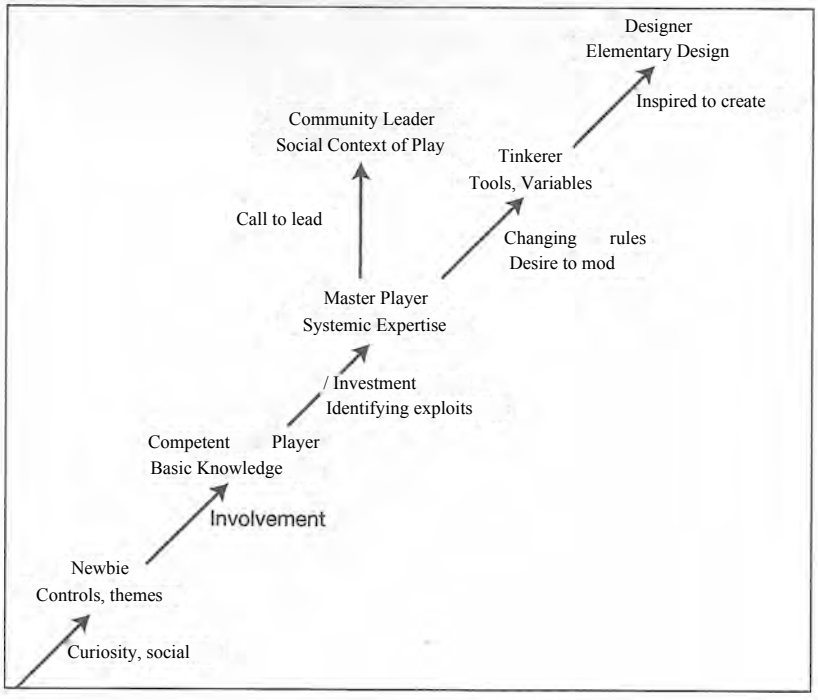
5. There is even an article titled "How to Use *The Sims* for Family Counseling" on eHow.com (http://www.ehow.com/how_4611836_learn-couples-counseling-Sims.html).

Across our studies of games and game players, our research team has found a general trajectory of experience (see Figure 2.4). Players begin as "nOObs" with little experience. First, they develop basic knowledge and experience with important game functions. But with a game like *Civilization,* that's simply achieving competency—becoming a basic-level gamer with perhaps 40 or 50 hours under one's belt. Past this point, the player begins developing exploits for gaming the system—simple solution paths that work across almost every situation. In *Civ,* for years this was "leave 2 phalanx in every city." A good game avoids these optimal solution paths, giving players many interesting decisions to make (see Balancing sidebar).

Gaming forums are the Wild, Wild West where this intellectual work happens (for examples of how this works in WoW, see Steinkuehler & Chmiel, 2006). In these forums, players post data from their games and examine others' data. They collectively analyze data across games and propose rule changes. As players gather superior strategies (collections of moves and approaches), they change the broader rule systems. Eventually, players create their own "mods," which are versions of the game with different rules. In *Civ,* this process is pretty clean-cut. Players build mods such as "Give peace a chance," which prohibits players from going to war, and then official expansion packs and future versions of the game include scenarios based on these mods. In this way, the fan community functions as an unofficial research and development lab.

Figure 2.4. Trajectories of Participation in Gaming Communiites



Balancing

Avoiding these optimal solution paths is also called balancing. To understand the difficulty of creating such well-balanced systems, consider something like *World of Warcraft*. Here's a game that is played worldwide by over 10 million people, many of whom spend extensive time examining systems, looking for exploits, and sharing them on sites such as Elitist Jerks.

Raph Koster, a lead game designer, artfully described the epic battle between players and designers in massively multiplayer games—one that designers are destined to lose. He frames players' pattern-seeking behavior in evolutionary terms, arguing that those who do not learn to see through the optimal solution paths of today's world (such as eliminating credit card debt) are in deep trouble indeed.

Blizzard has been able to achieve optimal balance in *WoW* because they've had nearly a decade to perfect it. If a system isn't working, they change it. Then they change it again. And again. It would be great if designers of educational systems had a similar design-user feedback-redesign loop. Sadly, we don't, and most educational games yield experiences that are good for learning some basic descriptive knowledge and manipulations, but not much else.

The participatory structure of game communities enables such remarkable learning to occur. However, we can't simply design games, stick them into classrooms, and then expect students to begin rewriting their textbooks. The school-based culture of passive knowledge reception (as opposed to production) needs to change. Such a change would require revolutionizing across the entire education system—from the professional development of teachers (who *themselves* are treated as recipients, not producers, of knowledge) to the assessment system.

THEORY AND PRACTICE

This chapter started with the question "What makes a good educational game?" One response might be "something that represents the domain accurately or recapitulates professional practices." But such approaches that privilege authenticity may also miss educationally beneficial opportunities that are newly available with digital media, such as leading a civilization for 6,000 years or traveling through time. Let's take the findings from the Chapter 1 and turn them into criteria for good educational games:

- *Good educational ga-rnes employ academic knowledge as a tool for achieving goals.* Recall how in *Pirates!* geography is a tool for success. In games, players employ knowledge and understandings as tools for action.
- *Good educational games lend themselves to systemic understandings.* Games appear to be particularly good for immersing learners within systems and enabling them to explore the emergent properties of systems. Other media and curricular strategies may be better suited toward other goals.
- *Good educational games employ sophisticated game design techniques* (e.g., orchestrations of time, overlapping goal structures) to provide a polished experience.
- *Good educational games offer multiple ways of playing them, so that players can experiment with a variety of identities in a group.* Good games let reluctant kids lead, encourage advanced students to help others, or engender friendships among isolated students. If games are ultimately participatory, good educational games might encourage *learners* to set up and negotiate these social structures *themselves* as a part of game play.
- *Good educational games pique players' interests.* In fact, authenticity or realism maybe *less* important than raising interest in terms in academic subjects, in terms of designing and selecting games for learning. Students can critique games as historical interpretations or, in some cases, play with systems and then build their own mods of the game. These approaches position students as critical consumers and producers, rather than passive recipients.
- *Good educational games are ideological worlds that instantiate particular ways of viewing and valuing the world.* Good games don't shroud these biases, but engage the player in a critical conversation about the world. In the case of *Civilization,* its material-geographic bias may be its biggest strength as it pushes the player to think about the causes of colonization. Educators may be better off choosing a game with a strong point of view and encouraging students to deconstruct it than choosing one that claims neutrality.
- *Good games are social, in that they encourage social interaction of different forms and lead to productive practices (fan communities, fan fiction, machinima).* Educators might inject games with social dynamics that encourage reflection, argumentation, and discussion. Some mechanics, such as supporting the development of expertise in different areas, lead naturally to peer-to-peer learning, apprenticeship, and production. As designers, we need to look for ways to encourage such discussion by creating memorable moments, differential access to information, or differentiated expertise.

- *Good games inspire creativity and smooth ramps to usher players from users to producers.* Examples of such games might be science games in which people design bridges, robots, or buildings (examples of such games are *Pontifex, Mind Rover,* and *World of Goo;* see Chapter 8) and historical games in which people role-play in creative ways and write about their experiences as a form of historical interpretation (as in *Revolution;* see Chapter 5).

The next chapter turns our focus to the social organization of game communities, providing a preview into how learning might be organized in the digital age.

COOPERATIVE GAME PLAY

by Kurt Squire and Henry Jenkins

Gamers are growing up. What do aging garners want? One theory is that gamers want to socialize. Picture this: A 32-year-old garner comes home from work. After dinner, his or her child is in bed, leaving an hour, at best a few hours, for gaming before the next morning. Marathon game sessions are out of the question. The desire to spend time with loved ones is paramount, and unless our gaming hero wants to create domestic turbulence, he or she had better not commandeer the home entertainment system.

Cooperative game play is one way out. Co-op modes allow multiple players to collaborate against common challenges. However, co-op modes have been an add-on rather than a core game play feature.

Square-Enixs *Final Fantasy: Crystal Chronicles* is one of the first games designed to be co-op first, single player second. In *Crystal Chronicles*, up to four players must organize tactical decisions, share inventory, and rely on one another's strengths. When a Game Boy Advance (GBA) is connected to the GameCube, each player gets a private screen and controller, giving him or her access to different information. The information on the GBA is meant to be private: Nobody really wants to see other players' inventories splattered across the TV screen.

As *Crystal Chronicles* players will attest, when a player has private information that he or she needs to share, the game suddenly becomes a stimulus for communication outside the TV screen. The talk around the game is a continuous flurry of tactical discussion. Furthermore, synchronized attacks create special bonuses, so the room quickly fills with chants of "Three, two, one, go!"

Teams that fail to coordinate are quickly decimated. This concept of mutually dependent fortunes—"If you die, I die"—makes *Crystal Chronicles* more compelling than preceding games in which a teammates death relegated that player to a virtual penalty box from which he or she had to watch his or her teammates clear enemies alone.

Cooperative game play that combines differentiated access to information and co-dependent goals has applications far greater than entertainment games. In education, for example, we know that having novices and experts work together in concert on problems is among the most powerful forms of learning. Eric Klopfer

and colleagues at the Massachusetts Institute of Technology have been applying this principle toward educational ends through augmented reality games.

In a game called *Mystery at the Museum*, which is played at the Boston Museum of Science, teens and parents play in pairs as a detective, technologist, or scientist on a mission to solve a museum theft. Students and parents constitute a team, and each member gets different information based on his or her role. Parents and children report that the game provides new opportunities for them to work and play together. As one parent put it, "I can't remember the last time I talked to my [14-year-old] son for this long without fighting."

CHAPTER 3

Teaching with Games: Learning Through Play

Hopefully, I've persuaded you that we can learn from games and that they represent new additions to our intellectual repertoire. But educators might reasonably ask:

- Can we ever put such games into classrooms?
- Don't games that require hours to learn and involve overt competition go against the grain of school?
- How would a games-based curriculum look?

This chapter draws on experiences teaching with games and aligned pedagogies in alternative environments to sketch out a vision of what such a system might look like. For those educators who are still skeptical of games, this discussion may challenge assumptions about schooling and learning.

BEFORE-SCHOOL CORPSE RETRIEVALS

"What in the hell were you doing back there, Kurt?"

"Yeah, what was up with that? Please tell me you got my corpse." A third kid pushed the first two aside. We barely fit in the narrow hallway of McGuffey Foundation School and this was becoming a scene.

"Whatever, man. I don't care. Did you get my stuff back?" A chorus of kids chimed in. "Yeah, c'mon, did you get it?" I was backed up against the wall, accosted by a pack of angry 5th graders. It was 8:30 a.m.

Before school on that cold winter morning, I had been online MUDding (MUD is text-based, online cooperative gaming—a precursor to *WoW)* with these same kids on a game called *Avatar*. I had led them into an area slightly above our levels.

Of course, I got us all killed. Now, in todays gaming world, this wouldn't be such a big deal. People die all the time. But, back in 1995 in *Avatar* (as in most early MUDs), the death penalties were severe. First, you lost 50% of the experience you had gained toward the next level. Imagine putting in 22 hours toward a level only to die and lose 11 hours of work. Cruel by today's standards, but normal for the time.

It gets worse. When you were resurrected, you came back to life naked. Completely naked. No swords, shields, helmet, underwear . . . nothing. (OK, you had underwear in our family-friendly MUD). If you ran back to your corpse within the hour, you could "loot yourself" and get back your stuff. But if you took longer than an hour, it was gone to the ether, forever.

Doing corpse retrie\'als was, as you might imagine, tricky business. First, you had to remember where you were in this twisty passage of text. There were no maps unless you made them yourself. Everyone I knew kept notes next to their computers saying stuff like "L, L, F, F, F, R, F, F, F, L" to remind themselves that, in order to get to the town of Midgaard from Nom (a popular starting position), you would go left, left, then forward three times, turn right, go forward three more times, and then turn left... or some such thing. This was only for unusual places; even my 5th graders had memorized basic paths such as how to get to town.

Even if you found your corpse, you had to avoid getting killed by aggressive monsters. Fortunately, you could "flee" (by typing */flee),* which would send you to a random room, but this was dangerous because you might run into another monster. Losing all your stuff (which happened at least once to everyone) meant rebuilding a character from scratch. The most heartbreaking losses were special items, such as a locket from an evil witch gained with a friend in a meaningful battle. Almost every gamer keeps at least a few of these things on them, even though inventory space is notoriously limited, a phenomenon researched by some of these same kids, 15 years later (see Zimmerman, Squire, Steinkuehler, & Dikkers, 2009).

So this is all to say that dying was a really bad thing.

But it was especially bad if you had to catch a bus to school in 5 minutes. Parents generally did not understand the importance of corpse retrievals.

In this case, the guy who got them killed was their teacher. Panic ensued.

"Were screwed!" one yelled at me.

"I have to catch the bus!" another added.

"Kurt! *You* can be late!" one finally realized. The next few minutes involved a group of 9-year-olds trying to convince me to take one on the chin while they raced for the bus.

I stayed on, clock ticking, got their stuff, and sped off to try to make first hour. Driving to school, I nervously tried to concoct a reason for my tardiness. Because

we team-taught classes, it wouldn't be the end of the world if I were late. As I attempted to sneak in through the back door, the always cheerful Liz Woedl called out from her room, "Nice of you to join us, Kurt!" I was busted.

After class, and after I was accosted by the aggressive mob, Janet Kretschmer, die principal, found me.

"So, did you get everything taken care of?"

"Umm ... yeah ... so you..." I wasn't sure how to play this one.

"Oh, yes, I heard. What on Earth were you doing taking kids to the Temple of Zin *before school*?" She had a point. *That* was the irresponsible part. Janet was generally on top of things.

My principal (maybe the only one in the United States at the time) not only played *Avatar* but was an immortal there.

In fact, it was through Janet that I first learned about *Avatar* (which at the time was called *Farside).* Janet (as she brilliantly recounts in *Darii, the Godmother,* n.d.) started MUDding when she heard her kids discussing "rings of holding," Ciquala swords, and other arcane trivia. She soon learned that her kids were going home every day, logging on to the Internet (which in 1994 was unusual), and playing MUDs. After confiscating a note saying "4e 5s 16w," she decided to log on herself to see what it was about.

It wasn't long before she, too, was hooked. Here, beneath the rest of the world's radar, was a virtual world of mysterious places, people, and things. For a newbie, it can take hours to even figure out who was "real," who was controlled by the computer, or what this even was.

Soon Janet had multiple characters and was approached to become an administrator within the community (essentially giving her the keys to the place). She checked in on players and resolved disputes. In addition to becoming an "immortal" (the highest possible level), she later contributed to several major designs. For example, the angel system enabled level-50 players to morph into angels, giving up their celestial bodies (and goods) to become permanent helpers who specialized in doing nice things such as corpse runs for newbies.

In fact, I recently had the wonderful experience of orchestrating a reunion between Janet, a few of those 5th graders (who are now entering graduate school), and myself. I asked Janet, "What on Earth got you to MUD?" She retold how it was actually the kids who invited her in (a testament to their relationship), adding, "That was part of why it succeeded. They invited me into their play space. But it enabled me to be there and accessible to them. I could keep a watchful eye without necessarily intruding. They knew they could find me if they ran into trouble."

Eric, one of the 5th graders, smiled and nodded: "Yeah—that's one of the things I appreciated. You weren't butting in, but you were always there if we needed it. If things got a little out of control—and they sometimes did—you would help straighten it out."

Janet wanted *someone* to keep an eye on these guys. Eric confirmed that their parents had no idea what they were doing—or that it was even technically possible. Janet could have just told their parents (and in fact she did). But had she attempted to shut down their fun, they would have simply moved on to another game, and this time not invited the adults. Playing along with them (albeit at a distance) allowed her to gain unique access to their lives. In short, she was doing a version of what Jane Jacobs (1961) described in *Vie Death and Life of Great American Cities* as the "watchful eye," but for the digital age.

As teachers, we used gaming as a way to connect with students. We noted if a student was keeping odd hours. We checked if a student was notably irritable or despondent. On a simpler level, it let us just talk. Video gaming is a lot like shooting baskets in that you can focus on one activity and use the interstitial times for conversation.

Sometimes gaming was the only thread left for us to connect to students. As an example, Janet tells a story about becoming an immortal after one student used foul language on a public, "family" channel (a banishable offense). This transgression resulted in our *entire* local service provider (the only one in the region) being banned from the game. This would be like an entire town losing its access to *World of Warcraft* forever. You don't want to know the vengeance the other kids were plotting.

The culprit was dealing with a lot of home issues and was lashing out all over the place. He already wasn't very popular, and if other kids had gotten a hold of him, things could have gone really badly. Janet used it as a teachable moment with the boy, and eventually she got hold of Snikt, the designer/owner of the MUD, on the phone and fixed the situation.

FROM PLAYERS TO DESIGNERS

What was innovative about the games of that period (and this is still true today for games that allow mods) was that immortals like Janet created entirely new content. Janet, for example, created a "MUD School" to teach players how to play. Any player—even kids—could invent new creatures and author new areas or suggest changes to the underlying rule structure or administrative policies.

This trajectory from user to designer is both remarkable and typical of the online games from this period. In my mind, it still is an educational promise of games:

How can we take newbies and turn them into content *producers*? How can we make them authors in a domain where they create the *content,* the *rules* by which it governs, and the social systems that encompass it? In short, this trajectory is going from being a game *player* to being a game *designer* and *community organizer* (see Figure 2.4). In education, we might want students to design games about things other than ores and elves, but we would love for them to develop this kind of deep knowledge, systemic understandings, communication skills, and leadership and responsibility over their social organizations.

In fact, *many* of our 20-odd kids who played *Avatar* produced content or became immortals. Two 5th graders (Eric Weiner and Nate Berger) wrote an area based on the Hundred Acre Wood (from *Winnie-the-Pooh).* This area, which was nearly 50 pages long, included maps, room and area descriptions, action-and-response triggers, and monsters and their items (including statistics). They turned it in as a writing assignment and got feedback. Other kids wrote fan fiction.

Skeptics might counter, "Yes, but what were they *learning*?" The most obvious benchmark of learning was spelling. Every student who played *Avatar* showed a marked improvement in spelling. This may be surprising, but not if you are familiar with most 5th-grade boys' spelling. In order to be understood by the machine or the people grouping with you, you had to at least approximate the English language.

What the kids remember most was the chance to be taken seriously by adults as competent peers and the experience of writing something played by thousands of people from around the world (including many in their school). Because they gamed before school, these kids often grouped with Europeans, which was important if you were a 5th grader from Oxford, Ohio. As one student described to me, "There was something really cool about having a computer programmer from the Netherlands mailing you pictures of his cat. Sounds kind of strange now, but it meant something at the time."

Nate used this experience of writing his 100-Acre Wood as the basis for his entrance essay into Dartmouth's creative writing program. For Nate, the experience was about becoming an author. He learned (1) that writing a novel-length project could be satisfying, (2) what it's like to undertake a project in which the results aren't known ahead of time, and (3) what it's like to collaborate. He now described writing "100-Acre Wood" as a lesson in debunking the lonely-writer assertion—that writers must slave away at a masterpiece that is unveiled to the public at the end of a lonely process. Writing "100-Acre Wood" taught him that writing could be collaborative.

Literacy scholars such as James Paul Gee might describe this as learning to think of writing as *design* (see New London Group, 2000). These students were

learning to work with a symbol system. In this case, the symbol system was mostly verbal language arranged in database format, but it also included maps and numerical values. Writing "100-Acre Wood" went beyond impressing the teacher and getting an A on the assignment. These students were using language to create specific effects in audiences—laughter, fright, surprise, and so on. Finally, these students were learning to position themselves as authors in terms of the MUD community as they made bids to become immortals.

For education. *Avatar* provides an incredibly powerful lesson: Learners should have clearly visible opportunities to become *leaders, teachers,* or *authors* in the domains they are studying. It should be clearly communicated what players must do to become experts, and they should have opportunities to interact with such experts regularly. By contrast, school functions to isolate students by age ability, filters all information through the teacher, and features few opportunities to interact with experts, much less *become* one.

To get a sense of how such a digital, participatory literacy might "transfer," it's worth sharing what Nate and Eric did next. As a gag (and a gift to their principal), they recruited me in a secret plan: They wanted to write a MUD area based on their school, and it would be called Operation Jelly-Filled Doughnuts so we could discuss it openly without being detected. Over the next several weeks, they turned McGufFey Foundation School into a MUD dungeon. Schoolrooms and corners of the playground became "rooms." Kids, parents, and teachers became monsters, each with unique abilities and items. For example, in her classroom, Sue (our science teachers) had a replica NASA spacesuit that became a highly valued set of armor that gave players extra intelligence, charisma, and mana (points for spell casting).

All teachers were boss monsters with signature moves. One teacher had an icy stare that would freeze you; another had a lecture spell that would put you to sleep. Nate's beloved Pittsburgh Pirates pump hat gave bonuses to agility, I believe, but took away a few points of charisma (a subject of much debate). Eric and Nate wanted to model how one of them got run over by a pack of 5-year-olds after the bell rang for recess, so the kindergartners were a roving mob of weak, low-level creatures that did immense damage.

My favorite example was the "teacher's red pen," the area's highest level weapon. There was a low-level chance that teachers would drop a teacher's red pen, which did decent damage but, more important, cast a whole series of "debuffs" (spells that make you weaker or less intelligent). In the presence of the almighty teacher's red pen, everyone loses his or her cool, modeling how being graded can negatively affect self-confidence.

INTEREST-DRIVEN LEARNING

It's essential to remember that these weren't kids let loose on the Internet who magically ended up writing game areas. They had a strong support network that nurtured and guided their interest. Like most stories of this sort, it starts at home. Both Eric and Nate had computers in the home and parents who cultivated their enthusiasm, although much of their gaming took place at the library. For kicks, I followed them after school once to see how they pulled off their gaming. In addition to being informative and entertaining, it shed light on how millions of youth today play *Runescape.* They started at Kmart, where they stocked up on candy and ran errands for their parents to provide cover. Next, they went to the public library for its free broadband. Before long, a librarian found them, so they moved to the college library. Gaming was banned there, but they discovered a way to hack in. On most days they could sneak in 2-3 hours of broadband gaming, which in the days of 2,400-baud modems was a big deal.

At school, they had a master teacher, Janet, who understood the research on kids' reading: Interest-driven learning can be a powerful motivator. When passionate about a topic, students will willingly read and write texts that are far more complicated than texts about topics they are not passionate about (Steinkuehler, Compton-Lilly, & King, (2010).

Identifying students' passions and using them as a vehicle for relating academic content is something the skilled teachers at McGuffey encouraged me to do regardless of technology. One student, Jason, refused to complete assignments or even to respond to adults. After becoming friends with Jason through gaming, I discovered his real passion in life was raising Great Pyrenees dogs. He loved learning about how Great Pyrenees protected herds from predators or how the breed evolved.[1] If you got Jason talking about Great Pyrenees, not only would he open up, but he wouldn't *stop* talking. I researched the breed so I could engage in conversation with him (I was raising Lucy, my own Chow-Lab-mix puppy at the time). From there,

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1. This is, in fact, really cool stuff. Jason taught me how Great Pyrenees were bred to basically look like gigantic 200-lb. sheep. They live among the sheep, peacefully, until a bear or wolf comes along, at which point the dog lunges for the predator's throat and the predator learns that these dogs are not big sheep at all. Jason told me about this after two of his dogs took out coyotes the night before. I didn't believe him (and because this was the early days of the Internet, it took a while to decisively settle the debate). However, he was right. After that, whenever possible I channeled Jason's interests in Great Pyrenees to advance his learning. I think a key was that I took an interest in Jasons hobbies and was willing to learn from him.

we forged a friendship that enabled me to work with Jason on academic matters, either by relating things to his interest or just by calling upon the goodwill we had developed.

Some (see National Endowment for the Arts, 2004) discount appealing to learners as pandering or fear that seductive educational materials will dampen students' desire to learn for learnings' salce. We need to remember that educators don't simply want learning for learnings' sake; we want students to learn what *we want them to learn* and then *respond* as if it's for learnings' own sake. Jason didn't hate *all* kinds of learning; he simply disliked what he *had* to do in school. He loved learning about Great Pyrenees for learnings' own sake. How do we create a coupling between the students' interests and academically valued ones? Sometimes we avoid the reality that there *is* a degree of indoctrination involved in trying to get kids to care about the same kinds of things "we" do. Maybe one reason that my relationship with Jason worked is that he *also* succeeded in getting *me* to care about the tilings he does.

Although this principle (learning is most powerful when it is driven by passion) is not new, many digital media researchers believe that it is increasingly relevant to the future of education, given the explosion of digital media. Kids have so much media—from podcasts to video games—vying for their attention that they are forced to choose to focus on their passions. As the sportswriter Bill Simmons is fond of pointing out, when people like me grew up, we had three or four TV stations to choose from, plus whatever books our parents owned. Something as simple as my favorite baseball team playing on TV against the Kansas City Royals was gripping because the Royals have a (live!) fountain in Kaufmann Stadium.

In contrast, todays' baseball fans can watch almost all of their hometown games on basic-cable TV, join free fantasy baseball leagues, receive live updates of the day's games, listen to any major league game on their phones for $10 a year, and even watch live games on their iPhones. Or, they can become creators and start blogs or participate in fan forums.

Media researcher Mimi Ito and her colleagues (2008) conducted an intensive 3-year study of youth engaging in such media practices and concluded that the process goes something like this: Youth begin by *hanging out* in places of interest to them (such as MUDs, Internet forums, or after-school settings). They start *messing around* with media (such as writing their own MUD areas on the back of their notebooks or editing their own videos). After messing around for a while, they start *geeking out* on specific practices. They hang out on forums, start their own film production companies, or join a MUD development team. This trajectory captures pretty well what happened to Nate and Eric.

OPEN ACCESS

Interest-driven communities like MUDs, sports fan pages, or fan fiction communities all share a second quality usually not found in schools: They have *open access* and enable newcomers to interact with experts on a regular basis. When forming a group to go hunting in the MUD universe, no one cared that Eric and Nate were in 5th grade. People did care if they couldn't do their job, which included spelling reasonably well. Further, the mechanisms for advancement were transparent and well articulated.

When many teachers encounter these ideas, their first reaction is that "it will never work with real kids in schools." They raise legitimate concerns: How do you manage a classroom of 25 kids each doing separate things? What do you do with the kid who never develops an interest in math, writing, or other academic subjects? How do you get kids to do the very hard work involved in producing something of quality?

Indeed, there are whole communities of educators who have been exploring these issues. Art educators are one group who often use design-oriented pedagogies in studio-type learning environments to capitalize on and extend students' interest. Schools such as McGuffey have developed similar pedagogies while also dealing with the realities of "normal" student-teacher ratios. We will provide case studies of whole-classroom and whole-school participation in later chapters, but first lets consider an entire system of educators across the world teaching similarly with deep ties to gaming.

THE MONTESSORI SYSTEM: FOLLOWING THE NEEDS OF THE CHILD

If I told you there was a school district that produced the founders of Google and Amazon.com; Will Wright, the creator of the most profitable video game franchise T/ie *Sims*; P Diddy, one of the most successful hip-hop artists and entrepreneurs of all time; and Katherine Graham, the Pulitzer Prize-winning journalist and editor of the *Washington Post,* as well as Jacqueline Bouvier Kennedy Onassis, Julia Child, and Anne Frank, you would expect that educators would study this district thoroughly. However, Montessori, despite its widespread success, garners relatively little attention in the United States. Many influential researchers in psychology had Montessori connections: Jean Piaget was the head of the Swiss Montessori Society, Erik Erikson held a Montessori certificate, and Bruno Bettelheim married a Montessori teacher. Even Mister Rogers was a strong supporter of Montessori education. When Barbara Walters asked Larry Page and Sergey Brin (the cofounders

of Google) if they attributed their success to support from their parents, who were college professors, they said no. It was *Montessori* that taught them to be self-directed.

Indeed, the Montessori system provides a model of what a game-based learning system should look like. Not that Montessori is perfect (no system is). However, Montessori is based on similar principles and has many connections to video games, making it a great test case for arguing for the viability of a video-game-based curriculum.

My firsthand experience with Montessori began in 1995. After teaching at McGuffey School, I was hired as a teacher's assistant (and later teacher) at the Knoxville Montessori School and trained there as a Montessorian. Montessori is a system devised by Maria Montessori, who was the first female Italian medical doctor and who practiced education in the early 1900s. I'd highly recommend that anyone interested in education read Montessoris original work, starting with *The Secret of Childhood* (1936). Working with poor kids who were said to be unable to learn, Montessori developed a theory that all children *could* learn if put in the proper environment. She developed an intricate, thorough system that goes from birth through adulthood, Today, Montessori is often dismissed as an elitist due to the high cost of enrollment in private Montessori academies, but the Montessori system was originally designed to work for the poor and did very well in that context. Sure, elites are choosing this system for their children, but shouldn't *all* children have access to this quality educational experience?

Tire typical Montessori day begins as students (as young as 2) arrive, independently put away their clothing, and select a lesson from the shelves (see Figure 3.1). The group often convenes for a brief "line activity," at which time the class will sit on a line together and share housekeeping notes. Here, they deal with issues such as impending birthdays or someone not picking up after themselves—a little like the meetings my wife calls at our house.

The next 3 hours (the morning work period) is the cornerstone of the day. Children select material to work on individually or with other children. The rules are simple: Children may use materials that have been demonstrated by a teacher (or a child skilled with that material). They are to use the materials properly and return them to their spot when they are finished. They also may choose to read silently, have a snack, or in some cases "do nothing." You'd be surprised how difficult it is to "do nothing" for 3 hours straight (ask anyone who meditates), so it happens less than people fear.

This unique morning work period embodies foundational principles of Montessori education. Children are *naturally* motivated to learn as a *normal* part of development. Learning cannot occur if children are forced to sit with their attention on their teacher; learning requires the ability to follow one's interests, engage

Figure 3.1.
Montessori Shelves

Photo courtesy of Amru Zainal Abidin. Used under Creative Commons.

the senses (and Montessori famously includes all of them—sight, hearing, touch, smell, and taste), and test ideas. Learning also requires *concentration,* which is why children have a 3-hour block of time. The Montessori system assumes that *all* children are capable of this kind of concentration and *need* opportunities to cultivate this concentration in order to become healthy adults.

No one tells children what materials to work with, when to take a break, or when to use the bathroom. It is expected that these are all choices that children are fully capable of making for themselves by the age of 3 (apparently, unlike most American high schoolers). In some Montessori schools, children set weekly target goals, which are done in consultation with teachers and parents. Snack, one of my favorite times, is taken by children on their own, and they are responsible for getting out the snack, setting the table, clearing the table, and doing the dishes. Indeed, in Montessori schools the children *themselves* are responsible for classroom cleaning and upkeep; being responsible for ones immediate environment is an important value. In contrast, many American public schools (again in the name of efficiency) reinforce not taking care of space, something Montessori would have considered unethical, as it prevents students from gaining the natural feedback (a messy room) from their actions (working sloppily).

In the afternoon, there is more variation in how schools implement the Montessori philosophy. The school I worked in dedicated the afternoon to free reading, special projects, and group work, including playing *SimCity* and making hypercard stacks (which the б-year-olds loved). Most schools use the afternoon to pursue individual interests in greater depth (one 9-year-old mastered every world map, with capitals); others worked on art or music projects or wrote and published their own

books. Many schools have enrichment activities at this time. My coteacher, Dawn Bullen, once led a multiweek optional science activity that culminated in students as young as 6-years-old dissecting fetal pigs. We discussed the ethics of dissecting animals at length. Because the fetal picgs were harvested from a slaughterhouse (and thus were already dead), most students opted to do the activity. We didn't, however, discuss the ethics of factory farming or the potential for animal-free economies.

Today, it is widely acknowledged that toddlers have an inherent desire to learn as they acquire language. However, later learning is often "laborious," and education generally becomes something done to you rather than something you undertake for fulfillment, or even as a sociobiological necessity. The trick for the teacher is to become a keen observer of children and to prepare a stimulating environment. So the Montessori environment is *anything* but a free-for-all. Kids *need* an environment *designed* to pique their interests, instill a sense of order and pattern to the world, and push them toward developing deep understanding. They need freedom, but within boundaries.

Children by and large do concentrate for extended periods of time without coercion. Some (mostly liberal) educators fear that Montessori is rigid or "not creative," especially with younger children, perhaps because of the lack of fantasy toys (see Kilpatrick, 1914). The guidebooks themselves are quite structured and include detailed instructions on how to use materials, including with what hand the tray should be lifted and so on. In my experience, this is interpreted differently according to the personality and approach of each instructor. Many (maybe even most) creative people are particular in the details of their craft (such as how to hold a harmonica properly or prepare one's creative work space). However, you can find enough variance among instructors to remember that its never just the system but the *enactment* of a system by teachers, students, and parents that matters. If students, parents, and teachers want more dramatic play in a Montessori classroom, there are ways to do it.

Other critics may say, "Well, those kids must be different, because I know my teenager, and that wouldn't work for her." They are correct. If you let an average 12-year-old "study whatever he or she wanted," maybe many would goof off or get into bigger trouble. Most of us were raised in a system that squelched our natural desire to learn and engrained a deep sense of passivity. "I don't want to figure these things out. . . Tell me what I need to know!" That mentality is the *enemy* of the Montessori approach. According to Montessori, the problem with most of us is that we weren't "normalized." Normalization is at the heart of what the Montessori system has to teach us (especially educational game designers) about children, learning, and school design.

Normalization

Normalization is a simple, but powerful, idea: Children who are allowed to develop "normally" have a deep psychological and social need to learn as self-directed, productive members of society. This normalization develops "through 'concentration' on a piece of work." Again, adults are not absent but "must provide motives for activity so well-adapted to the child's interests that they provoke his deep attention." This is like a game designer who creates levels that pique players' interests, require creative problem solving, and reward a job well done. Montessori writes:

> "Normalized" children, aided by their environment, show in their subsequent development those wonderful powers that we describe: spontaneous discipline, continuous and happy work, social sentiments of help and sympathy for others An interesting piece of work, freely chosen, which has the virtue of inducing concentration rather than fatigue, adds to the child's energies and mental capacities, and leads him to self-mastery. ... One is tempted to say that the children are performing spiritual exercises, having found the path of self-perfectionment and of ascent to the inner heights of the soul. (1967, p. 206)

Montessori thought this discovery of normalization (something observed across time and cultures) so important that she described it as "the single most important result of our whole work" (p. 204). Montessori chose to label the process *normalization,* in order to emphasize that it's a completely *normal,* natural part of development and *socialization.* Montessori is careful to describe normalization not as simply a "flowering" of a child but as a natural process "aided by the environment." Because Montessori refers to an environment prepared by an adult, this must be understood as a process guided by adults.

For example, as I write this, my 2-year-old is obsessed with playing with our dog's food, which he knows he should not do. As I stop him, I also observe what he's doing and ponder what this is really *about.* It might be his interest in sorting small objects, playing with the dog, pushing rules, or getting my attention (or all of the above). My short-term response is to reorganize the environment by putting up the dog bowls, but the longer-term response for me is to figure out what is driving that impulse and to channel it toward concentrated work. My wife later developed a Montessori-like activity involving sorting coffee beans into different cups and piles, which has satisfied his desire for fine-motor-skill development.

Preparing the learning environment (similar to designing games) is a key task for educators. Montessori explains, "The essential thing is for the task to arouse

such an interest that it engages the whole child's personality." Montessorians identify the characteristics of normalization as a love of ones' work and a love of order, concentration, self-discipline, independence, helping others, generosity, and joy. Almost anyone who observes a classroom of elementary children working autonomously recognizes it as inherently good and peaceful. *This,* rather than standardized test scores, sounds like a good educational outcome.

Thus, a related concept of normalization describes how groups settle. There is a "you know it when you see it" quality to a normalized class. Children are working intensely with materials alone or in groups. No teacher is telling them to get out their pencils and workbooks, no teacher is telling them what lesson to choose, and no administrator is concerned about who is on what page of the standardized curriculum because it is 2:00 p.m. on a Tuesday. That would be contrary to the very *purpose* of education.

Traditional public schools in fact "block" the normalization process. 1 would describe typical school experiences as training *docility* and preparing students for more schooling (something Ted Sizer describes eloquently in *Horace's Compromise).* Indeed, if concentrated, self-directed engagement is central to development, then our schooling system is not just ineffective but also ethically irresponsible.

Montessori argues that blocking childrens' developmental impulse to master their worlds and function independently in society is actually *deviant* (something I find amusing when applied to educational policy makers). However, it's not that adults are deviant if they say no every time a child wants cookies. Deviance can come from the child, the environment, or adults' imposing their will upon children. Adults must prepare the environment for healthy development. When such deviations are observed, the adult's job is to restructure the environment, much as my wife did with the coffee beans.

In Montessori, this normalization is what children engage in from the age of 2 or 3. This should be the core "game mechanic cycle" of education. Outside schools, children (particularly those with supportive home environments) do this regularly, and such experiences can even be found in popular culture, such as in video games.

Materials and Systems

The materials used in Montessori environments are ingenious and widely recognized for their elegant design (see Zuckerman, Arida, & Resnick, 2005; see Figure 3.1). In fact, they share many qualities with well-structured games. Each material is self-contained and self-correcting and is designed to teach particular concepts while reinforcing several others and "previewing" concepts that are much more advanced.

The pink tower in Figure 3.2, for example, is a set of 10 cubes, with the smallest cube being 1 cm^3 and the largest cube being 10 cm^3. Teachers use them to introduce the concept of three-dimensional size, to teach children how to stack (a motor skill), to illustrate properties of weight, and to reinforce measurement principles. The pink cubes implicitly introduce children to the "base 10 system" and cubic roots. The cubes themselves are *self-correcting* in that you can visually see whether they are in the correct position (it is difficult to stack them incorrectly). In addition, the teacher can introduce language for colors *(pink),* mathematical units *(cube),* early geometric terms *(edge, corner, center, vertical, horizontal),* and comparisons *(small* and *large, smaller* and *larger).* The key design principle is that good learning grows from robust intuitions about systems. In physics, educators have tried to design educational video games (such as *Surge* or *Supercharged!)* based on this same principle.

Subsequent materials extend these understandings. Students can also use control cards (which most lessons have) to check their work. These control cards present the same information, but on a 2-D plane, which introduces abstracted representations at an early age. Control cards function for learning much as walk-throughs do in video games. They enable skilled players to see complex problems solved correctly and to test their own understandings and performance in relation to them. Observe how much control is in the hands of the *learners:* They select the problems, they master the material, and they assess if they are doing the problem

Figure 3.2.
Montessori Pink Tower

correctly. In addition to the students' self-assessments (which occur in multiple forms throughout the curriculum), teachers also assess students' learning as they probe understandings during lessons. In this scenario, teachers function much as game communities do, as a social pushback on understandings. Students must convince outside communities (i.e., the teacher), not just themselves, that they have mastered the content before they can move on.

An epic Montessori material that embodies these ideas (and makes geeks swoon) is the trinomial cube. The trinomial cube is a puzzle designed to develop children's visual perception of patterns and indirectly prepare children for algebra. The cube is a visual representation of the algebraic formula $(a+b+c)(a+b+c)(a+b+c) = aaa + 3aab + 3aac + 3abb + 3bbc + 3acc + 3bcc + 6abc + bbb + ccc$. Each variable corresponds to a particular length, so there is one cube of size a^3, 3 solids of dimension *aab,* and so forth. If you ever wanted to *see* algebra, get one of these cubes.

The Curriculum

To see the Montessori curricular progression, just look at the shelves. The curriculum is divided into six categories: mathematics, language, science, culture, practical life, and sensorial experience, each of which is located in a particular region of the room. Famously, the Montessori curriculum goes from concrete to abstract in each area, arranged from the bottom of the shelf (most concrete) to the top (most abstract). Children begin learning mathematics through activities such as the pink tower (described earlier) and then move on to the stair. The stair leads to a variety of number lines, which are used to teach basic number theory. Next, they use mathematics manipulatives such as gold beads, which introduce the decimal system. The manipulatives get most of the attention, but the abstract materials, like the Pythagoras Board, are also important for developing mathematically literate students[2].

The curriculum has a *transparent* quality, in that modes for progression from the initial concrete levels (at the bottom of the shelves) to the more advanced abstract levels (at the top of the shelves) are clearly visible. Students progress along this trajectory at their own rate and go as far as they like. As such, the curriculum is also *meritocratic,* in that you can and should go as far as you can. A mature game-based pedagogy would also require letting go of lockstep group instruction.

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2. The Pythagoras Board is a wooden puzzle of the multiplication table that encourages students to master multiples in their most abstracted forms and see patterns across them.

A last feature to explore is the social nature of the curriculum. Although Montessori has been criticized for being insufficiently social (see Kilpatrick, 1914), my experience is the opposite. Montessori classrooms are multiage, meaning that younger students observe older, more advanced students working (a form of modeling). In my brief stint at Montessori and McGuffey, teachers grouped students in a variety of ways for many different purposes (indeed elementary teachers often do this). Sometimes it was to help a socially awkward child develop self-confidence by working with a friend. Other times, in order to slow down a fast learner who wasn't understanding deeply enough, the fast student would be asked to teach a slower student, forcing the fast learner to reflect on his or her learning. Thus, although the curriculum is personalized, it's much more social than standard group-based instruction.

Measuring Success

Many critics may ask, "Can we prove the positive effects of Montessori while using other systems?" In the Coda to this book, I address issues of experimental design in educational research. However, a big challenge is showing which effects are caused by the Montessori system and which were influenced by factors like self-selection or parenting. Did Larry Page and Sergey Brin (the cofounders of Google) become such successes because of the Montessori system (as they believe) or did their parents also help? The answer is "Probably both."

Yet with the new wave of public Montessori schools and charter schools, we are beginning to see more research. Mihály Csikszentmihalyi, *inventor offiow theory (a theory that is central to video games; see Chapter 10), and Kevin Rathunde (2005) studied middle school students and found that "Montessori students showed more intrinsic motivation; were more on task; and* reported greater affect, potency (i.e., feeling energetic), intrinsic motivation, flow experience, and undivided interest (i.e., the combination of high intrinsic motivation and high salience or importance) while engaged in academic activities at school." (p. 341). Ideally, we'd want to see measures of academic achievement, but the importance of studying motivation shouldn't be overlooked. In fact, in a digital age in which information is freely available and people are expected to be lifelong learners, these positive learning associations are far more important than test scores.

Montessori also complicates the research literature on learning. For example, a large body of literature shows that learners are not capable of exercising control over their own learning (see Kirschner, Sweller, & Clark, 2006). Some researchers will claim that this is evidence for why constructivist-inspired approaches cannot

work. This view is partially correct; novices are generally not capable of learning without a well-prepared environment. The prepared environment gives the novice freedom in doses that he or she can handle. The materials themselves structure and guide the exploration on a certain path. Indeed, the Montessori curriculum is *incredibly* structured; recall that the pink tower is carefully constructed, not just to teach motor skills and rudimentary measurement and vocabulary, but also to preview concepts such as the base-10 number system.

However, control isn't so much a *tool* for learning as a *goal* of education. We want students to identify problems, muster the resources to solve them, moderate their learning, and then check for understanding. That is the *point* of education. If students are not able to work with minimal guidance, then that's all the more reason to reform education.

There is a dangerous assumption prevailing in current education policy that education is really a problem of finding the "right" program (such as Success for All) that will work for *all* children and teachers across *all* situations. As opposed to treating education as a human endeavor that is driven by kids, teachers, and parents in complex social situations, this "magic bullet" approach makes educational *programs* the source of agency. It assumes that if you find the right program, you will "fix" education, end poverty, and save the world.

I want to be clear that I'm not claiming Montessori is "the answer." No one system is right for all children all the time. Perhaps it's the *teacher's* job to make such decisions at the classroom level (with input from students, parents, communities, and the nation at large). Of course, this leaves classroom instruction up to local control, and there's no simple way out of this conundrum. In our work with teachers (see Chapter 9), we present curricular models that we expect to be *adapted,* not *adopted,* and we try to engage in a deeper conversation about the goals and methods of education.

TOWARD GAME-BASED PEDAGOGIES

Approaches such as the Montessori system provide models for educational game design. Indeed, the connections between Montessori materials and games runs deep. Designer Will Wright often compares his games, such as *The Sims* and *Spore,* to Montessori toys (see Crecente, 2009). Like Montessori materials, they guide students through cycles of discovery. Both involve perceiving patterns and relationships through cycles of action, observation, and feedback (see Chapter 2). And both push back on understandings in *a self-correcting* way as learners strategize, fail, and revise.

Like Montessori, ***SimCity*** at its best engenders intuitions about systems. On the surface, players may be learning about laying roads or zoning areas, but they are also developing intuitions about supply and demand, growth cycles, delayed feedback loops, and traffic patterns. At its core, *SimCity* (as Wright confesses) is more about nonlinear complex systems than about how cities operate.

Critics of *SimCity* argue that it lacks realism. In *SimCity,* you're not a mayor, a city council member, or anyone with a historical analog. You are this weird, God-like presence with the ability to tinker with abstract variables. It's precisely its implausability that makes the game compelling. Games enable the direct manipulation of variables, similar to how a novel provides access to internal dialogue. Of course, games built on the real-world practices of being a mayor might also have value; in fact, role-playing games often do this. However, bringing in fantastical elements (like speeding and compressing time) or the direct manipulation of variables opens the possible worlds and learning experiences unique to games, as discussed in Chapter 1.

I experimented with using games in my Montessori school. Although there is debate about computers in Montessori classrooms, every student had a computer at home, and parents actively encouraged their use. In fact, as 1 observed them interacting with the Montessori materials and computers, my students gravitated toward the computer in the same ways Maria Montessori's students engaged with her materials in the early 1900s. They were enraptured, trying to understand how it works, repeatedly puzzling through problems until they accomplished mastery.

With this in mind, I used *SimCity* with my 6- and 7-year-old students to introduce them to elementary social studies concepts (such as electrical, water, industrial, commercial, and residential systems). Within the Montessori system, teaching with *SimCity* was easy; Simply set up a computer in the back of the room and devise a series of lessons on how to play. There were none of the big "concerns" of fitting games into traditional classrooms and curricula. Short time periods, setup, differential learning outcomes, individualized pacing and progress were issues. As the children became comfortable with the game, they all wanted to tell me about their cities (much as a typical 6-year-old would be dying to tell you about *Pokémon).*

To build on this natural inclination for reflection, I borrowed an idea from my educational technology professor, Chris Wolfe, and introduced HyperCard. With HyperCard, students could talce screenshots from their games and explain key accomplishments (such as showing off their bridges or public transportation systems). Not surprisingly, they loved it.

THEORY AND PRACTICE

We opened with the question "Can we put cutting-edge games into classrooms?" My experience suggests that the answer is yes. However, to do so requires changing the status quo of schooling and making a new commitment to interest-driven learning, differentiated learning trajectories, multiple levels of expertise, collaboration and competition, and learning through design rather than administrative efficiency.

Thus, we should not ask, "Can we adjust schools to accommodate games?" any more than we should have asked 500 years ago, "Can we adjust universities to accommodate books?" The real question we should be asking is, "What are the key features of a powerful learning environment that need to be leveraged to implement a mature vision of game-based learning?"

» *Game-based learning environments require a deep commitment to interest-driven learning.* The teachers at McGuffey valued understanding and unpacking students' interests and extending them into new academic domains. Some systems such as Montessori (but also Waldorf and Reggio) are set up to naturally promote such interest-driven learning and production-oriented designs. Without a deep commitment to such interest-driven learning, it's easy to imagine game-based learning failing, because opportunities to extend expertise in unique directions are squashed by standardization pressures.

» *Game-based learning environments might empower teachers to act as coaches, advisors, and producers rather than as content dispensers and police officers.* Once kids are interested in learning and engaged in focused work, teachers' work becomes much easier and they become resources, rather than obstacles, for students enacting their goals. Games allow this independence. But the brilliance of principal janet Kretschmers move to join her kids in gaming stems from a sophisticated conception of adulthood that sees teaching as providing progressive freedom.

- *Game-based learning pedagogies require dedication to* design *as a worthy goal of education.* The most advanced, sophisticated forms of participation in games culture—designing levels, mods, fictions, or guilds—are largely unacknowledged, if not derided, by mainstream educational institutions. We might recognize the genius in Nate and Eric's creation of the McGuffey Foundation School as a game level, but we realize it would be *banned* by many schools rather than encouraged. Further, the original creation of complex media, while being self-evidently a goal of education, simply isn't valued by todays mainstream education assessment mechanisms.

In 1995, when McGuffey kids explored the dark corners of the Internet and found MUDs, it was an esoteric phenomenon. Subsequently, such participatory cultures have become mainstream. The next chapter probes the nature of these communities and suggests how they might be powerful metaphors for the future of education.

CHAPTER 9

Games Go to School: Situated learning, Adaptable Curricula

Ivan Vasily is dead. Police claimed that he drowned while fishing by the south shore of Lake Mendota. Between January and the time of his death, Ivan put on 25 pounds and started drinking heavily. His health condition deteriorated considerably.

As one of his friends, your task is to investigate the case with two of your best friends. It is your duty to present the causes and effects to the public.

"I bet that Ivan died of poisoning," Dr. James speculated. "The baby was feeling bad too, and so is the mother" (implying that the whole family was poisoned). "Neither of them is overweight," he added.

Agent Stevens, a government official who was responsible for understanding the legal case, noted an inconsistency. "But he never saw Santiago!" Santiago worked with Ivan and was also ill. A coincidence? He didn't think so.

"Remember that he showed the same symptoms as his wife and son," noted Dr. James, who had seen their medical charts (only doctors can gain access to patient records) and saw too many similarities within Ivans' family to ignore the possibility of food poisoning.

"See... both of them [Ivan and his wife] are overweight, but Ivan was the only drinker, so it could have been alcohol [interacting with the toxin]." Dr. James hadn't definitively diagnosed the problem, but perhaps alcohol played a role, too.

Agent Andy Stevens didn't buy this theory, but it was worth thinking through. "OK, let's see: Poisoning. But is it like *food* poisoning or is it *poison*?"

"I think it's fish poison... because there is tons of mercury in the lake." None of the records mentioned mercury, but Dr. James knew of mercury in fish caught from Lake Mendota. Ivan liked fishing; perhaps they had ingested it from fish?

Agent Stevens nodded in agreement, "I know,"

Dr. James continued this line of thinking. “I don’t think it would have been *intentional* poisoning, Andyl’ Doctor James didn’t see anyone wanting to *murder* Ivan.

“Well, we don’t actually know any motivations yet,” Agent Stevens reminded them. Stevens didn’t want to jump conclusions prematurely. Dr. James steered the conversation back to medical facts.

“Remember, the wife and child were showing signs of being overweight, and so was the dad. The wife and child... who are not drinkers..” Dr. James puzzled through the data. “It could have been the alcohol” (mixing with the toxin), Dr. James concluded.

“Yeah,” agreed Agent Stevens. This sounded reasonable.

Dr. James continued, “And if they were all eating fish—that’s the only thing we know they are consuming.” It looked more and more like fish interacting with alcohol. This would explain how Santiago, the mom, and the baby all got sick, but only Ivan died.

“Right,” Stevens said. He was coming to the same conclusion—and without indulging in wild speculation.

They still needed to rule out other factors. They returned to the docks. Was the water deep enough for Ivan to have drowned?

Willy Loman, a fast-talking insurance representative, stopped them.

“Let me tell you the truth. Ivan’s death was an insurance fraud. This man could not live without a full-time job, and he had problems finding one. The 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 is there evidence to suggest otherwise?”

Dr. James wouldn’t stand for it. This *wasn’t* suicide.

“He is wrong. I think obviously it is runoff from ... well, *something* put mercury in the lake. The catfish ate ... consumed the plankton and absorbed the mercury. And then Ivan 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 tód is suffering from nervous disability, so honestly he must have died of mercury or something else.”

* * *

The preceding vignette wasn’t an episode from *Law and Order,* but an exchange between two students playing *Mad City Mystery* (see Figure 9.1), an augmented

Figure 9.1. Students Playing *Mad City Mystery*

reality (AR) game designed by Mingfong Jan (the transcript is cleaned up for readability; for the full study, see Squire & Jan, 2007). In *Mad City Mystery,* each student plays a different role. In addition to the medical doctor and government agent, a third player is the environmental scientist. Each role has unique capacities. The doctor can take vital signs, the government official has access to secret documents, and the environmental scientist can sample for toxins. Each role is required to develop a full picture of the case. Virtual characters like Willy Loman were designed to provoke their thinking and encourage reflection.

This jigsaw design seeks to support engagement and learning. First, it immerses each player in a role with unique abilities, which we hope increases role identification. Second, differentiated roles require players to synthesize what they read. Third, it creates *responsibility,* as players are accountable to their group for understanding their information. Finally, it creates a cooperative, distributed puzzle-solving game, which provides a pleasurable context for meaningful interactions with content.

To give away the ending, there is no one right answer, but Ivan's death was probably caused by exposure to TCEs or PCBs. Our doctor was on the right path, but he was incorrect in several ways. Mercury poisoning (which probably caused the baby's low birth weight) won't kill you overnight. It can cause a variety of neurological disorders, most acutely in young children. Yet, whatever affected Ivan was sudden. One day, he was fine (albeit overweight and drinking too much), and the next day he was sick enough to drown, suggesting direct, recent exposure to

a contaminant. He and his colleagues all experienced dizziness and shortness of breath. The documents reveal that there had been a TCE spill in Ivans' factory. A case could also be made for him ingesting PCBs.

This chapter uses games like *Mad City Mystery* to investigate the following:

- How do we create game-based curricula that are tied to academic standards, playable within classroom constraints, and yet retain game-based learning features (e.g., piquing interest, systems thinking, engaging students as designers)?
- How can we experiment and innovate within schools in order to build the capacity to transform educational institutions as digital media becomes more widely adopted?

This chapter follows the story of my research teams' attempts to put these ideas into practice and turn a prototype into a curriculum that works with 20 or 30 teachers. Ideally, I hope it provides an example of how to do educational game design in schools today. At the very least, maybe it will inspire an interest in game-like learning.

PLACE-BASED GAMING

Alad City Mystery pilots convinced us that the *unique* benefit of augmented reality (AR) games was turning your world into a game board (see Figure 9.1). *Mad City Mystery* players saw their neighborhood through the lens of science, and this was *fun.* They viewed everything from architecture to sewer pipes as data sources. They connected observations with what they knew and asked new questions. Recall how the medical doctor brought his knowledge of mercury *into* the game. Another player then projected it outward and asked, "I wonder if mercury comes out of the downtown coal plant." This caused the group to ask more questions. One player eventually asked, "What is with that coal plant in downtown Madison? Isn't that dangerous?"

Jim Mathews, a local teacher and graduate student, had his students play *Mad City Mystery* and was inspired. Jim believed that a game that was even more rooted in the students' physical surrounding could be compelling. We introduced Jim to MIT's Augmented Reality Gaming platform and let him have at it.

Jim's game (or more accurately, situated documentary), *Dow Day*, pushed our thinking further. In *Dow Day,* players are journalists on October 12, 1967, who are covering student protests in Madison, against Dow Chemical Company. Dow

manufactured Agent Orange, a chemical sprayed on millions of civilians (including half a million children) during the Vietnam War, and now the company was on campus interviewing for jobs. Some students believed that Dow should not have access to university facilities, and they planned a peaceful sit-in to protest.

Dow Day was a defining event in U.S. history in the 1960s, as detailed in David Maraniss's (2004) *They Marched into Sunlight* and the 1979 Academy Award-nominated film *The War at Home.* The riots that Dow Day ignited spread to Chicago, disrupting the 1968 Democratic National Convention. Many student protesters drove to Chicago for the event, and some gained local and regional prominence, perhaps most famously Paul Soglin, a former Madison mayor and long-time civic leader.

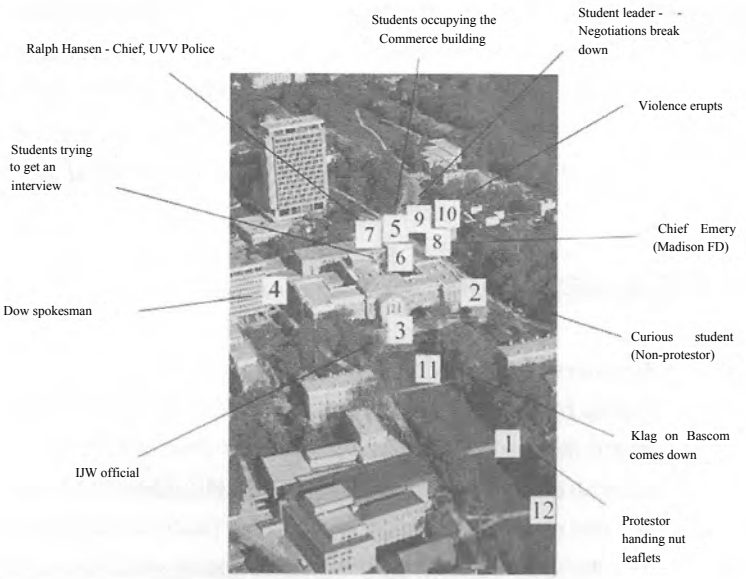
Jim wanted to use *Dow Day* to teach critical media skills and historical empathy. Most of Jim's students thought the Vietnam War was deeply immoral and couldn't imagine how any good American would support it. Jim wanted them to understand how working-class police officers might view the protesters differently. How would these officers feel about protecting a group of privileged kids who were interviewing for high-paying jobs from another group of privileged college kids? What if police saw themselves as defending the rights of students (some of whom might be their children) to pursue pharmaceutical careers to help people? In the walce of Iraq, revisiting this chapter in Madisons history was timely.

Jim used roles, primary documents, media, and location more deliberately. Every conversation in *Dow Day* is based on primary documents drawn from original newspapers, books, or film. For example, players are briefed by receiving two primary documents. The player then goes to Bascom Hill. Players meet protesters, interviewees, police officers, and university officials—all real people speaking in their own words. On their mobile media device, participants view archival footage of protesters marching up that same hill, right up to where the students are now standing, and watch skirmishes breaking out under the bell tower. The game directs their attention to aspects of the physical space that contributed to the escalation of events, such as the narrow hallways in the campus buildings that made escape difficult (see Figure 9.2).

Back in class, Jim also presented these same primary documents to players and asked them to write their story. They compared their stories with historical reports, each of which is biased in many ways. The "official" city papers fabricated details (such as reporting that one student brought a meat cleaver to the rally), and student papers vilified police officers as unthinking pigs.[1] Through Jim's game design, students are

1. The image of the student holding a giant meat cleaver is priceless. The absurdity is readily apparent: How could a student walk around a rally wielding a giant meat cleaver and not be noticed? Where did the student get it? How could it be concealed in such a crowd? And, if it was used, where is the bloodied police officer?

Figure 9.2.
***Dow Day* Game Space and Objects**



encouraged to think beyond their own personal perspectives to see that *Dow Day* was an unfortunate tragedy caused by several interacting and complex forces, not just mindless malice from cops. As a reflection activity, Jims' students are asked to add a character not originally in the game and then to restructure the game to reflect their own historical interpretation. This approach eases players into designing games.

PLACE-BASED LEARNING

Teachers like Jim Mathews and Mark Wagler (see Figure 9.3) transformed our AR games from a technology into a *curriculum* by reimagining AR games as an educational method. After playing *Mad City Mystery,* Mark wanted his 4th- and 5th-grade class to *design* a game. Mark already taught with place-based inquiry methods; his science class investigated local issues (such as migratory birds) and published their results in a student-run journal. In social studies, they researched historical events in the local community (such as about Wisconsin's immigrant Hmong population) and turned them into cultural tours. Language arts, math, and even art were all connected as they painted, sculpted, and wrote pieces connected to place.

Mark thought his students could design a game about their neighborhood called *Greenbush.* Greenbush is a Madison community settled in the early 20th century by Italian and Jewish immigrants as well as African Americans migrating from the South. It was the one Madison community that accepted everyone regardless of color, culture, or religion. As a result, a vibrant, diverse community

Figure 9.3.
Mark Wagler Working with Middle School Students

Photo courtesy of Mingfong Ian

formed with many unique features, including gardens with roots in Sicily, Africa, Russia, and the American South; integrated dance halls that hosted a wide range of national performers, including Duke Ellington; and synagogues that became the Jewish center of Madison. The multiethnic gardens, a precursor to the urban gardening movement that is so hip with the kids these days, were especially fascinating. Greenbush, or "Bush," was gutted in the 1960s when a city-supported hospital complex broke up the community under the guise of "urban renewal". As neighbors and families were displaced across Madison, the social structures (churches, union groups, synagogues) that tied life together were lost.

LEARNING THROUGH DESIGN, OR HOWTO DESIGN AN EDUCATIONAL GAME

Mark, Mingfong, and another graduate student, John Martin, created a curriculum for students to design a game based on their neighborhood, Greenbush (see Squire et al., 2007). The first thing that kids asked was "What kind of a game would it be?" There were crimes in the history of Greenbush that cried out to become a mystery game like *Mad City Mystery*. But what would that say about Greenbush? Residents had been "policed" by the Ku Klux Klan for being perceived as un-American. Did the class want to reinforce stereotypes that already caused immense damage? Designing a game about other peoples' lives—representing who they are and how they live—is tricky.

Mark, a veteran community organizer, immediately enlisted several amateur and professional historians to guide the class. Joe "Buffo" Cerniglia became a class favorite. Buffo led neighborhood walks, shared stories about the Bush, and introduced students to residents. Buffo became a compass that the class used to gauge whether their ideas were true to the lives of Greenbush residents.

The project quickly ballooned out of control. Students collected thousands of primary documents, including photographs, diaries, and newspaper clippings. They created dozens of audio and video interviews with former and current residents. They even developed and administered a survey to 1,000 residents and analyzed the data. Not bad for 4th and 5th graders, but what to do next? They could spend their Uves wading through all this stuff.

They first published their materials online through the Center for the Study of Upper Midwest Cultures. You can visit their website and see their work at csumc.wisc.edu/cmct/greenbush. Next, they organized a meeting for anyone interested in Greenbush. They wanted to celebrate what they found, involve more

people from the community, and see how people responded to their interpretations. They created posters, invited speakers, and made their own presentations—all at the Italian Workmen's Club (see Figure 9.4). By now, the project was in its 2nd year. Mark's students kept it going, in part thanks to his mixed-age classroom. Every year, half the class returned so that the veterans could teach the newcomers the classroom standards (much as with Apolyton).

They decided to have players keep the same roles that they had while designing the game (historians, ethnographers, and community planners), What better way for players to learn than to replay their roles as researchers? We have since latched on to this concept as a design tool: The roles you take on while researching a game are often good player roles.

They had roles and resources, but they still needed a driving *challenge.* The story of 1960s Greenbush, a time of great conflict, was alluring and clearly contested. The city and university were buying land to "clean up" Greenbush, but its residents didn't see anything wrong with the Bush. They wanted to keep their homes, churches, community centers, and traditions. The story had a classic David-versus-Goliath theme. Bureaucratic city planners wanted to break up established neighborhoods because they were "unseemly"—-and happened to sit on desirable land. This was ironic given that the Greenbush was poor specifically *because* it was the only place that would allow immigrants to settle.

Historically, this period reflects national trends. Sadly, most American cities have a similar story, and this game could be replicated across the country: Immigrants, African Americans, and rural poor poured into cities at the turn of the century. They stuck and were stuck together. From the late 1940s through 1970s, their communities were bulldozed in the name of renewal. Neighborhoods such as the Bush were soon robbed of the local ownership that gave them their vitality.[2] Today's Madison (like most cities) is dealing with the aftermath of such policies. Communities are fragmented, impoverished areas are still segregated, and there isn't substantial intermingling in schools or churches. As one Greenbush resident

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2. The issues of contemporary schools are directly related to the consequences of these decisions. Many cities are trying to "undo" these design decisions (such as returning businesses to local ownership). Unfortunately, the dominant metaphors for understanding poverty-stricken areas (e.g., "decay" or "cancerous") persist and suggest that urban problems can be solved by "surgically removing" bad housing (or, even worse, the people living in them). Such tactics continue as if the structural racism and xenophobia that created these conditions are gone. Indeed, the "problem" with schools today goes back to these designs, because school attendance is determined geographically. Where students go to school is determined by where students live, which is determined by culture and class and the perpetuation of de facto segregation.

Figure 9.4. Wagler's Class at the Italian Workmen's Club

Photo courtesy of Mingfong)an

commented, back in the day, if you moved up in social class at least you didn't have to leave the neighborhood. You could buy a home one block over. Now, because of real estate practices that subtly enforce segregation, if someone "makes it," they move and take their money out of the neighborhood. Such immigrant neighborhoods are common in many cities (from Brooklyn to Madison) and are far from perfect, but they have historically included features now considered cutting-edge in city planning, including multifamily dwellings, close neighborhood associations, and mixed-income properties.

The class wanted to share this insight through a game that helped players see traces of the old through the face of the new. Scratch beneath the surface and signs of the old Greenbush remain. Haberdasheries and Italian delis dot the main thoroughfare. The local pizza joint was built by Italian workers as a safety net and to improve living conditions. The largest Catholic churches and synagogues are still there, and many Orthodox Jews still live nearby. Understanding the history of the neighborhood unlocked a more nuanced understanding of it. *Greenbush* provided a key for opening conversations about the neighborhoods future.

Greenbush takes place in the present day. It starts with a city council meeting on a proposal that will shape its future. The university wants more land to feed its growth and is eyeing two areas: a swath of unattractive government housing built in the 1960s and the last tract of original Greenbush homes. Although there are no known plans for such a development, it's a plausible scenario that could actually happen within the next decade.

The game play involves traveling back in time to historical Greenbush. Players visit locations, meet residents, and choose which agenda to prioritize. It's tempting

to just bulldoze the ugly government housing and homes to make "better use" of the land. However, the history of the Greenbush shows how these poor residents will probably be moved to the farthest, least desirable land, far away from their workplaces, health care facilities, and public transportation. In fact, in the 1960s, this is just what happened, causing the creation of Madisons "problem areas," commonly called Allied Drive.

The games central idea is to invite players to "peel back the layers" to see not just the *structures* but also the historical *forces* causing this change. As players travel through time, they become immersed in the period by interacting with the massive number of resources Mark's students collected. Standing on a street corner, they see photos of the vibrant community that once occupied the space. They hear stories about the city's gardens, churches, and dance halls. The game also showcases hidden Greenbush gems, such as the Italian Workmen's building, the memorial to the old neighborhood, and a bocce ball field.

FROM GAME DESIGNER TO COMMUNITY ORGANIZER

It's easy to see how Mark's kids honed their reading, writing, analytic, mathematical, and social studies skills designing this game, but Mark valued how the game design encouraged students to *look at their own neighborhoods as constructed objects.* Game design forced students to think more deeply about how outsiders would experience their game versus how they would experience the students' articles, artwork, or websites. Being a game designer offered an integrated identity in which academic skills were mobilized toward redesigning the world.

After presenting their work to the Greenbush community, they drafted a resolution for the city council asking the council to honor and restore historic Greenbush values, to commit to "never doing this again," and to continue the tradition of Greenbush being a mixed-use, mixed-income, and mixed-ability community (see Figure 9.5). On June 6, 2006, the resolution was passed unanimously by Madison's city council. As of this writing, there have been two successful Greenbush Day festivals, each attracting hundreds of attendees.

What happened next was surprising. Mayor Dave Cieslewicz turned to the 5th graders to ask what they thought should be done about Allied Drive, the segregated, lower-income neighborhood on the outskirts of town created, in part, by the Greenbush "urban renewal" policy. Mark's class suggested that they start by "asking what the residents themselves think should be done," which apparently was unusual, but should sound familiar. As simple as it sounds, *listening* before offering

solutions is the first step in the successful, thoughtful design of everything from neighborhoods to schools.

The students spoke of this learning experience as being deeply transformative. A few cried after the city council meeting. Their interview comments reflected this, as they said things like, "I never knew 25 5th graders could accomplish so much." Participants reported applying these insights to new situations. As one commented, "When I visit new places, I wonder what their past is, and if they ever had something happen like what happened in the Greenbush." Others wondered if their planning could increase the sense of community. It astounded me to see 5th graders make such an impact. Think of how much energy lies sitting idle in rows of classrooms. This design curriculum could marry inquiry- and project-based curricula, using games to engage kids in specific ways of thinking while opening up the learning experience for them to design (see Barron, 2002; Hmelo-Silver, 2004; Savery & Duffy, 1995).

Games aren't just a tool to teach the same old things in new ways, but a catalyst for mobilizing students' knowledge to encourage them to think systemically in their interactions with the world. Designing *Greenbush* drove the students' engagement in complex academic practices (from reading academic texts to designing and administering surveys). This work involved *authentic* participation in a project with real-world implications and legitimate social impact. Students designed a playable game, built a public website for its distribution, held a real conference, and helped author actual legislation. This sort of authenticity is *participatory authenticity* where students take part in goal-driven activities of real-life import (see Barab, Squire, & Dueber, 2000). Such education lessons develop

Figure 9.5. Student Presenting Work to the Madison Common Council

naturally from games, but they also tie to older pedagogical movements. Mark's work is based largely in inquiry- and place-based learning, and there are echoes of Dewey in this idea that education isn't *preparation* for life but *participation* in life.

COMMUNITY ORGANIZING AS CURRICULUM

So how do we create integrated game-based curricula that is tied to standards and honors the values of game-based learning?

Games spark interest in new domains and inspire design. To elaborate from the examples of Mark's class and the GVCamp experience, games:

1. *Spark interest-driven learning in students and teachers.* Games are really good at getting people excited about a topic—and not just in the content of the game itself. Playing *Mad City Mystery* ignited students' interest in their neighborhood and got them asking why things were the way they were. One reason *Greenbush* worked is that the content arose from *passion*—both in Mark and in his students. We can't overlook the importance of curriculum in engaging *teachers.* The more we teacher-proof materials, the more we lose this opportunity and drive away talented teachers. In contrast, when a class and teacher collaborate to pursue their mutual interests, transformative learning will follow.
2. *Create new interests.* In our examples, enjoyable learning led to new questions and interests, which drove further learning. These interests were highly personalized. Mark's students took away interests in topics ranging from Jewish and African American history to local politics, just like Morgan in *Civ* Camp took away an interest in history and Josh became a game designer.
3. *Lead to intrinsically motivated authoring.* Much like Morgan built Revolutionary War mods in *Civ* for fun, Mark's class went far beyond what was required in the assignment out of personal interest and a desire to malce a difference in the world. Mark's students held meetings on evenings and weekends; one student even worked all summer to complete lůs own variant of the game (which was about the Jewish experience of Greenbush). Ultimately, games are a unifying framework that allow students to become legitimate media producers. Applying the *trajectories of participation* framework (from Chapter 2), in Mark's class the students shifted from novice players to expert players to game designers to community organizers and designers of social systems, which some have called "soft modding" (see Gee & Hayes, 2010).

Interest-driven learning is similar to learning inspired by games in purely entertainment venues (as *Civ* did for me). Games enlist our dreams and desires and activate our identities. They raise new questions and open new possibility spaces. When games teach us skills and give us tools, they often motivate us to act. Thus, there seems to be a nonintuitive, but natural, fit between games and participating in the world. It seems counterintuitive that games (i.e., fantasy) could enhance civic participation, but there are at least four reasons that they might.

First, games engender a "ludic spirit," a spirit of playfulness. The moment we invite kids to see the world in a playful way, it connects pleasurable emotions with learning. It's fun to see your world in new ways and to realize that you can make an impact. Local games ask players *to see their worlds differently* and to ask, "Why is this so?" and "Could it be different?" Fantasy breaks from the world and imagines other possibilities; when used creatively, this can be fundamental to learning.

Second, games are inherently participatory. There is no game without the player. As a gamer, there is a feeling of "shared hallucination" in the sense that we actively construct the game reality we are temporarily inhabiting. This is true of both single-player and multiplayer games, but the experience is most profound when it's shared.

Third, once a person has had profound learning experiences in a world that is noticeably "designed" (or "socially constructed"), there is a tendency to ask, "Why is our world designed the way that it is?" and "Could it be designed differently?"

Fourth, games engender expertise within simulated systems and encourage us to ask how these skills could pay off elsewhere. If I have led civilizations in a game simulation, maybe I start thinking of becoming a policy maker. If I lead a successful NFL franchise in *Madden,* maybe I could coach or manage another kind of group.[3] If I lead a guild of hundreds online, maybe I could become a successful leader in other communities.

This participatory gaming doesn't necessarily result in "community organizing" (particularly as it is practiced as a discipline), but it often requires organizing in a literal and metaphorical sense. Whether it's *Civ* players organizing Apolyton University or *World of Warcraft* players organizing raids, multiplayer gaming requires working with other people. It's an open question whether this tendency to go from *game player* toward *community organizer* is typical of games or unique to the

3. Bill Simmons (2007) writes, "Why wouldn't they [coaches] also have some slacker college student who has played 250,000 hours of *Madden* in the past 3 years and faced every conceivable football situation on hand to throw out advice like, 'Dude, let them score here; we can get the ball back down eight'?" *Madden* players are literate about even the most arcane football situations.

game-playing cultures we specifically fostered in our study. But games researchers like Dmitri Williams (2006) have found empirical evidence that gamers are more likely to be civically engaged than nongamers. This relationship requires profound gaming experiences (particularly in which players shape the world). It requires clear models of how to link gaming practices to practices outside the game in everyday life (e.g., how game design can relate to community design). These are the links we tried to build in our C/vClub. Can we scale them to an in-school program?

RAMPING UP

"Kurt, they're taking away my multiage classroom," Mark told me. I stared into my phone, unable to believe my ears.

"They're doing what?" I asked.

"Yep, my principal insists."

"Well, then, Mark, you'll have to work with us." What better person to lead technology workshops than a man raised as an Amish Mennonite?

Core Features of Local Games

Eric Klopfer (from MIT), Chris Dede (from Harvard), and I were awarded a Department of Education grant to explore games' potential for teaching reading comprehension, argumentation skills, and writing. We wanted to create tools and resources for teachers to create their *own* games tailored to their classroom constraints. We started with model games that teachers could adapt, each of which included the following core features:

1. All activity is situated within *roles.* The moment the unit starts, students are no longer "students" and are instead "professionals." This sets them up to be competent performers learning under a new value system.
2. Learning is driven by emotionally compelling *challenges.* You want kids to learn because ifs relevant in the world, not for a test or because "it's good for you."
3. Players access *authentic tools and resources.* Learners should use complex, realistic tools of the sort they would encounter in authentic situations outside the classroom. Usually these resources are beyond their current skill level, and the game provides *motivation* and *context* to help students master them.
4. Game mechanics promote *collaboration,* such as *jigsawing.* In addition to being a sound instructional strategy, it promotes communication, a goal of education.

Critically, we didn't offer one curriculum for teachers to implement, but a framework for thinking about games and education. This approach is based on a *process* theory of change. We saw the materials not as the *solution*, but as a *catalyst* for creating conversation, reflection, and teaching. Too often, we treat educational materials as a change agent (or silver bullet), but doing so deprotessionalizes teachers. Teachers have their own values, goals, and knowledge. We shouldn't "teacher-proof" curricula so that it can be tested; instead, we should create compelling materials that address teachers' needs and inspire them to teach creatively and effectively.

This stance treats educational reform as a *process,* not a *product.* Systemic school reformers who have worked for decades to transform classrooms, schools, and districts toward more learning-centered practices conclude that the educational reform cannot be rooted in your pet solution (e.g., educational video games), but should engender conversation among stakeholders (students, teachers, parents, and community leaders) about the core purposes of education and how they are manifested in particular designs such as classrooms, grades, and so on (see Jenünk & Carr, 1996; Reigeluth & Garfinkle, 1994; Squire & Reigeluth, 2000). The moment one group "hands" another the solution, you have failed. Efforts that invest the time in developing consensus about underlying values can weather the setbacks that characterize all reform efforts. Not coincidentally, these are the same principles community organizers use. A community organizer can't go into a community and say, "Here's what you need to do!" The point is to empower people to take ownership.

Chris Dede wanted to require interdisciplinary teaching partnerships to catalyze creative reflection. We designed four games: *Sick at South Beach, Saving Lake Wingra, Riverside,* and *Hip Hop Tycoon.*

Integrating New Methods in the Curriculum

Before turning to the games that were widely adopted, we should briefly touch upon *Hip Hop Tycoon,* a game by Ben DeVane (now a professor at the University of Florida) and Chris Holden (now a professor at New Mexico). Ben noticed that many of our *"Civ* kids" were enthralled by hip-hop culture. Ben, a closeted hip-hop aficionado, wanted to use entrepreneurism, a core value of hip-hop culture, as a way to develop kids' financial literacy. Citing precedent in games such as *Railroad Tycoon,* Ben felt a game that blended hip-hop and finance could grip kids.

As Ben researched business loans, he noticed disturbing facts about subprime adjustable rate loans. "These things are crazy!" he shouted to anyone who would listen. "This whole sector is going to implode. We *need* to make a game about it." So Ben and Chris designed a game in which students play as business financiers, sales staff, and

human-resource directors competing to run hip-hop stores. Running a store requires mathematics, reading, and financial skills for comparing loans and making budgets.

You would think that after the recent subprime mortgage meltdown, people would crave curricula that educated students about these issues, but that couldn't be farther from the truth. There is no natural fit for financial literacy in the curriculum. Math teachers feel tremendous pressure to cover content, and anything that strays from the textbook is a hard sell. Social studies teachers were more interested because their standards cover entrepreneurship (although it is rarely ever taught). Although we did use *Hip Hop Tycoon* in one school, we eventually abandoned it due to the uphill battles.[4] Its almost as if schools are structured to ensure that people don't learn useful things that malce a difference in the world.

SITUATING LEARNING AT SOUTH BEACH

The most popular of the three games was *Sick at South Beach,* a modification of *Mad City Mystery* based on a real story. In *Sick at South Beach,* four girls who had gone swimming get sick from *E. coli* poisoning. You might think the girls contracted *E. coli* from die large sewage outflow nearby that dumps untreated water into Lake Michigan an average of five times a year or from a contaminant from the rusty well nearby, but it turns out that the *E. coli* was caused by the goose poop that piles up on the shore of Lake Michigan and gets washed into the water when it rains. It is common for *E. coli* to spread this way.

By focusing on a real issue, we could bring in concrete data. Rather than inventing plausible contestations of space, we simply researched data for that place. Jim Mathews, the lead designer, found news reports of sewage overflows, *E. coli* outbreaks, and community efforts to care for their beach. Watching footage of untreated water flowing from exactly where you are standing proved to be as compelling as watching protesters march during *Dow Day.* The Great Lakes Water Institute provided access to their decades of data, which included good graphics and charts.

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4. When a Milwaukee paper wrote a nice stor/ about the game experience, the right-wing blogosphere jumped on it as "pandering" to youth. Soon the story spread to talk radio, and we were under fire. It's no wonder that 30% of students drop out of school when we treat anything fun, however relevant, as "pandering." How ironic is it that the groups blaming "poor people for taking out bad loans" are the same ones blocking efforts to teach our children the skills to suss out such bad deals?

Teaching Teachers with Games

We worked with 30 teachers that first summer. First, we all played a game together and then discussed the games' gist and the concept of teaching with games. Next, we brainstormed how to adapt the game to local contexts. This invited teachers in as *designers*. Finally, we presented a model curriculum that teachers could adapt for their classrooms (see Table 9.1). Twenty-four teachers taught with *Sick at South Beach* that first year and we studied two classes in depth (for the full study, see Squire, 2010).

Table 9.1. Overview of the *Sick at South Beach* Curriculum

DAY	ACTIVITY
1	*Introduction and Roles.* Complete job applications.
2	*Employee Orientation.* Discuss roles and documentation.
	Data Log and Map. Discuss maps and data logs.
3	*Diseases.* Read and discuss diseases using reading strategies.
4	*Water Quality Web Quest.*
5	*Medical Records.* Build predictions based on medical forms.
6	*Game play:* Play *Sick at South Beach.*
7	*Group Debriefing.* Interpret test scores.
8	*Create Presentations.* Make final prognosis.
9-10	*Persuasive Writing.* Analyze persuasive writing samples and create presentation rubric.
11	*Presentations.* Present prognosis to community.

Supporting Role-Play

Our partner teachers modified the curriculum, which improved it vastly. For example, Lyndee Belanger had students *apply* for their roles. Seeing their job qualifications was not only cute, but also connected them to the game. Several teachers followed her lead, and we now often use the job application feature. Lyndee also had students wear lab coats and asked the school security guard to deliver information in confidential folders. The kids loved it. These ideas spread quickly to other classes.

Not every teacher used props like Lyndee, but they all role-played. Tina Kurtz, for example, used the students roles for classroom management. When a student acted up, she asked, "Would a scientist talk that way?" She also used role-playing to set expectations of quality. For example, here's how she introduced one days activities:

> You are going to receive confidential copies of their medical records. In your group, keep in mind your job, who you are. You are speaking as that person.

> You are looking for clues about these illnesses related to your job. But if you see something really obvious not related to your job, point it out to the group.

Tina plays up the students' roles as *professionals* who are responsible to a team. She divided students by professions and asked them to process information within their disciplinary community. Then, they returned to their team for debriefing and reporting (dual layers of jigsawing). The following exchange from a doctors' meeting exemplifies such interactions:

"It's cryptosporidiosis. That's what we think it is." The doctors had huddled around their data for about 15 minutes and had finally reached a conclusion.

"Can you tell me why?" Tina challenged.

A second doctor in the group expanded on their conclusion. "Because they had diarrhea, [reading now from a chart], weight loss, cramps, fever, nausea. If it wasn't *that,* it would be *Campylobacter jejuni,* because this one had bloody diarrhea, but the first one didn't say anything about it being bloody. It also has fever, nausea, and vomiting. And it is the most common cause of bacterial infection." This back-and-forth was typical. It built on game play from *Mad City Mystery,* but connected the experience across classroom activities—from discussions to reading exercises—so as to produce deeper learning than in a tradition 1-day experience.

Embedded Assessments

This exchange also illustrates how the game was designed to elicit misconceptions, a key step for using games for assessment. Through carefully placing red herrings in the game, we were able to understand which sources of evidence students used and which they did not, and to what extent they understood the texts. The student arguing for cryptosporidiosis, or crypto, was partially correct; judging solely by symptoms, it could have been crypto. But crypto is a parasitic disease transmitted through fecal-oral contact (eww!), and they didn't have an explanatory model for how it was contracted. Crypto enters the game because in 1993 there was a highly publicized outbreak in Milwaukee after crypto got into the water supply, infecting 400,000 people, and over 100 people died. During this outbreak the rusty well at South Beach was one of the few' safe water sources because it tapped into the underground aquifer. People flocked to it from miles around, and we met old-timers who still go to the well for drinking water. At the end of the unit, Tina had her class visit the well and fill milk jugs with its water to see which kids would drink it.

Tina liked the game play because it wasn't about being right or wrong but about *arguing from evidence.* She explained, "In fact some of them made pretty strong cases for the wrong things. But they made a strong case and they talked to one another. They would argue who was right and who was wrong. It was exciting." For Tina, this argumentation was good because it engaged students as competent problem solvers. So she used it at the beginning of the year to set class expectations.

Supporting Customization

Our teachers came from diverse areas of Milwaukee, so they tied South Beach to different learning goals. Lyndee used the unit as part of a schoolwide reading-comprehension initiative. Tina coordinated reading across the curriculum, so she tied the game into her initiative for reading and writing across genres. As we learned about our participating teachers' contexts that first year, it solidified our view that "standardizing" one game across all contexts was boneheaded. No "one master intervention" would work for all. We could, however, provide compelling materials for teachers to adapt in various contexts.

Breaking Down Classroom Walls

We shouldn't minimize the difficulty of getting new curricula into schools. It took 15 months to go from first contact to getting permission to use materials that *teachers codesigned with us.* Curriculum coordinators told us that *they* decide what goes into classrooms, not teachers. They also wanted research evidence that the activities worked, and that was just the data we were trying to collect. In order to test the curriculum under our grants, it had to first be tested, creating a recursive loop nightmare (see Barriers to Technology Integration sidebar).

In addition, talcing 75 kids to the beach to do science was scary. As difficult as it is to teach with technology, its not nearly as difficult as organizing field trips. In profound ways, school is about putting kids in "safe" classrooms and cutting them off from the world. Managing layers of permissions, contact with teachers, and scheduling buses became Marks' full-time job. This struggle to simply let kids walk out the front door of their building doesn't bode well for technologies such as the Internet, which promise to "break down classroom walls." Schools, in many respects, are designed to keep the world *out.*

When we took the kids outside, the results were shocking. First, across each of our 50-plus implementations, students said that *going outside* was the highlight of the project. Kids pleaded not to cancel trips even when the wind chill approached zero.

Barriers to Technology Integration

When we introduced handheld computers into Milwaukee classes, the first Issue the schools' lawyers raised was, "Can kids use these to get online?" Recalling attempts in the 1990s to wire every school, I chuckled. The next question was "Can kids use microphones to pass audio notes?"

I looked to Jim Mathews, who was fuming. "No, they cannot," Jim assured them. "But they can still talk with each other and write messages on paper."

The lawyers looked at one another as if to say, "Any way we can tie them down and mute them so that they can't communicate at all? That would be safer."

While school lawyers debate whether it is OK for kids to talk, students are getting wireless-enabled iPods, Nintendos, and cell phones. Soon, nearly every student will bring his or her own broadband multimedia device to school. This is a major technological challenge to the social order of schooling. There's no way that one teacher can compete with 30 kids who have broadband multimedia machines in their pockets. Already, there are stories of kids sharing pictures of exams or sending thousands of text messages in a month.

I don't think it can be stopped, any more than the Church could stop people from reading in the 15th and 16th centuries.

Many of the Milwaukee students were visiting Lake Michigan for the first time and were confused to find that they lived so close to the "ocean." One asked if the beach rocks were "real or fake." Research reports that many kids from poor areas rarely travel more than a few blocks from their home (something depicted in HBO's *The Wire*, based on true stories; see also Ludwig, 2008). I asked Lyndee about these results.

Oh, yeah . . . Well, remember, most of them can't find Milwaukee on a national map." I also didn't believe that, so I took her up on it. The next day, we asked them to show us where they lived, and the majority thought they lived near Seattle. This was surprising to me, as I grew up on Lake Michigan, too, and it profoundly shaped my understanding of the world. To this day, I orient myself in new spaces in terms of Lake Michigan.[5] Yet the rhetoric coming out of Washington, D.C. (i.e., more federal control, curricula controlled by textbook companies)

5. I recently saw this mentioned on Facebook as "You know you're from Northwest Indiana when you still orient toward Lake Michigan at all times." Do people raised near other bodies of water navigate this way? If anyone knows, please let me know.

is about *reducing* students' opportunities to experience their local environment. The "one size fits all" style of education in vogue precludes learning about the world around you.

Situated Understandings

Once students visited the beach, their orientation toward the unit shifted dramatically. Students became emotionally engaged in the problem and identified more strongly with their roles—something constructivists call "taking ownership." Note, for example, the following heated discussion.

"It says right here, *'contaminated water,'"* Alice reported. "What does that mean?" She paused on the word *contaminated,* which was new. Words like *contaminated* aren't in kids' everyday vocabularies, and yet they aren't technical jargon, either (such as *eutrophic* or *hegemonic,* see Beck, McKeown, & Kucan, 2002). They are "bridging" words, words that appear relatively often, are used in specific ways, and connect common and specialized languages. Not Imowing such vocabulary is a barrier for at-risk students because reading academic texts requires understanding them. *Sick at South Beach* was good at introducing these words, getting kids to identify what they didn't understand, and then providing experiences that contextualized their meaning. A primary power of games may be introducing such terms by showing how and why such knowledge is used.

Jessica interjected with a hypothesis. "I think its crypto. And I'm not changing my mind!" Perhaps she was reflecting her "professional" conclusion as a doctor; perhaps she's just authoritative. Regardless, she was invested.

"It's the food," Susan declared, equally confident.

Jessica turned to Alice and shouted, "Burned!" Alice whispered back, "The teacher is right there!"

Tina chided them softly, "You mean yelling, 'Burned!' to solve your argument? I'm trying to find you making your case." Tina used the game's fiction to enforce classroom rules. Using the game to set high expectations was an unexpected benefit of the imit.

Alice, who was reviewing symptoms, noticed something. "Wait, you guys. It's not giardiasis." Susan agreed. "Its not hepatitis A either. It says here that it appears 1 to 2 weeks *after* exposure."

Jessica asked the teacher, "Can we look at our interviews again?" Notice how Jessica asks permission to review previous work; she feared that reviewing texts might be cheating (see Cheating and Teaching to Tests sidebar). "Yes, they are all in there," Tina said with a smile. At the point at which students asked for permission to reread complex academic texts, Tina knew she had won. The group turned to the chart.

Alice reiterated her position. “Listen, it can’t be this one [pointing to giardiasis and crossing it off], because it appears 1 to 2 weeks after exposure.” Alice organized their thinking by crossing off unlikely culprits. This exchange was typical for how groups debated explanations, each member vying to be the one who cracked the case.

Learning Through Interaction

In each class, representations like the chart shaped their thinking, particularly ones constructed to make sense of data. Students constructed many representations (see Figure 9.6), and their choice of representation (e.g., concept maps versus charts) affected their findings. Groups that made concept maps had the most accurate prognoses, as it encouraged synthesizing across data sources, whereas bar charts or graphs focused on single variables.

Class talk was decentralized, driven by the problem rather than the teacher. In his study of science classrooms, Jay Lemke (1990) characterizes most of the talk as being “teacher centered,” meaning that teachers ask questions like, “Why did the kids get sick?” with students then vying for correct answers. If you map the conversation patterns, it looks like a bicycle wheel with the teacher in the center and kids at the edges. The teacher directs the interaction, and diere is little if any extended student discussion.

Cheating and Teaching to Tests

What does it do to students' innate desire to learn when we teach to the test? What does it teach about how “professionals” learn?

For example, in Montessori schools tests are a foreign concept. When my class of 5th graders transited to “normal” schools, we started giving tests on Fridays to introduce the concept of testing. Once, a child left his seat to look up the answer in a book.

“What're you doing?” I asked. "Finding the answer? he dutifully responded. He said that he knew the answer but couldn’t think of it offhand. I tried my best to explain that you can't do such things in tests. “But it’s right there!" he said, pointing to the book on the shelf. I explained, “You can’t get up and just look it up. In fact, you can't get up out of your seat without asking permission.”

“Well, how do *you* get any work done?" another asked. I replied, “The trick is to keep from getting bored and stay out of trouble. The first thing you do is find someone who had the same class before you. Get the homework assignment. You can do it while your teacher is lecturing. If you’re clever, you can ask questions about the assignment in class. Otherwise... well, you learn to space out a lot" Silence fell over the room.

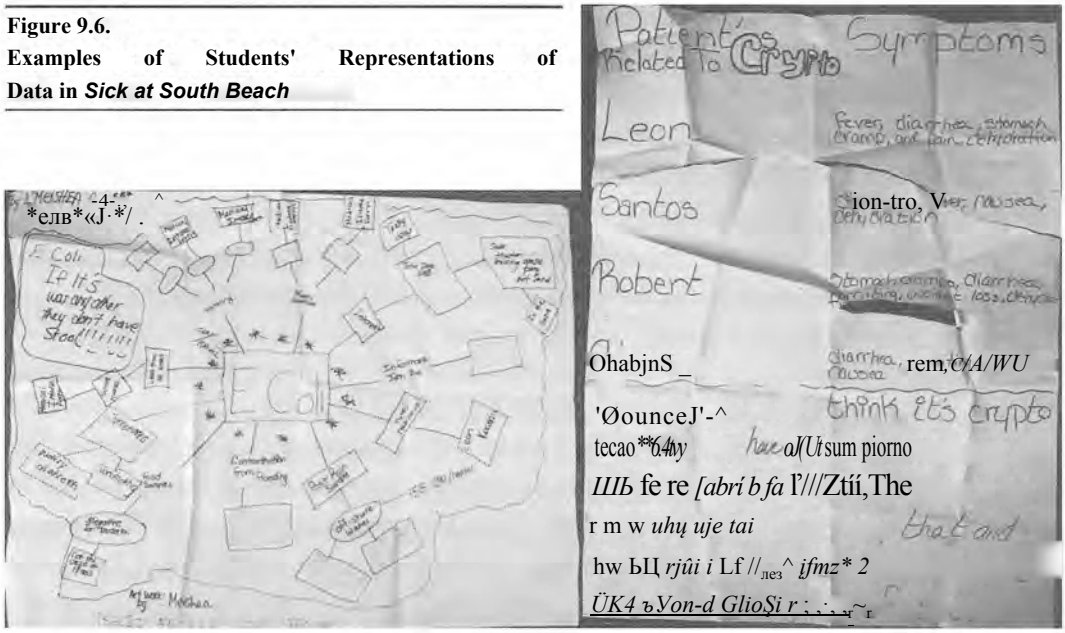
In contrast, *Sick at South Beach* is problem centered and looks like a spider web of interactions among peers with the teacher being one of several hubs. Discussions were driven by the problem (solving the case). Kids argued with one another, brought in resources, and raised follow-up questions. From a learning perspective, this arrangement is desirable because kids are *thinking* and active problem solving is driving the activity.

Promoting Literacy Through Games

Some groups extended the curriculum beyond the formal framework, primarily through connecting literacy instruction to science. In language arts class, they edited their reports. Each group wrote a two- to three-page technical report on (1) the causes of the illnesses and (2) what they thought should be done. Getting students to *care* about writing was a perennial challenge for Brian, who said, "If I just have them write a letter for the sake of writing a letter, they don't get into it as much. Students revised much more in this assignment than usual." Brian attributed this extra revision to the fact that students perceived it as authentic. "They felt that they were valued; they were important. It wasn't just a school task, but a real-life situation that needed to be taken care of."

Teachers graded the reports by a rubric, and all of them received 3s and 4s on a 4-point scale, with roughly one half receiving 3.5 or higher. One third of the students

Figure 9.6.
Examples of Students' Representations of Data in *Sick at South Beach*



solved the problem successfully (attributing the illnesses to *E. coli)* and had a soimd argument to justify their conclusion, incorporating the necessary and relevant facts and ruling out other diseases. Another third arrived at the right answer but with a weaker argument. The last third argued for crypto, based exclusively on patient symptoms.

Designing Games for Science

Sick at South Beach confirmed the hypothesis posited by MIT Games-to-Teach (2003) that it is worth pursuing teaching and learning science through forensic games, fŏds compete to solve complicated problems. They learn academic language. They read about gross stuff such as "fecal-oral contact" (which middle schoolers love). The game play is challenging; it requires reading above their grade level, learning new vocabulary, learning concepts such as the water cycle, and reasoning from evidence—all of which map directly to academic standards. But the biggest educational benefit may be the holistic experience of conducting an investigation. Students experience *being* a forensic investigator and that it can be cool to do science. In post-interviews, being professionals (not handheld computers) was the first thing that kids mentioned. Even the water chemist said, "Before the game I had no clue what a water chemist was, but I found out what they do." A wildlife ecologist jumped in: "Same thing with the wildlife ecologist. I thought that they played with animals." Imagine if instead of reading little sidebars in textbooks about what scientists do, lads actually got to *play* as scientists.

Game Mechanics

We identified a few "portable" design features that succeeded in engaging students. The aforementioned job applications were one example, as was connecting videos to place. For another example, Jim used budget mechanics to force students to prioritize information. Different tests (e.g., *E. coli* vs. crypto) cost money, so kids had to carefully choose which data they wanted. The effect was for students to synthesize information across the entire game as they prioritized tests.

Sustainability

Our next major challenge was how to sustain the project beyond the grant. We could imagine teachers checking out machines and coordinating field trips, but in Milwaukee the average teacher lasts *1 year* before moving to the suburbs or quitting. (I hope you find this shocking). The curricular knowledge could not reside with the *teacher* if we wanted it to continue.

We started working with community organizations to increase sustainability. Such organizations play many roles: They guide the game direction, provide real data, and ultimately, "own" the game after funding ends. Plus, they invite participation after the game as a *real* citizen scientist, journalists, or volunteer. They provide trajectories for participation in more advanced design activities beyond the game.

SCIENTIFIC CITIZENSHIP

These ideas came together in *Saving Lake Wingra,* the final game of our study, which was built with help from *The Friends of Lake Wingra* (a similar game that was developed by the Urban Ecology Center in Milwaukee). The game opens with news of a "secret" plan to transform Lake Wingra, a quiet lake in Madison, Wisconsin, into a hub of recreation and commerce. *Saving Lake Wingra* explicitly asks students to debate the future of the lake. Ecologically, the lake is threatened by urban development. Storm water runoff clogs natural springs, ruining the lake for anglers, boaters, joggers, and aquatic species. And Lake Wingra's shores are among the most ethnically diverse gathering places in Madison. Hmong, Mexican, African American, and European Americans all use the lake and its surrounding land for bicycling, sustenance fishing, and recreation. It's the perfectly contested place (see Saving Lake Wingra sidebar)

Saving Lake Wingra increased competition by having players represent stakeholders with competing agendas. Environmentalists want to remove invasive species. Recreational users want, increased lake access. Developers want condominiums (at least before 2006 they did). Learning how humans use natural resources represents a number of social studies standards. Native Americans began altering the lake thousands of years ago, and the lake's current shoreline was designed as a park in the early 1900s (concurrent with the development of Frederick Law Olmstead's parks).

In fact, the games' twist is that there is potential for a consensus plan to remove invasive species and maximize the lake's benefits. There is no "natural" state for Lake Wingra, or for inland lakes of its size; there are only dominant patterns of interaction. A Lake Wingra filled with sediment or overrun by carp serves *no one*—not fishers, not business and landowners, not environmentalists. Our goal was to get students to see through the divisive rhetoric dominating public discourse and to identify areas of mutual interest upon which they could build common ground.

Thus, the games' hook is "environmentalist vs. recreational users," but the *real* lesson is in finding common values to improve our futures. From a game perspective, the knee-jerk political responses made great red herrings, but once you

understand the issues, the solutions became quite clear. We hoped that through playing the game students might ask, "Why aren't we doing anything about this?" and become compelled to act.

Saving Lake Wingra-a Student Reflection

I think that we should combine all four plans to clean up Lake Wingra. We should use the revenue from the condo plan and the marina plan to finance the storm water and invasive species [plans]. Not only would this clean up the lake but potentially create new jobs. The city of Madison could hire people with little or no education and pay them minimum wage or slightly above to take out invasive species. We could also sell condos for top dollar so maybe we could build a water treatment plant. If we do this, it will clean up the lake, create new jobs and homes, and make the lake more enjoyable. More people would use the lake and it would be clean. As for the condos and the marina, we would use only green materials and we would have to put signs that say "No Littering" and have monthly cleanups of the beaches. I would also like to limit the lake to nonmotor boats until the lake is cleaner. For the storm water plant, if we build the water treatment plant, we can clean up the water and then put it into the lake. We'd also have to build rain gardens all along the shores. For the invasive species plan, as I said before, we can hire people to take out the invasive species. This plan will make everybody happy.

Over the next 2 years we ran *Saving Lake Wingra* with 20 to 30 classes, including many different iterations and flavors. The vast majority of students chose to remove invasive species and prevent storm water runoff. In pre- and post-tests, students showed deeper understandings of water systems and scientific argumentation, as well as more sophisticated thinking about the lake, although we did not see statistically significant gains when compared with our control groups (more on this next). These results were good, but students didn't grasp key ideas of new urbanism, such as why condos on the lake could be *good* for the environment by reducing urban sprawl.

Students engaged in complex forms of argumentation, as they had in past iterations, but the most important feature of the game was how it positioned players as actors designing their own futures. One Hmong boy, for example, met a Hmong family that was fishing, and he shouted, "That's me! *I'm* Hmong!" He was hooked.

As one student described in a post-test interview from January 2009, "I feel I am higher ranked than I should be. Usually, I am a kid. I just work, copy it down, and write some questions or answer the questions."

Another player, Caleb, described how the game was validating:

> Teacher is always ruling over you. Instead of [saying] the teacher's word is law, and that's the end of it, in this project, there was a lot more room for your opinion and stuff. Some teachers will say, "My opinion is right," so nobody can challenge it. And so then you have to learn this no matter what's your viewpoint.

School, for Caleb, is largely recapitulating what the teacher wants. Crystal agreed with Caleb and interrupted him to say, "Like, they were this [opening his arms to show the teachers' status] and we were this [closing his arms to show his status], and now we are both this [using arms to indicate the gap was shorter]." Our partner teachers generally *agreed* with students' critiques of school. They *wanted* to engage kids in authentic inquiry and focus on learning rather than control. Our project succeeded when it gave teachers compelling materials that inspired good teaching and enabled them to organize their schools around powerful ideas.

The most compelling evidence for learning arrived on my doorstep Christmas Eve, 2007. A few months after we ran our curriculum with Spring Harbor Middle School, die *Capital Times* ran a feature about the health of Madison's lakes. One student, Sulvan, who had played the game, read the story, and decided to write a letter advocating more funding for field trips to the lakes, the *Capital Times* included the following letter to the editor:

> ***Let Students Lead Charge for Saving the Lakes***
> by Sulvan Gu, student, Spring Harbor Middle School
>
> Dear Editor:
>
> I personally think that we wouldn't have to give any money exactly to the lakes, but that we could give the money to schools.
>
> Why? you ask. It's pretty straightforward. Schools could use the money to afford trips to the lakes so we could learn more about the disaster of the lakes.
>
> Now you may be asking, "How could teaching children help save the lakes?" Doing this could do many great things.
>
> A child might be astonished by the news and become inspired to volunteer saving the lakes.

> Even though this is less likely, there is a very high chance that the child will spread the news. This could lead on to the people who received the news spreading it! The more people that heard the news the better we can save our lakes.

We can't say that we *caused* Sulvan to write this letter; who knows, maybe he wrote letters to the editor all the time, and he probably had supportive parents. But I love Sulvan's implicit model of change. You've got all of these kids sitting around in school all day, Let's put 'em to work doing social good!

SCALING

The question of how to help interventions grow beyond research communities is complex. It's framed as "scaling" in most communities. The metaphor of scaling is so ingrained that we often forget that it's a metaphor. There are many metaphors that one could use (viral spread of ideas, grassroots growth, and so on), and we often forget that scaling is rooted in designing mechanistic systems. The logic is simple: Build a small model (like a model car), get it working right, and then make it bigger. Some reformers see education similarly, Design a curriculum, get it working with a few teachers, train teachers to use it the way you intend (which is called implementation fidelity), and then roll it out to large numbers of teachers.

Implicit in this approach is the idea that educational specialists should be telling hundreds of thousands of teachers, many of whom they have never met, the best way to teach. Maybe this sounds fine in theory—if you believe that the educational experts know what works in local contexts. Mark Wagler's class fell victim to this logic. An administrator wanted everyone doing the same thing at the same time, and Mark's multiage classroom violated that. So his school lost one of its most highly regarded teachers. It's no wonder that good teachers are quitting in droves. Thus, the dominant scaling metaphor deprofessionalizes teachers and moves control further away from students.

Our change model is a process-oriented approach unconcerned with whether the interventions can be scaled up. We are more concerned with spreading reflective teaching practices that engage kids in advanced design thinking about themselves and their communities. We may not know how any one teacher should do his or her job, but we can provide that teacher with the resources to transform individual teaching practices as he or she sees fit.

I'd like to think that our project succeeded because collaborating teachers took away principles that applied to their teaching. Many teachers started conversations with their students about video games. One teacher enthusiastically reported how discussing *Grand Theft Auto* in class enabled her to connect with disaffected boys. In fact, this interest in games and youth culture was the idea that spread most easily and virally.

The most transformative learning occurred for those teachers who designed their *own* games. The best example came from Tina Kurz. Inspired by *Sick at South Beach*, Tina partnered with another teacher to create a semester-long technology course in which students designed, developed, and play-tested a game about their city, Oconomowoc. Borrowing our handheld computers was too constraining, so they wrote a grant to purchase their own. Tina's *students* actually made the pitch to the school board. They presented the rationale, the unit plan, and their findings from *Sick at South Beach,* They even used situated learning theory to explain why this was good education. In the end, they used the game to design and plant a new rain garden to protect a local stream.

This, to me, is the most powerful scaling you can get. Tina and her colleagues took on the ideas underlying the unit and creatively applied them to her own context. That is die goal of scaling—not getting 10,000 teachers to all do the same thing at the same time. In fact, if 10,000 teachers were all doing the same thing, our intervention would have failed. We *wanted* students and teachers to design games about their unique local communities.

THEORY AND PRACTICE

This chapter proposes a model for game-based learning that is interest driven and seeks to propel students into learning new domains by engaging in design activities. How can we promote change in schools? The answer to that question lies in building community partnerships.

- *One promising strategy to transform schools is to partner with community groups (recreational clubs, scouts, church groups, or volunteer groups like Friends of Lake Wingra).* Teachers, administrators, and researchers all come and go, but place-based community organizations such as Friends of Lake Wingra stay put. Our game design project connected youth to groups ranging from fishing clubs to environmental groups that steward local place and provide contexts for authentic participation.

- *Sustainability features are built into community groups because they are fundamentally interested in improving the quality of life for local community members.* They leverage on-the-ground social networks. They also provide third places—gathering places that are neither home nor school—so that kids can pursue their interests and identities free from who they "have to be" at home or school. They can meet mentors who can turn those interests into lifelong pursuits. Our G'vClub (working with the Wisconsin Youth Company) was this kind of third place. Gaming eventually led to other good school habits, many of which had academic value. Students developed identities as "experts" within the game, which, in turn, helped them feel comfortable being good at school.

» Thus, a productive avenue for games (as described in Chapter, 10) may be to *start growing innovations outside the formal structure of schools, which have a tendency to shoehorn innovations to meet the particular constraints of school* (45-minute time blocks, local standards). If we can provide deep learning experiences that compel teachers to bring innovation into their classrooms, perhaps we can empower more lasting change. This isn't to suggest turning our backs on teachers, and indeed our group continues to work with many teachers. However, we believe that to facilitate real transformative learning, we must be open to creating alternative structures to those provided by schools.

CHAPTER 10

The Future of Games for learning

This book has explored how games function as a medium—how they can engage interest in learning and can lead to understandings of complex phenomena. We've explored game cultures, how they operate, and how they suggest participatory models of learning. We've presented the case for an emerging approach to education that builds on earlier traditions such as constructionism and progressive pedagogies. Still, there are tremendous challenges. Our educational system remains mired in an industrial model of "one size fits all" curriculum, and the history of education is replete with reform efforts that tried to tackle these systemic issues head-on but that were met with tremendous resistance (Collins & Halverson, 2009). This book has focused mostly on work from research communities, but a mature field of education and games needs to engage broader constituencies. This chapter asks:

- What might an integrated game-based learning paradigm for K-12 education look like?
- How can we get such games made?

CREATING EDUCATION MEDIA

Today, examples of quality educational media exist, from *Nova* to *Dora the Explorer*. Most successful properties share a common blueprint of academic-industry partnerships and longitudinal commitment. These properties (particularly *Sesame Street*) have "scaled up" not by adhering to a rigid formula, but by building on the successes of one another.

One of my favorite design principles of these early childhood programs is that powerful learning occurs when adults engage with children during viewing. The adult observes the child's interests, discusses the program, and extends those interests into new areas. These shows (such as *Jack's Big Music Show*) actively engage the parent through inside jokes. The success of this body of work as a whole shows what can be accomplished when there is significant investment over time.

But games aren't television programs. Broadcast media models may not help with questions like "How do we teach novices to become expert designers?" To explore what partnerships for a digital age might look like, let's reexamine the development, distribution, and publishing environment of games.

INDEPENDENT GAMES

With their cutting-edge technologies and huge economic impact (particularly sales, subscriptions, and profit margins), it's easy to focus on the high-end commercial entertainment gaming market. But a substantial independent games movement has thrived in the 2000s by producing niche games at a fraction of the cost, occasionally bringing their developers great profits, particularly on emerging platforms.

Game maker 2D Boy's *World of Goo* is a great example. *World of Goo* is a physics-based puzzle game in which the player controls "goo balls" that they channel across landscapes and into pipes, leading them to "the Goo Corporation." 2D Boy is a company of two developers who struck off from the behemoth Electronic Arts. The game's conceit is a metaphor for the games industry itself, with players channeling goo balls (i.e., workers) to feed the corporate machine.

Its puzzle solving is all about physics. As Drew Davidson (2008) describes, the lesson of the game is that "physics is your friend." As players build bridges and structures, they wrestle with concepts such as "center of gravity" and the material properties of the goos. During play-testing, the team realized that using physics enabled them to create more sophisticated levels in a fair manner (as opposed to using random "gimmicks"). Any game that makes "physics your friend" captures the playful spirit of academic content in a way that good educational games should.

World of Goo also suggests where the market for educational games might be. Not only is *World of Goo* a cute game, but it has received smashing critical success (90% scores across the board and many "game of the year" awards). And it's making gobs of money. Developed for about $96,000 (according to developer estimates), it brought in $496,000 in the first few weeks of release for the Nintendo Wii (see video game sales charts: http://news.vgchartz.com/news.php?id=2478). Combine that with the sales for the PC release, Steam direct downloads, Mac purchases, and so on, and you have millions in profit.

Few would say that *World of Goo* is educational, but it's instructive (as is another engineering game, *Pontifex).* You could use its underlying game play to teach engineering principles such as triangulation. One could imagine building educational

materials around *World of Goo,* using it as the basis of giving kids' firsthand experiences with challenges requiring knowledge of physics. An educational version could point out these principles to users; if you don't already have an idea of "triangulation" it's hard to infer those concepts from the game in any articulated way.

World of Goo is but one example in an emerging independent games movement that is expanding contemporary models of gaming. *Braid, Flow, Fez, Diner Dash, Flower, Crayon Physics, Desktop Tower Defense,* and *Love* are all thriving games outside of the traditional marketplace (see *Flower* sidebar).

Production and distribution platforms such as Wiiware, Xbox Live, and online game aggregators such as {Congregate are paths for games to reach new audiences, it may not be this way forever, but there's an open window that educational games could exploit

A key lesson for educational designers and developers, however, is the potential for leveraging the robust game development environment of software tools and engines. When we built *Supercharged!* simply importing 3-D models into a game engine took weeks if not months unless one spent tens of thousands of dollars on the Renderware tool suite. Now, this task is trivial and cheap (in the hundreds of dollars), with Unity's game development tools easily porting games to both computers and cell phones. *World of Goo* used Open Dynamics Engine, Simple DirectMedia Layer, PopCap Games Framework, TinyXML, Advanced Encryption Standard, irrKlang, and libcurl in its development. Other developers have made great headway with Flash and its many plug-ins. Likewise, the Torque Garage Games development community continues to gather steam, as does Unity. In an ideal world, educational game developers would expand upon these tools, creating their own software development niches. Nascent educational game companies like Filament or Fire Hose Games may become that community. Unfortunately, in the past, educational technologists haven't gone to the Game Developers Conference to learn game development patterns (such as the currently popular one-page design document; see Librande, 2010). Likewise, until very recently, game developers have avoided educational conferences.

These routes do not necessary translate to millions of sales, but millions in sales aren't required to be profitable. New pathways enable unique games to get made, and educators, if they are savvy, can use such games to find unique audiences. In many respects, this is a long-tail phenomenon of a large collective market for niche titles. Indie games are not attempting to compete with *World of Warcraft* (although recall that Nintendo sold 17 million copies of *Brain Age,* which is a pretty "lo-fi" game). Rather, they malce use of new development models (oftentimes one or two people leveraging development tools), and they choose publishing deals that make the most sense for their title.

Flower

To simply describe the current wave of indie games as providing "alternatives" to the mainstream games industry sells short their aesthetic innovations. For example, in *Flower*, each level takes place "inside a flower's dream" as it sits in an apartment. The player flies a flower petal through fields and makes the fields come to life in an explosion of color.

Designer Jenova Chen described how "we just had this concept that every PlayStation is like a portal in your living room . . . that would allow you to be embraced by nature."

Critics may ask, "Why don't games just go outside, then?" It's a fair question. Most people I've shown the game to do in fact decide (however temporarily) to make experiencing nature more of a priority in their lives.

However, we wouldn't reject an Ansel Adams photograph because it "pulls people away from nature" or critique the sweeping outdoor shots in *Dr. Zhivago* because they keep film viewers indoors. *Flower* makes a statement about our blighted urban landscapes and the feelings of freedom that are lost when we lose open spaces.

Independent games like *Flower* show that games are capable of expressing a range of emotions, but developers may need to go around the mainstream industry to do it.

Educational developers could use similar channels for distributing games, particularly in informal contexts. What's missing, however, is a mature *game-publishing* model. Educational developers need

- *Good research in educational markets* (including homes, large school districts, alternative schools, charter schools, after schools, and community organizations). Textbook publishers and educational service providers control school markets through a variety of means. Thus, channels other than schools may be the best place to start with game development and publishing.
- *Models of best practice for game development.* The commercial industry has mechanisms for sharing lessons learned, such as postmortems. No good mechanisms exist in the educational games community to critique one another's work and learn from successes and failures. Educational game publishers could help ensure quality by requiring best development practices.

Raising the resources to develop an educational game can be daunting, but often there are content providers, educational groups, or other stakeholders who can help. For example, *Building Homes of Our Own,* a game that has been used in industrial design classes, was sponsored by the National Association of Homebuilders. The future of games may require similar partnerships. Alex Chisholm and my colleagues at the Learning Games Network (see Learning Games Network sidebar) have begun pursuing this work, as has E-Line Ventures, a new educational game publisher.

All this discussion, however, takes place outside the traditional textbook publishing and adoption processes. Textbook publishing is a mess. In short, die textbook adoption process is dominated by the demands of large states (most notably Texas). To get approved, textbook companies acquiesce to state political pressures about what content goes into textbooks and what is left out. One (naively) assumes that disciplinary knowledge determines what goes into textbooks, but it's actually a political process.

The corporate publishers have locked up channels into schools. In fact, the move to "scientifically validated" materials may have been nothing more than an attempt to further control the school market. If you need very large studies proving that your materials "work," before you get into schools, innovation, particularly by smaller companies, is shut out. Imagine a small start-up trying to get their games into schools—even with a local teacher who is involved in its development—but it first has to show that their games work with thousands of students.

Learning Games Network

The Learning Games Network (LGN) is a nonprofit institution trying to spark innovation in the design and use of learning games through promoting collaboration among scholars, teachers, developers, producers, and so on. LGN develops model projects (such as ¡Cue) to demonstrate how such partnerships could be done and builds general infrastructural capacity (such as an international group of teachers available for piloting and teaching with games across many contexts).

I'm the vice president of LGN and a founding member. Our hope with this initiative is that we can proactively shape the field by researching and disseminating best models of educational game design and development, helping to arrange partnerships between developers, content providers, and learning and media specialists and expanding the field, Games is an area in which one good proof of concept is often infinitely more persuasive than a research paper.

Selling directly to states or districts is difficult As a graduate student, 1 worked with Sasha Barab consulting with Activeink, a Texas-based company producing on-line problem-based learning materials that was perfectly constructed for this problem but still struggled (see Squire, Makinster, Barnett, & Barab, 2003). A game-based company that had some success in 2000-2001 was LightSpan, which developed materials for Sony PlayStations. LightSpan thought that, as the PlayStation2 took off, the millions of unused PlayStations would make good, cheap 3-D gaming machines. Their games were eventually adopted by thousands of schools in 43 states. Many schools dropped them after a few years and they were sold to PLATO Learning Inc. Recently, PLATO repackaged the same games for the Sony PSP and they've gained new life.

Indeed, the past decade has witnessed the rise and fall of many technology-enhanced learning companies. Whereas the Learning Company was bought for $2 billion then sold for pennies on the dollar, Riverdeep leveraged its market position to eventually buy Houghton Mifflin. The business activity of the period was typical of the dot-com bubble and crash. Companies such as Activeink or Riverdeep saw wild fluctuations in value as people identified business opportunities in digital education media companies,

Yet almost every game designer sees the opportunity; the economics of textbook publishing, in which schools replace expensive textbooks every few years, is flawed. The company that can create an online system in which content is regularly updated, assessments are integrated into the curriculum, and reports generated that feedback into instruction (particularly providing assessment data to teachers and parents) will have enormous opportunities. Virtual schools are one good place to look for this innovation, as they are deeply tied to digital content and compete with traditional schools for students' tuition dollars.

The "educational games" that succeed in this era in all likelihood won't be typical games with traditional content, but learning systems that span home, school, and other interests (such as hobbyist pursuits). They will be assessment systems. These may be summative assessment systems used for credentialing (i.e., to pass a professional exam), and they also may be used to inform learning decisions. They will identify what the user does and does not understand and offer diagnostic guidance. Much as many games auto-adjust difficulty settings, they will present new levels and challenges based on previous performances. Just as a *WoW* player goes online to access videos to learn strategy, learners will have access to expert performance represented in a variety of ways.

An integrated game system can also suggest new games, levels, or experiences (off-line or on) for extending learning further. These systems need to function as

our mentors did in our after-school C/vClubs, allowing students to build on their interests and extend them into new domains. Many of these functions may be done by *people,* rather than machines. Teachers generally do better than machines with these tasks. In our work in C/vClub, this process was deeply social, driven by personal relationships and mutual respect.

Along with Constance Steinkuehler and Richard Halverson, 1 am currently exploring how to capture performance and represent it back to players for learning. The classic example of this is *Rise of Nations.* As Gee (2007) describes, gamers love to pore over charts and graphs to see how they can improve. You see the same thing in raids in *WoW* as players study damage charts to measure their performance, or in our C/vCamps as players analyzed games to improve future performance. There may be opportunities to adapt *new* assessment models, such as evidence-based design, into educational games.

A big challenge is how to combine good game play and meaningful data about learning. Good games mix open- and closed-ended game play. They often support creative and novel solutions. They include opportunities for transgression. They present deep problems that we return to over and over and can approach from different angles. Many designers creating games from an assessment perspective (such as evidence-centered design) put the assessment, rather than the game play, first. As a result, they generate games that are assessable, but may not really be worth assessing as games.

When approaching the question of assessing learning through game play, it's good to take it with a good slice of humble pie, as it's really hard work. Franziska Spring (2009) published a dissertation on dynamic feedback in the game *Hortus,* a construction game around growing plants. Her goal was to understand what type of feedback helps players and how to assess learning through game play. She found that it's really difficult to discern patterns in players' actions whenever there are meaningful choices (actually, it's tough in any situation). It still remains to be seen if we can construct snapshots of cognition based on mouse clicks of these sorts.

All this is promising, but it's also a *huge* departure from what's happening in schools. There are *potential* alliances between assessments and games, but the intrinsic values of games (personalized learning experiences, choice, access to expert communities, and permeable walls of the classroom) contradict the rhetoric of control dominating todays' educational discourse. As a result, these innovations may flourish in informal learning environments such as libraries, community centers, or museums, and perhaps through supplementary services.

INFORMAL LEARNING CONTEXTS

Informal learning institutions have incentives to build relationships with new constituencies. If my local museum can track my interests, it gains valuable market research data that it can use. Right now, Facebook is the hub for such marketing and advertising. However, Facebook ultimately owns that data. It would be nice to have multiple affinity spaces that enable institutions to capture this data (as Ning aspires to), but people seem loathe to join 18 different groups and systems. However, if K-12 schools remain inclined to "lock down" their systems banning Facebook and so on, schools' relevance may fade further.

Once educators move into informal settings, the context changes entirely. Informal educators are largely free to pursue the goals they think are important (rather than those imposed by political bodies). If you're at a science museum, these goals might range from increasing ethnic diversity among scientists to fostering scientific citizenship in adults. Creating engaging materials and producing lasting interest in science is an almost universal concern. Stakeholders need to entice learners, and if you're a science museum and fail to attract repeat visitors, you go out of business.

If games do indeed capture attention, increase interest, and springboard to other educational activities, then they are the perfect fit for informal education contexts. In fact, in a recent study, Miller (2001) found that consumption of science media trailed only the completion of a college degree in predicting science literacy. This statistic is striking. If we really want to make a difference in areas like science, maybe we're best off targeting out-of-school experiences, creating compelling learning experiences that propel kids to investigate science, just as *Pirates!* and *Civ* propelled me to take an interest in social studies. The question for educators is how to connect those interests to communities and ensure equitable access. Indeed, the real reason that compelling educational materials don't get made, even when the field appears to be at the cusp of producing a wave of engaging, effective materials, is that such engaging materials require preexisting knowledge (and motivation), are expensive, and are best experienced with a capable mentor. Closing this impending participation gap could be a mission for schools.

Working in informal contexts enables educators to avoid the top-down requirement of uniform learning outcomes. In CivCamp, differential learning goals and outcomes contributed to the distributed center of expertise. Thus, the historical "problem" of games supporting diverse learning goals becomes a "feature" in informal settings.

Imagine visiting the aquarium and picking up (or buying) a game on the way out. The game might feature "realistic" depictions of the aquarium and levels with

actual habitats. It might alert participants to new programs. As the owner of a 100-gallon tank myself, I'd love to play with different setups and purchase new fish directly in game to be shipped to my house. That's the sort of fluid boundary crossing that informal science educators want, and the kind of funding model that might make it happen.

Perhaps the best way for games to have an impact on mainstream education isn't by marching through the front doors of schools and hoping that scores of teachers will embrace these principles (although surely some will). Perhaps the better route is to gather informal science educators, game developers, and content specialists to create compelling games, and then build networks of teachers who use them creatively in their teaching. My own next generation of research will explore whether we can partner with scientists doing cutting-edge work in areas such as nanotechnology, epigenetics, personalized medicine, or systems biology to create games that communicate the ideas in their fields to broader publics. Títeres a clear need for compelling materials in these areas, and games seem perfectly suited for it.

SCIENTIFIC CITIZENSHIP

Scientific citizenship is one potential leverage point for building educational games. Today's dominant social and scientific issues (such as climate change, gene therapy, pandemics, or personalized medicine) require an informed populace capable of understanding scientific advancements as they develop (as opposed to learning "all they need to know" in school). Yet scientific civic literacy rates in the United States struggle to reach 20% (Miller, Pardo, & Niwa, 1997). "Scientific civic literacy," according to Miller, requires

1. An understanding of critical scientific concepts and constructs, such as ecosystems, the molecule, or DNA;
2. An understanding of the nature and process of scientific inquiry;
3. A pattern of regular information consumption; and
4. A disposition toward taking action to make change in one's lifestyle as necessary (adapted from Miller, 1998).

This model of scientific civic literacy has some added benefits as a reasonable "goal" of science-based games. It builds on findings suggesting that role-playing as professionals can be engaging, and it creates a bridging identity much closer to where students are. Further, it avoids fetishizing professional science as a model of

expert behavior and suggests ways for people to be engaged with their own communities. So often we base our interventions on getting "kids to think IIIee scientists" when, in reality, we want them to be active participants in a democratic society. We *do* want people to understand how scientists think and to experience being a scientist, but relying on such an approach exclusively perpetuates the myth that only professionals can do science.

Scientific citizenship is a particularly useful framework for designing educational games because it suggests how we might mobilize a citizenry toward action around areas of pressing concern, from global warming to water issues. There are many additional strategic benefits: Materials in these areas don't exist, most of the scientific fields are deeply embedded in simulation as a way of knowing, visualization is key for understanding the phenomena, and games enable broad and cheap distribution via the web. Given the fast-paced nature of scientific discovery, informal science education is poised to play a crucial role in ensuring that our populace is prepared to meet tomorrows challenges.

EXAMPLE: *CITIZEN SCIENCE*

As an example of what this might look like, lets examine *Citizen Science,* a game I'm developing with Filament Games with support from the National Science Foundation (see figures 10.1, 10.2). *Citizen Science* is the latest chapter in the game design sequence of *Environmental Detectives, Mad City Mystery, Sick at South Beach, Saving Lake Wingra.* The game is based around Lake Mendota in Madison, Wisconsin. Lake Mendota, in addition to being right outside my office, is also thought to be one of the most thoroughly researched lakes in the world. The University of Wisconsin-Madisons limnology department (as one might predict) sits on the lake, and researchers have been studying it for about 100 years.

However, like many of the worlds aquatic systems, Lake Mendota is under stress. Agricultural runoff dumps tons of fertilizers and waste into the lake every year. This runoff adds phosphates and nitrates to the water, which causes algae blooms. These algae cloud the water, threatening to choke the lake by blocking oxygen and sunlight. This process, called *eutrophication,* is a common one and threatens many urban lakes and waterways. Even worse, the effects of these phosphates often aren't experienced until *years* after the dumping occurs. So whatever algae problems we experience right now in Lake Mendota are a result of what farmers did upstream 20 years ago. If we stopped the dumping right now, we would have to wait 20 years to see an effect on the lake.

Figure 10.1.
Citizen Science,
Developed by Filament Games with Matt Gaydos and Kurt Squire

Figure 10.2.
An Embedded Model That Players Use to Test Theories About Lake Mendota

Today, Lake Mendota isn't in great shape. It's a lot better than 40 years ago, back when they blatantly dumped waste into the lake. Still, Lake Mendota is nasty to swim in. When I first moved to Madison, this astounded me. Madison has this beautiful natural resource right on campus, blocks from downtown and the state capitol, and yet it is unswimmable.

Enter *Citizen Science.* One reason Madison hasn't done anything about Lake Mendota may be that people don't understand what's happening. Further, people haven't imagined Madison with swimmable lakes. One of the problems

of any social design (whether it be schools or lakes) is that people get locked into mindsets of how things *are* and are unable to envision what they *could be* like. Could *Citizen Science* open up citizens' imagination by showing them what Lake Mendota *could* be like and then inspire people to action?

And wouldn't it be cool if game players had the experience of creating that change *themselves*? If you "saved Lake Mendota" in a game (much as you have saved plenty of worlds in role-playing games), might players develop similar dispositions in the real world? Such a game could have value beyond Madison or lake ecology. If you understand what's happening to Madisons lakes on a systemic level, then you have an intellectual toolkit to understand other key ideas in ecology.

MOBILE MEDIA

What is the next horizon for educational games research? Cell phones are one of the most quickly adopted technologies in history, although they have largely been overlooked by educators. The small screens and technological "thinness" of these devices make them easy to scoff at, but their educational potential is dramatic.

Already, over half of secondary students attend school with a mobile device in their pocket. For those who don't work with kids on a regular basis, this may be surprising, but cell phones are indispensable tools for coordinating busy schedules (Ito et al., 2008). This trend appears to cut across class lines. In 2009, the youth at *Civ* Camp all started showing up with iPod Touches (in addition to their mobile phones). They all know where the free WiFi is (i.e., in libraries, coffee shops, Culver's restaurants), just as the kids I taught 15 years ago knew how to get online at libraries with free broadband. Access is now ubiquitous. "Smartphones" (such as the BlackBerry, Palm Treo and Sidekick) were high-tech gadgets marketed to business professionals and technology geeks, but with the release of the iPhone (and, in response, Android and similar devices from their competitors), mobile media devices are penetrating the mainstream. It's a safe bet that mobile phones will be the first multimedia, networked computer technology to reach one-to-one penetration (Wellman, Smith, Wells, & Kennedy, 2008).

Skeptics might ask if youth will really access these devices in any broad fashion. My impression is an emphatic yes. Over the past year, our research team has begun studying this. We have interviewed kids with iPhones, we have bought iPhones for kids who didn't have them to see what happens, and we have experimented with teaching strategies in a classroom where *every student* had a broadband-enabled mobile media device.

The most obvious finding is that youth *love* their mobile devices. They love the ability to access personalized media in a mostly private environment. They love carrying their personal media libraries in their pockets, and they love being in touch with their friends anytime, anywhere. And they love games. The youth we studied with iPhones ail download dozens of applications tied to their personal interest. Don't get me wrong, I love my computer, but I'm pushing 40. Today's youth see media differently. A mobile phone isn't a "weak computer" but rather a portable, indispensable media and communication device. Most often students have no control o\'er their environment; mobile media devices give them tremendous power and control over their lives as they can pursue interests, participate in social networks, and consume and produce media wherever and however they want (see Squire & Dikkers, 2010).

Having an iPhone amplified these students' interest-driven learning. One of my favorite examples was a student named Tom, who, like many kids, was bright, but didn't do particularly well in school when he wasn't motivated. During a work period, I noticed him listening to something with his iPhone and futzing with it periodically while working on his project. I asked Tom what he was doing, and he showed me how he was listening to music on Pandora, looking up new artists that he likes online, using a guitar application to figure out chord progressions, and copying lyrics he liked into his notebook (or typing them into the notepad on his iPhone). Tom plays the guitar and is working on a band, and this was the "homework" he did in his spare time. He did all this while working on a neighborhood redesign project in Jim Mathew's class.

For Tom, the iPhone made it possible to pursue interests in a way that was unfathomable even 5 years ago. When I grew up you had to "know someone" to find out about new bands, which meant hanging out at record stores (if your town was luck)' enough to have one) or finding the right 'zine. Five years ago, Internet-savvy people could do this at their computers, but broadband wasn't ubiquitous. Kids like Tom usually had to share family computers with parents and siblings. Today, Tom, with an iPhone, can pursue these interests while at the grocery store with his mom, on the way to soccer practice, or in between classes. In short, with mobile media devices we can pursue our interests throughout our day. This is profoundly important for youth who do not have the same unfettered access that many knowledge professionals—and parents—do.

In a very real way, these devices are reconfiguring our experience of place. Tom is simultaneously in his classroom, in his practice studio, and in contact with all of his friends. Many of the walls that have defined education (particularly to keep information or people *out)* are now removed.

Educators have only begun to pay attention to mobile devices, and mostly it's with the intent to ban them. Indeed, smartphones are incredibly disruptive to the dominant order of schooling. Every teacher competes for time with Tom's music, podcasts, film, and game collections, plus all Tom's friends and everyone he could potentially meet over the Internet. If a teacher says something Tom disagrees with, he can fact-check what the teacher said, perhaps without the teacher's even knowing it. Information (such as answers to test questions) can spread through a class or school in real time. In fact, there are already many stories of students talcing pictures of tests with then· phones and sending them around school. Texting answers is also reportedly on the rise, but most students I've interviewed report that if they cheated, it was easier to do it the old-fashioned way.

At the root of this disruption is a contradiction between the capacities of mobile media devices and the social order of schooling. The *private* nature of mobile media communication is key. A teacher has a hard enough time monitoring 30 kids when her back was turned. Now that they can communicate silently... good luck!

Cell phones won't dismantle the modern educational system on their own. In fact, every wave of technology going from radio, to film, to television, to the VCR, to computers, to the Internet has offered similar promise. However, personalized media devices should take a big chink out of the armor of the "teacher as lone authority-provider of information" model. *Kids are bringing them to school* whether educators like it or not.

Mobile media highlights how in every place but schools, learners are pursuing areas of personal interest with technology. The challenges mobile media present don't necessarily point to games as "the" solution. But games remain a good model to pursue given these conditions. Games excel at building and sustaining learners' interest in academically related areas, Games are models for teaching in which the goal isn't memorizing information, but *using* information to solve problems. Games enable and promote personalized learning (as players delve into different aspects of a model), and learning is often collaborative. And games allow for models of how students go from consumers to producers of information.

Indeed, future games probably will not live on one device or another, but will span any number of devices. In some ways, fantasy football or baseball are good models, in this regard. Games might collect data based on what players do, and then enable them to interact with the data back at the computer. This is a particularly good model for museums or community groups tied to specific places that want to continue a relationship beyond that experience.

At GLS, we're envisioning a class of applications that *deepen* a students' experience of place (rather than removing them from it) that learners can take with them

everywhere they go (similar to Four Square). In the summer of 2010, our team launched its first iPhone application, ARIS (arisgames.org), which enables anyone to build a game like *Dow Day* or *Saving Lake Wingra* for their neighborhood.

CREATING THE FUTURE OF EDUCATIONAL TECHNOLOGY

It's an exciting time to be in educational technology—or it should be. Ideas that we once struggled to enact, such as simulation games, game-authoring systems, or knowledge-building communities, are now thriving. Educational technology sits at the intersection of technology, learning theory, and design and offers a crucial perspective for understanding how to design compelling educational media, question how they might change what it means to know, and research their impact with learners. I want to end this book with an argument for educational technology as a *creative* endeavor. This vision is inspired by Seymour Papert's desire to go out and *create* the future of learning rather than to simply study it. It represents a hope and passion absent in much scholarship today, given the current pressures for scientific rigor. Of course, we need to understand what works and what doesn't, but to frame our *entire* enterprise in such terms is, again, to risk standing on the sidelines of our own game.

I see more gamer- and Internet-generation students entering educational technology, and they are asking these questions. Many technology and learning enthusiasts are avoiding the academic sphere altogether and starting their own companies. New platforms like the iPhone should accelerate this. Regardless, today's youth have been raised with games, the Internet, and even cell phones, and they orient to this media far differently from the way I do.

I look forward to learning from them and reading the stories they have to tell. I hope you've enjoyed mine. We're working together to malce this revolution happen.